# MASSAGE Therapy

## THE EVIDENCE FOR PRACTICE

Edited by
Grant Jewell Rich

Foreword by
Janet R. Kahn

Mosby

*For Ashley Montagu,*
*whose work on touch continues to inspire us*

## Editor

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MOSBY
An affiliate of Elsevier Science Limited



First published 2002
Reprinted 2002

ISBN 0 7234 3217 1

**British Library Cataloguing in Publication Data**
A catalogue record for this book is available from the British Library

**Library of Congress Cataloging in Publication Data**
A catalog record for this book is available from the Library of Congress

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Transferred to digital print, 2007
Printed and bound by CPI Antony Rowe, Eastbourne

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# Foreword

*Massage Therapy: The Evidence for Practice* is an important volume because it deepens and broadens our awareness of the nascent scientific investigation of therapeutic massage. By collecting these papers into one volume, the editor and authors provide a starting point for conversations—conversations within the therapeutic massage community, conversations within the health sciences and research community, and, most importantly, conversations between those two groups. Only good can come from this.

Therapeutic massage is at once one of the oldest of the healing modalities, and simultaneously one of the least studied. In itself this discrepancy is simply an interesting observation likely to prompt speculation. Maybe there has been relatively little research on it because it is so familiar to us. After all, didn't most of our mothers rub our bumps and bruises when we were little? It doesn't take a rocket scientist to know that rubbing helps. Perhaps also because rubbing sore bits and giving backrubs is something we can all do, it is easy to dismiss massage as a household remedy, not 'real medicine' and therefore not likely to be very powerful. Of course it helps, but just a little.

And so, as Kuhn told us (Kuhn, 1970), when ideas or practices are commonly accepted, their investigation is often ignored. Why spend hundreds of thousands of dollars to find out something that we already know? Combine this with the general assumption that at the very least massage, like chicken soup, couldn't hurt you, and you find no pressing sense that investigations are needed to protect public safety. Simply put, there was not much motivation within the health care community to look at massage. This was matched by the lack of interest in research the massage community showed for many years. An all too common attitude seemed to be, 'I see and hear from my clients about the benefits of massage every day. That is proof enough for me.'

There is, however, one very important reason for examining therapeutic massage more closely, and that is that millions of people around the world use it. In 1998, 11% of adults in the USA utilized massage, collectively making an estimated 114 million visits to massage therapists that year (Eisenberg, et al., 1998). In national surveys of Americans' use of complementary and alternative medicine, therapeutic massage is consistently shown to be among the top three modalities used (Eisenberg, et al., 1993).

This usage alone demands that we stop making assumptions about its efficacy or lack thereof, and its safety or lack thereof, and instead conduct systematic inquiry into these issues. We need to know when and why people are using massage. We need to know whether they are in fact deriving any benefit or taking any risk through this behavior; and when massage is shown to have particular effects we need to explore why and how this happens. This volume begins to do that.

To do this in a concerted way will require real change. Consider, for instance, the NIH allocations. Between 1993 and 1997, the Office of Alternative Medicine (OAM) funded 50 studies. This included ten on acupuncture, seven on botanicals or other ingestibles, six on hypnosis or guided imagery, four on massage, three on chiropractic, and one or two each on a total of fourteen other modalities spanning the alphabetical gamut from ayurveda to yoga. In dollar terms, OAM invested $1,881,053 in the study of botanicals, $584,901 in acupuncture research and $115,200 in investigations of therapeutic massage. Funding became even more focused and more discrepant as time went on. By 1999 OAM had become the National Center for Complementary and Alternative Medicine (NCCAM) and in that year it funded eleven studies on botanicals totaling almost five million dollars ($4,902,281), ten studies on acupuncture ($2,703,435), a Center for Chiropractic Research ($650,352), and two studies on meditation ($404,235). There were no studies on massage funded by NCCAM in 1999; one small study ($13,968) on massage had been funded in 1998 (NCCAM).

These numbers do not reflect NCCAM priorities alone. In fact, that is not the main story they tell. The lack of funding for massage research is primarily a product of the small number of proposals on massage submitted to NIH each year. This in turn reflects the relative lack of interest, imagination or preparedness on the part of both the massage and research communities for this enterprise.

Happily, I believe this picture is changing and this book both illustrates and contributes to that change by presenting some of the pioneering work done to date. The volume illustrates something of the span of possible applications of massage that should be investigated. It offers studies exploring the potential of massage to be of benefit to people across the life-span, from Dieter and Emory's solid review of the growing body of literature on kinesthetic and tactile stimulation with premature infants to Remington's work with the elderly. The book offers data exploring the possibility that massage could be of help to people who are coping with serious illness including those with cancer, AIDS, spinal cord injury, and clinical depression. It also offers, in the chapter by Hodge, et al., one of the best of the existing studies examining the potential for massage to ease the stresses of everyday life, in this case the stresses associated with a highly demanding workplace.

This volume represents massage therapy research at its current stage of development. Consonant with the relative lack of funding mentioned earlier, we find here studies with sample sizes that are frustratingly small and cannot really tell us what we want to know. But larger studies will now be done precisely because, as Lawvere so accurately points out in the chapter on massage in ovarian cancer patients, these relatively small studies, at the very least, indicate that it is possible to do research on these topics and with these populations. They are bushwhacking studies, making the path easier for the next folks to travel.

The book also shows us the progress that has been made. The field of therapeutic massage research is more advanced than it was five years ago, the discussions more methodologically sophisticated than they used to be. Gone are the days, for instance, when one could simply label an intervention massage without a solid presentation of the protocol used and the rationale for it.

Grant Rich is to be commended for seeing the need and possibility at this time for a single volume offering a look at the range of research on therapeutic massage. Since there are no peer-reviewed journals devoted specifically to massage research, there is no one place that interested parties can go to stay abreast of it as it emerges. On the contrary, research on therapeutic massage, as the citations in these chapters illustrate, is found in a wide array of journals each with its own substantive focus—adolescence, neuroscience, oncology and the like. This volume, then, offers those new to the field of therapeutic massage a concise look at the range of possible applications. In doing that, it should spark the interest and imaginations of researchers and practitioners in many fields.

In addition, by bringing together the presentation of relatively new data in the same volume with reviews of the literature on areas where it has begun to amass, and discussing the methodological challenges inherent in the field, Rich has offered massage therapy educators an aid in bringing research into our classrooms. This is vital. For massage to mature as a profession, we must produce practitioners who are versed in the basics of research methods and who are capable of and committed to locating and staying abreast of the research. We owe this to our clients. New knowledge is being produced. This book shares some of it and will likely prompt more of it. This information can protect client safety and improve our practice. This is a good contribution.

Janet R. Kahn

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NCCAM website http://nccam.nih.gov

# Acknowledgements

I wish to thank all those who helped me through this long project. Thanks to my fellow members of the former editorial advisory board to the AMTA's *Massage Therapy Journal*: Lisa Mertz, Dawn Jordan, Diane Polseno, Mark Dixon, and Elliot Greene, Past President of the AMTA. Thanks to Janet Kahn PhD, of the AMTA Foundation, for encouragement and support for conference attendance. Thanks to the anonymous reviewers of this book. Thanks to my colleagues in the psychology department at Bates College, especially to Georgia Nigro PhD, Kathy Low PhD, and John Kelsey PhD, who read and commented on parts of the manuscript. Thanks to Clementine Brasier for her humor and patience as I struggled with the copier. Most of all, thanks to Elaine Brewer for her support, counsel, and encouragement throughout this extended process.

# Introduction

*Grant Rich*

The twentieth century has not been kind to touch. In the late 1920s, for example, the renowned psychologist and founder of behaviorism, John Watson, wrote a best-selling child-care book that gave parents the following advice with regard to their children: 'Never hug and kiss them, never let them sit on your lap. If you must, kiss them once on the forehead when they say goodnight. Shake hands with them in the morning' (Hunter & Struve, 1998, p. 50). While early in his career Freud advocated massage in psychotherapy, as he developed his classic psychoanalytic treatment he abandoned touch and favored minimal physical intervention. The ethics of touch in psychotherapy continue to remain a controversial topic, and several recent books are devoted solely to this debate (e.g., Hunter & Struve, 1998; Smith et al., 1998). Outside of the field of psychology, many recent books have explored societal ambivalence towards touch in a variety of cultural, historical, and religious settings (e.g., Johnson, 1993; Montagu, 1986). Touch, depending on the context, may be healing or hurtful. It is certainly always powerful.

Thankfully, one form of healing touch, massage therapy, appears to be making a comeback as we enter the new millennium. While massage has been used for hundreds of years and in numerous cultures, with the rise of biomedicine its use declined in the mid-century United States. Today however, the membership of the American Massage Therapy Association (AMTA) is steadily increasing, and is currently about 47,000. The flagship journal of the AMTA, *Massage Therapy Journal*, has a readership of over 60,000. Even outside the field of massage therapy, professional interest in the field is high; for instance the major journal of the 140,000 member American Psychological Association (*American Psychologist*) recently published a review article on massage therapy effects (Field, 1998). Interest is increasing not only in the consumption of massage therapy, but also in the seeking out of training to become a massage therapist. One recent article notes that 'six hundred and ten state approved and one hundred and forty other massage schools operate in the United States' (Massage and Bodywork, 1999). In addition, more and more public colleges are adding massage therapy programs. One in three US citizens uses some form of alternative medicine (Eisenberg et al., 1993).

In the United States, 28 states and the District of Columbia offer some type of state-wide massage therapy credential, such as a license, certification, or

registration. Many other jurisdictions require local licenses for practice in cities, towns, or counties. Twenty-three states use the National Certification Examination for Therapeutic Massage and Bodywork. Most states require a minimum of 500 hours of massage school training, though Texas therapists need only 250 hours plus a 50-hour internship, while New York therapists are required to have a minimum of 1000 hours of training. In Canada, therapists in British Columbia must complete 3000 hours of training and there is speculation that more US states will opt for more stringent requirements in the future (*Massage Magazine*, 2001). Many therapists have additional training in massage and many therapists have college or graduate level education as well. While the pros and cons of mandated licensure are hotly debated, Cohen (2000) notes that some possible advantages of credentialing include better consumer access to alternative health care, increased integration of biomedicine and alternative health, and an improved system for physician referrals and third-party payers. Other potential advantages include reductions in fraud and increases in competence. Readers interested in the legal context of alternative health care are encouraged to read Michael Cohen's books *Complementary and Alternative Health Care* (1998) and *Beyond Complementary Medicine* (2000). Cohen is a Lecturer at Harvard Medical School.

While healing touch has been used for centuries — cave paintings 15,000 years old depict its use (Hunter & Struve, 1998) — *research on massage therapy* is a much more recent development. Massage research tends to be published in a plethora of academic and trade journals aimed at psychologists, nurses, physical therapists, physicians, and other specialists. Researchers may be familiar with research on massage therapy originating in their own discipline, but not with relevant literature originating in other disciplines. Thus, even the research 'experts' are often unaware of pertinent articles on massage therapy (often these articles, if listed at all, are listed in only one specialty's database). Massage therapists and practitioners, and even massage school faculty may be even more at a loss to find a handy 'one stop' source of reliable research on massage. While there are several fine books on massage techniques (e.g., Andrade & Clifford, 2001), currently massage students are often left 'clueless' as to a reliable source for reporting, learning, and understanding research on massage. Thus, I believe that part of the appeal of this book is that it will serve as Grand Central Station for the best of contemporary massage research. Each chapter offers an extensive bibliography of cited sources. The contributors to this volume represent the best of the current massage researchers. Most of the chapter authors hold university or hospital appointments, and several are dually credentialed as doctoral-level researchers and clinical massage therapists. Massage research is an interdisciplinary topic and chapter authors hold advanced degrees in fields including nursing, psychology, pharmacy, medicine, occupational therapy, and epidemiology.

One of my intellectual heroes is the late Ashley Montagu, PhD, anthropologist and author of numerous works on topics ranging from sexism, to racism, to love. He is perhaps best known to the massage world as the author of the seminal work *Touching* (1986). As chair of the editorial advisory board to the AMTA *Massage Therapy Journal* I interviewed Montagu several years ago in his home (Rich, 2000). Throughout our time together I was struck repeatedly by his warmth and wisdom, traits he cultivated throughout his 94 years. None of his comments though, impacted me as greatly as his following words: 'The touching situation is one of communication and connection.' He paused for a moment and let out a long sigh. 'We have been disconnected. Ordinary relationships become extraordinary through the touch situation, really.' My hope is that this volume offers a connecting place where theory may meet practice, and researcher may meet therapist. Such connections are essential, and perhaps extraordinary.

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## INTRODUCTION TO SECTION 1

The following two chapters by Edzard Ernst and Martha Brown Menard address important issues concerning research and massage therapy. Ernst's chapter offers an easy to digest introduction to research methods for beginners. Experienced researchers may wish to skip ahead. For those readers who are new to research methodology, the Ernst chapter is a fine place to begin to understand some of the basic issues surrounding choice of research design, including advantages and disadvantages to the designs and special concerns related to conducting research on massage. Martha Brown Menard's chapter focuses on somewhat more difficult research issues and also specifically examines methodological issues relevant to massage. Martha Brown Menard is well suited to author the chapter since she chairs the research grant review committee for the AMTA Foundation.

For those readers who are new to research and who would like pointers to book length treatments of research methods, may I suggest W. Lawrence Newman's *Social Research Methods* (1997), Bordens and Abbott's *Research Design and Methods* (1999), or Shaughnessy, et al.'s (2000) *Research Methods in Psychology*. While these books do not specifically address massage therapy, they do offer standard treatment of social science research design at the undergraduate level. My other suggestions to therapists interested in research are to collaborate with a university or hospital research group and to take a course or two in statistics and research design/methods at a local university or community college.

Quality research in massage therapy is in its infancy and there are many variables which theoretically may play vital roles in the massage experience but which have not yet been systematically studied. One way to analyze the problem is to suggest that the massage experience includes the effects of the therapist, the client, the setting, and the interaction of all of these variables. Specifically, very few studies have examined therapist effects in detail. Therapists vary in amount and type of training, in years and type of experience, in their training in other disciplines relevant to massage, such as nursing, physical therapy, and psychology, and in many other ways. For instance, perhaps part of the effect of the massage derives from positive social interaction between client and therapist, not the physical manipulation of tissue. To examine such an effect, one might envision a study in which therapists spoke with some clients and not others. To date, therapist variables have been neglected in massage research.

The setting in which massage is conducted may also impact the effectiveness of the massage. For instance, is the massage done at the client's home or the therapist's office? What temperature is the room? Is music played? If yes, what kind? What is the lighting like in the room? What is the scent of the room? All of these factors may be operationalized into

variables for study by massage researchers. One suspects that data on such variables would be of great interest to schools and practicing therapists seeking to improve their practices. To date, setting variables have been neglected in massage research.

The massage modality employed also may impact the effectiveness of the massage. Are passive joint movements advised? Or is passive touch the technique of choice? Is there a measurable difference between various neuromuscular techniques? Does the use of oil or powder impact the massage experience? Some studies (some of them in this book), do indeed address the efficacy of specific massage techniques and specific massage modalities. More work must be conducted however, to examine the relative efficacy of the component techniques in controlled situations, however. For instance, is the traditional hour-long Swedish massage effective for relaxation due to the stroking component? The petrissage? Or is the whole greater than the sum of the parts?

The client is another basic element in the massage experience and presents numerous possible sources of variation. Aside from the obvious variable of client condition, theoretically one might consider the client's previous experience with 'alternative health' and with massage in particular, the client (and therapist) gender, age, feelings about 'touch' (such as cultural taboos or previous negative experiences with touch or abuse), etc. With the exception of studies focusing on certain clinical conditions, few studies have examined such client variables. Finally, the massage experience includes the interaction of therapist, client, and modality. For instance a given technique may be appropriate in one context with one client but not appropriate with another client in another context. Another example of how interactions may operate is that one therapist may be ideal for client A but terrible for client B. These interactions need to be studied in detail by future researchers.

A final few words about research methods and massage therapy. Traditionally, one important element in the research design of an experiment is to construct a control group that is alike in every way but one to an experimental group and to randomly assign subjects to either condition. Thus one issue frequently raised by massage therapy researchers is the issue of a 'sham' massage group to serve as a control group to an experimental group receiving the genuine massage. Just what might a 'sham massage' be? Some researchers have argued for offering superficial techniques in lieu of deep techniques. Others suggest passive touch instead of the 'real' massage. Still others suggest a treatment group in which subjects do not receive massage, but do receive potentially therapeutic 'non-specifics' such as attention and conversation with a caring person. Another important issue to bear in mind is the impossibility of the therapist being 'blind' to the treatment. No one has yet devised a convincing way in which the massage practitioner can be naïve as to whether he or she is giving a

real treatment or a sham treatment. These two limitations, the issue of blinding the therapist to treatment type, and the issue of inventing a convincing 'sham' massage to serve as a treatment for a control group, have plagued the field of massage research. But what many massage researchers fail to remember is that these issues are also issues in the much larger, much older, and much more established literature on psychotherapy efficacy. While these issues may make research more challenging they do not mean that quality research cannot be conducted on massage.

In an important article in the flagship journal of the American Psychological Association, Past-President Martin Seligman (1995) addresses the state of the evidence for the efficacy of psychotherapy. Every massage researcher should read this article. Let me quote from the study directly. Seligman notes that in the 'ideal efficacy study' all of the following elements should be found (p. 965):

1. The patients are randomly assigned to treatment and control groups.
2. The controls are rigorous: Not only are patients included who receive no treatment at all, but placebos containing potentially therapeutic ingredients credible to both the patient and the therapist are used in order to control for such influences as rapport, expectation of gain, and sympathetic attention.
3. The treatments are manualized, with highly detailed scripting of therapy made explicit. Fidelity to the manual is assessed using videotaped sessions.
4. Patients are seen for a fixed number of sessions.
5. The target outcomes are well-operationalized.
6. Raters and diagnosticians are blind to which group the patient comes from.
7. The patients meet criteria for a single diagnosed disorder, and patients with multiple disorders are typically excluded.
8. The patients are followed for a fixed period after termination of treatment with a thorough assessment battery.

While Seligman was discussing the efficacy of psychotherapy, each of these elements should apply to the ideal study of massage efficacy. Note that Seligman discusses the impossibility of 'double-blind' studies which are common in drug studies but impossible for psychotherapy studies since both therapist and client know what the treatment is. As Seligman puts it, 'Whenever you hear someone demanding the double-blind study of psychotherapy, hold on to your wallet' (p. 965). The same could be said for studies of massage efficacy; double-blind studies are impossible. (How could a massage therapist not know he or she is giving a massage!) Seligman notes that the ideal psychotherapy efficacy study follows patients for a fixed period after the end of treatment. Unfortunately, few massage studies have followed clients for more the 24 hours. Future researchers

should certainly aim to examine the long term benefits of massage therapy.

Seligman notes that efficacy studies with the above eight elements have been considered the 'gold standard' (p. 966) for psychotherapy research. However, he then continues to describe 'what efficacy studies leave out' (p. 966). Seligman notes the efficacy studies may 'underestimate or even miss altogether the value of psychotherapy done in the field' (p. 966). Citing Seligman directly (p. 966), these limitations occur since psychotherapy done in the real world (as opposed to in controlled laboratory conditions):

1. is not of fixed duration. It usually keeps going until the patient is markedly improved or until he or she quits.
2. is self-correcting. If one technique is not working, another technique — or even another modality — is usually tried.
3. patients in psychotherapy in the field often get there by active shopping, entering a kind of treatment they actively sought with a therapist they screened and chose.
4. patients in psychotherapy in the field usually have multiple problems.
5. psychotherapy in the field is almost always concerned with improvement in the general functioning of patients, as well as amelioration of a disorder and relief of specific, presenting symptoms.

Seligman notes that to address such issues concerning psychotherapy as it is actually practiced in the real world would require *survey* methods sampling large numbers of users, rather than the type of experimental efficacy study with the eight elements described earlier. Again, Seligman is describing studies of psychotherapy, but the issues are directly relevant to massage researchers as well. For instance, while a controlled efficacy study of massage therapy might require adherence to a manualized protocol, in the real world, therapists often self-correct and change techniques and modalities as they see fit. For example, the therapist might switch from stroking to percussion. Another example might be that in a laboratory experiment the researcher must randomly assign a client to a therapist (one that the client may not necessarily like or feel an emotional connection to), whereas in the real world, clients frequently seek out, screen, and choose therapists of their choice. For instance, a client might seek out a therapist of the same gender. With regard to the fifth item, laboratory studies frequently examine a single condition using specific outcome measures. This technique is very important, but Seligman suggests that perhaps more global measures of life satisfaction, subjective well-being, quality of life, and happiness, may also be important outcome variables to examine in psychotherapy. Theoretically, such variables may indeed be important to the massage experience as well. At any rate, in

sum, it appears that both experiments and surveys are useful techniques for massage research as well as for psychotherapy.

A final method of research that may be useful in studying massage therapy are qualitative methods, including interviews and field observations. Such qualitative techniques are commonly used in anthropology, oral history, and some forms of sociology and humanistic psychology. While such methods do not offer quantified results, these methods are excellent exploratory and descriptive tools, especially for topics that have been understudied in the past. Indeed there are now computer programs such as NUD*IST and Ethnograph that assist in the analysis of qualitative data such as interviews or field notes. Perhaps massage researchers of the future will feel comfortable using these methods in conjunctions with experimental and survey methods. One excellent resource on qualitative methods is H. Russell Bernard's (1994) textbook *Research Methods in Anthropology*.

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# 1

# Evidence-based massage therapy: a contradiction in terms?

*Edzard Ernst*



## INTRODUCTION

Massage has a long tradition in several medical cultures. In the USA, it is presently experiencing a most remarkable boost in popularity (Eisenberg et al., 1998). Unfortunately, research has significantly fallen behind this development. This chapter is aimed at discussing issues related to research methodology as they pertain to testing the effectiveness of any form of massage therapy. In tackling some of the most common problems, I will take a pragmatic approach. This chapter is not about dry statistical formulae, it is about simple, common sense aimed at novices to medical research.

## AUDIT

Practitioners often confuse audit with research and this has caused much confusion in the area of massage therapy. Clinical audit is the systematic evaluation of clinical activity in its broadest sense (Abbot & Ernst, 1997). It involves the identification of a problem and its resolution through various audit cycles. This can involve examination of the structural aspects of the delivery of care, of the processes involved in delivering care, and of the outcomes of care. The essential quality of clinical audit is that it brings about change, and this aspect is generally under-emphasized. The principal concern of clinical audit, and the outcome indicators integral to it,

should be to determine whether treatment, already shown to have a specific effect (efficacy), does so in practice (effectiveness), and whether the resources spent on it are being used to best advantage (efficiency). Thus clinical audit can be usefully applied wherever improvements are to be made in the clinical practice of massage therapy. It is, however, not strictly a research tool, and thus it is excluded from further discussion.

## UNCONTROLLED DATA

### Traditional use

Massage is amongst the oldest treatment known to mankind (Westhof & Ernst, 1992). Therefore, can anyone doubt that it works? The 'test of time' relies exclusively on experience. While experience is, of course, part of the basis of any clinical medicine, it can be highly deceptive. The history of medicine provides many examples for this to be true. Take blood letting for example; it represented the undisputed panacea for centuries. Its widespread practice must have killed thousands more than it ever benefited (Bauer, 1996). When it was finally discovered to be ineffective, through controlled trials, it was not the intervention but the new (and therefore suspect) method of the controlled trial that was doubted (Lilienfield, 1982). Today we know that blood letting in the form of haemodilution only helps in a few, defined conditions (Ernst et al., 1987).

Traditional use also tells us less about the safety of a therapy than we intuitively assume. But let us assume that a given traditional treatment is *not* burdened with frequent adverse events, which sooner or later make alarm bells ring. It might still be associated with rare or delayed and therefore not immediately obvious yet clinically relevant complications. The 'rule of three' tells us that the number of subjects studied must be three times as high as the frequency of an adverse drug reaction to have a 95% chance that the reaction will actually occur in a studied population (Hanley & Lippman-Hand, 1983). When an adverse drug reaction occurs with a frequency of 1 in 2000, one needs to monitor 6000 users to have a 95% chance that the adverse reaction will be observed at least once. To have a 95% chance that the reaction will occur twice or three times, one has to enroll 9600 and 13,000 patients respectively. The bottom line is that the experience of massage therapists is an unreliable tool to determine either the effectiveness or the safety of their therapy.

### Case reports

A clinical research idea often starts with an interesting observation concerning the treatment of a particular patient. A therapist might report: 'I have treated condition X with massage and my patient improved dramatically'.

When put in writing, this initial observation is called a case report (Ernst, 1995). By definition, such case reports are anecdotal evidence; they are essential in clinical medicine as they generate new ideas and constitute experience, but they can never be conclusive. The patient might respond in a different manner or might even have improved without any treatment at all.

## Case series

Case series are accumulated case reports evaluated either retrospectively or (more rigorous) prospectively (Ernst, 1998b). They can vary considerably in quality (have better defined inclusion/exclusion criteria, more sensitive endpoints, etc). Case series seem an attractive research tool to many therapists as they do not require informed consent, pose no problem in terms of treatment denial, and fit comfortably into clinical settings. Their most important methodological drawback is the lack of a control group. Thus they have no place in the evaluation of clinical efficacy: their results simply do not tell us whether an observed change was indubitably due to the treatment or to any of the following factors, each of which can influence the clinical results (Ernst, 1998b):

- placebo effect
- natural history of the disease
- regression to the mean
- patient's desire to please the therapist
- therapist's desire for a positive result
- concomitant therapy
- other nonspecific effects.

This, however, is not to say that case series are of no value; the opposite is the case. They are certainly useful, even essential for formulating a hypothesis. In turn, this hypothesis requires testing by other methods, e.g. randomized controlled trials.

## Observational studies

Observational studies are very similar to case series. In fact, they are large and well-organized studies without a control group. Because of their size, they may allow comparisons of sub-groups and some inference as to whether or not the observed clinical effect was associated with the therapeutic intervention. For instance, one could conceive a large study of massage therapy where perhaps 1000 consecutive patients with a given condition are treated and the outcome (say pain) is determined. Sub-group analyses could then determine whether patients who were more severely affected or those who received more treatments responded better in terms

of pain relief than the rest of the group. The principal drawback does, however, remain: there is no control group that received a different (or no) therapy. Thus observational studies can hardly answer the question whether the perceived effect was caused by the therapy (specific effect) or some other factor (nonspecific effect) (Pocock & Elbourne, 2000).

## CONTROLLED CLINICAL TRIALS

The need for controlled studies to evaluate the effectiveness of a treatment is often misunderstood. The 'effectiveness' observed in uncontrolled studies is really the 'perceived effectiveness', which is composed of the specific therapeutic effect plus other, nonspecific factors (see later). Whenever one wants to be certain about the relative importance of these factors and aims at defining the specific effectiveness of the therapy, one has no choice but to conduct controlled trials and compare the results of an intervention group with those of a carefully chosen control group (Fig. 1.1).

When scientifically investigating whether or not a given therapeutic intervention is effective, one essentially asks whether there is a *causal* relationship between the treatment and the outcome. Some may (rightly) argue that most if not all conditions have more than one cause and that therefore this approach is naïve and simplistic. Even though the multicausality of disease is an indubitable fact, this argument is wrong. By definition, medical treatments are aimed at providing the cause for the clinical benefit quite regardless of multicausal etiologies — a massage therapist treating low back pain treats the patient under the assumption and with

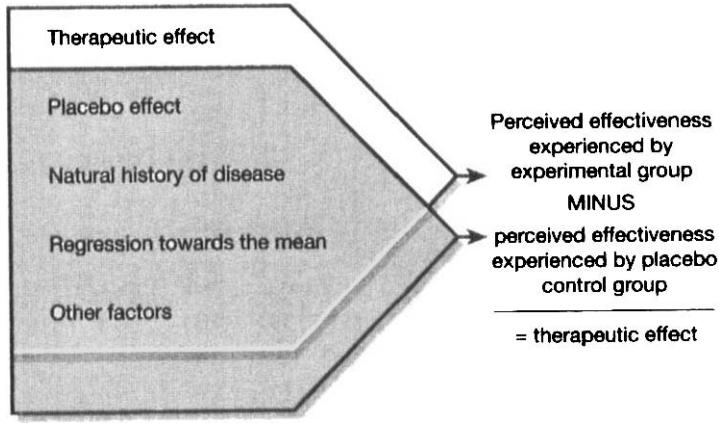


**Figure 1.1** Therapeutic effect in relation to other factors determining outcome.

the hope that the massage will ease the pain (which would represent a cause–effect relationship) irrespective of the fact that back pain clearly has many causes. To *not* be interested in the cause–effect relationships in therapeutics means to disregard one of the most essential ingredients in medical therapy (Ernst & Resch, 1996).

Typically, controlled clinical trials are prospective investigations. Yet it is often easier, faster and less expensive to do research retrospectively, for instance, by looking at a number of case notes in an attempt to define which treatment helped best in a given condition. For several reasons this approach is substantially inferior to prospective investigations. There are always several factors that influence the outcome in addition to the treatment given, e.g. the natural history of the disease (Fig. 1.1). Since retrospective investigations are restricted to the data available which, of course, have not been gathered for the purpose of the study, they normally have not been produced under standardized conditions nor do they follow a rigorous predetermined protocol. Inclusion-exclusion criteria (see later) are difficult or impossible to implement on a post-hoc basis because of lack of relevant information, and because randomization (see later) cannot be achieved. Therefore, neither suitability nor validity of the data can be reliably established. Yet, to provide conclusive information on therapeutic effectiveness of a given treatment, all these factors would need accounting for. This can be done reliably *only* with prospective research designs.

## Parallel group versus cross-over designs

In trials with parallel groups, participants are split into several (typically two) sub-groups. These receive two different treatments (see later) and the changes that occur in group 1 are compared with those of group 2 (Fig. 1.2). Thus different individuals are compared with each other. This creates numerous confounding factors, and the hope is that, provided both groups are large enough, these will cancel each other out, particularly if the trial was randomized (see later).

In an attempt to reduce confounding, it is tempting to compare one study participant with him/herself. This is the basic concept of cross-over studies (Fig. 1.2). In such trials all participants are treated with two different approaches (e.g. with massage therapy versus drug treatment). To minimize bias, one can randomize the sequence of the two approaches (see later). Essentially the clinical changes in one treatment phase are then compared with those that occur in the other phase.

While cross-over designs have highly attractive features, they are also burdened with numerous problems (Ernst, 1998b). Generally speaking parallel group designs are today considered to be more rigorous.

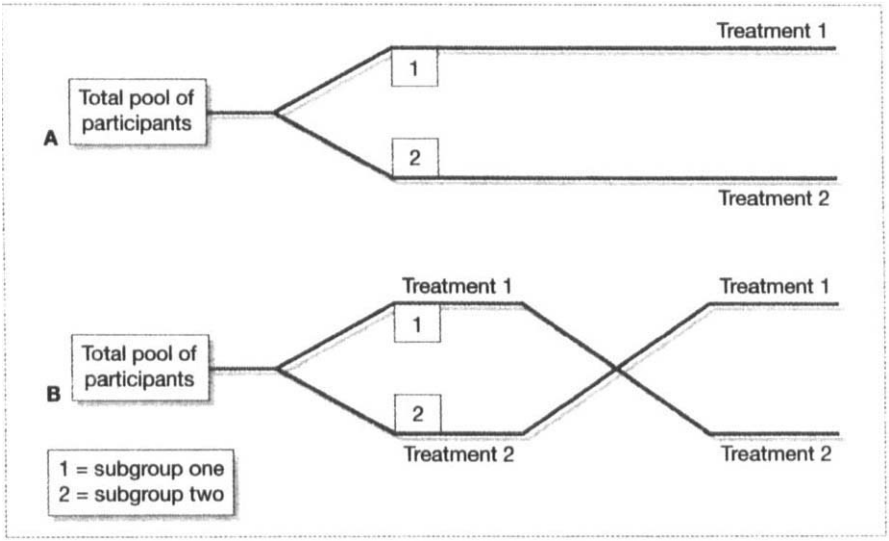


**Figure 1.2** Schematic design of parallel group trials (A) and cross-over studies (B).

## Placebo controlled trials

The placebo issue is also often misunderstood. No one doubts that the placebo effect can be very powerful indeed (Ernst & Resch, 1994). While in clinical practice we should do everything to make the patient benefit from nonspecific treatment (placebo) effects, we need to exclude them in research aimed at defining specific effectiveness of therapeutic interventions. This is achieved adequately by introducing a parallel group of patients who receive a treatment identical to the treatment under investigation except for the supposed specific treatment effect (i.e. a placebo group). One argument often voiced against this approach is that this neglects the importance of nonspecific treatment effects. This is, of course, not true. The fact that one eliminates a given determinant of a clinical outcome does not mean that one does not appreciate its importance — by eliminating the natural history of the disease in a controlled trial, one by no means disregards its importance. All one attempts is to create a set of circumstances where outcomes and results can be interpreted in a straightforward manner (i.e. 'causality' of the factor under investigation is confounded as little as possible by other factors or circumstances). The trial situation differs critically from the therapeutic situation in this way.

In contrast to what is often said, one can do placebo-controlled trials with *any* form of treatment, even with massage therapy — for instance, one can give sugar pills (placebo) to one group of patients and treat the experimental group with massage therapy. With several therapies (including

massage) it is, however, exceedingly difficult or even impossible to find placebos that are *indistinguishable* from the active treatment for the patient and/or therapist, and only such placebos can be used for patient-blinded studies.

In such situations one is often left with the second-best option to an ideal placebo, i.e. an intervention that mimics the active therapy as closely as possible (but not completely), e.g. superficial massage in a trial of Swedish massage of muscular pain. Admittedly these options represent compromises between the feasible and the desirable. Further features can enhance the credibility of such 'imperfect placebos' — for instance, one can make sure that only patients who have no previous experience with the type of massage under investigation are included in a trial. They are therefore less likely to tell the real thing from the imperfect placebo. The development of a credible placebo crucially depends not only on experience but also on creativity and fantasy.

There may be many situations where other controls are adequate or even superior to placebo controls. For instance, whenever a 'gold standard' (accepted form of therapy for a given condition with proven effectiveness) exists, ethical considerations demand to test a given therapy (e.g. massage) against this 'gold standard'. The research question then would be whether massage is as effective as or superior to the standard treatment.

It is also essential that any control treatment (placebo or other) is comparable in terms of factors relating to the clinical setting: identical environment, same team of caretakers, similar length of patient/therapist contact, similar therapeutic relationship, etc.

## Blinded versus open studies

Blinding relates to the fact that the two, three or more parties involved in a clinical trial are masked as to the intervention (i.e. active or control). Blinding the evaluator is usually no problem: the assessor (that is, the investigator who quantifies the results, e.g. pain reduction) does not need to know what type of therapy the patient had been submitted to. Blinding patients in trials of massage therapy is probably not achievable. The same obviously applies to the therapist. In essence this means that in clinical massage research only evaluator-blinded trials are feasible.

## Randomized versus non-randomized trials

Randomization is the cornerstone of an unbiased assessment of therapeutic effectiveness. A vivid example of how things can go badly wrong is the Bristol Cancer Study (Bagenal et al., 1990), where the lack of randomization was the main reason for flawed results and the confusion that followed. Randomization means that one sample of patients is divided into

two or more subgroups through pure coincidence. *Only* this method can achieve that both groups are comparable in terms of known *and unknown* potential determinants of outcome (provided the sample is big enough). Non-randomized trials are wide open to bias. This has several reasons. For instance, investigators might intuitively put the more ill patients into that treatment group for which they hope treatment is more effective, or certain other characteristics render a patient more suitable for one of the two forms of treatment tested. This and the fact that one cannot account for factors that are presently unknown, are crucial reasons why only randomization will guarantee that all treatment groups within a study are comparable and that we are prevented from comparing 'apples with pears' (Schulz et al., 1995).

## Inclusion-exclusion criteria

'In view of the differing diagnostic criteria on conventional medicine and complementary therapy, it does not appear possible to define a population which can be randomized for a controlled clinical trial of one form of therapy against another...' (Watt, 1988, p. 151). This quote reflects the notorious problem of inclusion-exclusion criteria and emphasizes the different views held by orthodox and complementary therapists. Yet the problem is not insurmountable. Firstly there is no absolute need to insist on strict inclusion-exclusion criteria (i.e. 'define a population'). They are desirable in order to achieve optimally homogeneous patient samples, which in turn, reduces the 'background noise' in the experiment. Yet they are not mandatory — all we face when relaxing these criteria is the need to increase our sample size. Secondly, one can sometimes use orthodox plus unorthodox criteria in sequence. For instance, one could conceive a trial on patients with rheumatoid arthritis diagnosed by an orthodox physician where the patients are subsequently seen by a therapist who defines the suitability of each patient for the massage therapy under investigation. This 'definition' can be based on anything from reproducible variables to personal intuition. Only if a patient passes both 'filters' will he/she be included in the study. Undoubtedly, this would make any study more tedious, yet it would not render it impossible.

## Outcome measures

One often gets the impression that medical research has opted to measure what is measurable instead of what is relevant. Proponents of complementary medicine frequently claim that the known criteria to evaluate success or failure of therapy are not meaningful in their field. Actually this is also true for much of mainstream medicine where surrogate endpoints

abound — for instance, blood pressure or serum cholesterol: is it relevant to lower these variables or to prevent a heart attack? The latter is not *a priori* a consequence of the former. What we really want to know is often difficult to measure.

In certain clinical situations encountered by massage therapists there may not be any hard and validated endpoints at all. Yet other meaningful, 'soft' endpoints have been and are being developed — for instance instruments to measure quality of life or well-being (Cella & Tulsky, 1990). Even simple patient preference can be quantified, for instance, in cross-over trials. These can be used, depending on the research question, in conjunction with other endpoints like visual analogue scales or 'hard' physiological variables.

## SYSTEMATIC REVIEWS

If we accept that the randomized clinical trial is the least biased (yet by no means perfect) method to test for therapeutic effectiveness known today, we still have to admit that one such study is rarely fully convincing. In medical research, one always wants to see independent replications. A single trial could be wrong by chance, through some undetected bias or even through fraud. Where more than one study exists, they often yield different results. For instance, it is conceivable that, for one given indication (say, depression) five studies suggest that massage is effective while five imply that it is not. In such a situation proponents of massage could publish a (apparently evidence-based) review of the positive trials. An opponent could do the same with the negative trials.

This example demonstrates the importance of systematic reviews (and meta-analyses — which are systematic reviews that include statistical pooling of data). Such research projects have to include a detailed explanation where the authors explain what they did and how. They have to demonstrate, for instance, that they included all the data (not just those they liked). This renders a review of this type reproducible and minimizes selection and random biases.

For these reasons, systematic reviews provide, according to the accepted standards of evidence-based medicine (Cook et al., 1997), the most compelling evidence for or against a given therapy (Fig. 1.3). In the realm of massage, several non-systematic (e.g. Callaghan, 1993; Tidius, 1997; Buss et al., 1997) and systematic (e.g. Ernst, 1998a; 1999a,c) reviews have been published.

Systematic reviews are perhaps the best evidence, yet they too are not flawless. Problems can arise when the primary studies are of poor quality (garbage in, garbage out) and when certain (e.g. negative) results never get published (publication bias).

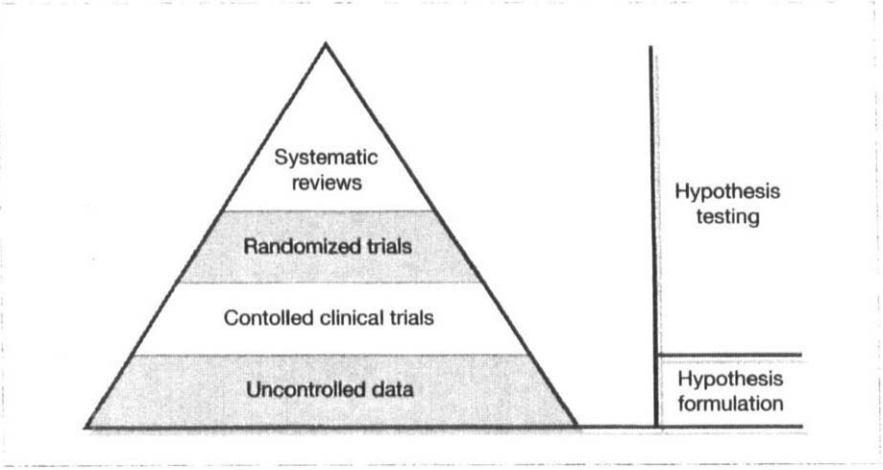


**Figure 1.3 Hierarchy of evidence.**

## THE 'OPTIMAL' TRIAL DESIGN

From the discussion so far it follows that there is no such thing as an 'optimal' trial design. A study can only be optimal in that it answers the question it set out to answer. All types of investigation discussed above can be optimally matched to a research question. In other words, it is the match not primarily the design one should try to get right. Or, to put it bluntly, there are in principle no faulty designs only bad matches (Fig. 1.3).

If, for instance, one wants to generate or strengthen a hypothesis (which would require testing later), case reports or case series are optimal. If one wants to determine whether massage is more effective than no treatment, a randomized, evaluator-blinded study with two parallel groups — one receiving massage and the other no such therapy — is probably ideal. If one requires to know whether massage is superior to another (e.g. gold standard) treatment, the same design but with a different comparison group would be ideal.

It should be re-emphasized that the entire discussion above is directed towards testing the effectiveness of massage therapy. Obviously there are many other areas of research (Table 1.1). It is clear that for all these areas of research, different methods have to be used and the above discussion does not apply.

## PRAGMATIC PROBLEMS

In this last section, I would like to give some practical guidance to those who are new to research and would like to give it a try. Many researchers

**Table 1.1** Examples of research question matched with adequate research design

| Research questions | Examples of possible design |
|---|---|
| How prevalent is massage therapy? | Surveys |
| Who uses massage therapies? | Surveys |
| What are the main indications? | Surveys |
| What are reasons for using massage therapy? | Personal interviews, postal questionnaires |
| Are there adverse effects? | Literature review |
| How frequent are these adverse effects? | Large scale observational study |
| Does massage offer value for money? | Cost-benefit, cost-utility studies |
| Which treatment will help a given patient? | Single case study |
| Which mechanism brings about a given clinical effect? | Investigations using physiological variables |
| What expectations do patients have? | Personal interviews/qualitative methods |
| What experiences do patients report? | Personal interviews/qualitative methods |
| Does massage offer value for money? | Cost evaluation studies |

(including myself) have learnt research 'the hard way', e.g. by making all the mistakes themselves. Perhaps the following paragraphs will prevent others from making my mistakes all over again.

## Why do research?

There are many reasons to do research, and some are clearly better than others. Enthusiastic novices often want to prove that their therapy works. This is probably one of the worst reasons for doing research. An investigation should *not* set out to *prove* a point but rather to *test* a hypothesis. An investigator with an 'axe to grind' is hardly an objective researcher. Clinical research, in particular, must be patient-centered. Unquestionably, the best reason for doing research is the hope of coming one step closer to the truth and to help (future) patients.

## Preconditions

Certain items are essential because, without them, there is no use in even attempting research. It is worth remembering that bad research can be unethical (Emanuel et al., 2000). It can mean not only a waste of resources but also the needless suffering of patients.

An adequate knowledge of research methodology and of the subject area under investigation — for example of treatment modality (e.g. the form of massage therapy to be tested) and disease — are absolute prerequisites. To some degree expertise can be 'bought in' (see later), but the project leader must have at least a minimal understanding of all the issues involved. If you do not have this expertise, acquire it — or do not embark on research.

It almost amounts to a platitude to state that certain infrastructures are also essential. By this I mean things like the time to carry out the work, access to a library, electronic databases and computers as well as the (prospect of) funds to finance all the work and equipment involved. Before you even start planning a research project it might be a good idea to draw up a simple checklist of all the preconditions required in your particular case and go through it one by one.

## Background reading

You may want to embark on a subject, say a study of Swedish massage to treat back pain, and not be fully aware of what has been published on this subject already. Yet it is mandatory that you are! Thus it is highly advisable to conduct an in-depth search for all published articles, read all of them thoroughly and make sure you understand all aspects (if you do not, seek help). Failure to do this background research properly might seriously embarrass you and your colleagues later on. You (or someone else) might, for instance, find out that the study you have just done has already been conducted in a more definitive way by someone else. This would obviously render your work redundant and a waste of time, energy and money.

## Define your research question

Using the above example, you may have started out with the idea of studying massage for back pain. Now that you have read the published articles on the subject, you will almost certainly have found that the question you are asking is much more complex than originally anticipated. Do you want to formulate or test a hypothesis with your research? What type of patients do you want to study? What type of back pain? What type of massage do you want to test? How do you want to recruit your patients? Do you need to conduct a controlled trial or an observational study? What should the control treatment be (if any) — a 'placebo' or a standard treatment? Can you randomize the treatment groups? Is the treatment under investigation representative for its class? Do you need one therapist or more? What should their qualifications be? Are all conditions optimal for the treatment to work? And so on. Only when you have answered such questions (they will invariably come up when you do your background reading and they will differ according to the nature of your project) will you be able to define the research question. Doing this is essential for deciding which methodology is the best for what you have in mind. It is also a decisive step towards developing a protocol (see 'Recruit a research team').

## Check the logistics

This preparatory work will have led you to a more concise idea of what may be coming up. Certain things will have become clear to you and you might, at this stage, what to (re)check whether the logistic preconditions for your research project are fulfilled. For instance, do you have access to the type (and adequate numbers) of patients you need to study? How large should your patient sample be? Is it realistic for you to obtain sufficient funding? Is it likely that you can obtain patient consent for what you plan to do? Is the evolving proposal ethical? Do you have the necessary rooms, help (secretarial back up, research nurses), etc? There will almost certainly be other questions to ask. My advice is, again, to draw up a checklist and tackle one problem at a time.

## Recruit a 'research team'

You will probably find that your general research knowledge and experience are not enough to cover all aspects of your project competently. It is therefore usually mandatory to assemble a team for developing a sound protocol of your study and guide you through its experimental phase. Depending on the type of your investigation this team will vary in size and composition. In the example of massage for back pain, it might include a statistician (almost invariably advisable), a clinical expert in back pain (for example, a rheumatologist) and an experienced massage therapist. Make the team as small as possible but as large as necessary.

Within this team you should now organize a series of discussions to evolve a protocol. Subsequently, you might take the lead and draft an outline and circulate it within the team until every team member is satisfied. The team should supervise the entire investigation. Once the protocol is finalized, the planning phase is (almost) finished. All that is needed now is to submit it to the appropriate ethics committee, and secure funding. During this process several (hopefully small) revisions of your protocol may prove necessary.

## Obtain funding

Funding is, of course, very often the real obstacle (Ernst, 1999b). Research funds are invariably limited and rejection rates are often high, particularly if you have to compete with applications from mainstream research. Rejections can be extremely disappointing, but you must not be deterred. To succeed you have to try over and over again and learn from the criticisms of those who review your application. Here, too, you should seek expert advice. Establish contact with patient organizations, try all the charities you can think of, use your imagination and leave no stone

unturned. If research in massage therapy is ever to get anywhere, I strongly feel that some dramatic changes to the all too miserable present funding situation have to be brought about.

At present there are few funds especially dedicated to such research. Thus we find ourselves competing with mainstream scientists for a more and more limited amount of money. This means that our applications are judged by panels who usually have little understanding of (or sympathy for) complementary medicine. This in turn results in the undeniable fact that very little money is spent on such research (Ernst, 1999c).

I have said and written it before, and I will carry on doing so: in view of the high popularity of complementary medicine (Eisenberg et al., 1998), it is quite simply unethical not to research the subject systematically — and this, of course, requires adequate research budgets.

## CONCLUSION

Massage therapy remains grossly under-researched. In particular, clinical trials need to test the effectiveness of defined types of massage for defined conditions. The methodology for doing this is similar to clinical research in other areas. Existing trials of massage therapy are often burdened with significant limitations (Cawley, 1997). Lack of research expertise and research funds are probably the two main reasons for the paucity of reliable evidence in this area. We should find ways of overcoming these obstacles.

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# 2

# Methodological issues in the design and conduct of massage therapy research

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## INTRODUCTION

Much has been written about methodological issues in designing and conducting research on complementary and alternative therapies (Cassileth et al., 1994; Levin et al., 1997; Vickers et al., 1997). Most authors agree that the same methods, both qualitative and quantitative, used to evaluate conventional medicine can and should be applied to complementary and alternative therapies as long as they are applied appropriately. Determining what constitutes appropriate application, however, is where differences of opinion arise (Cassidy, 1994, 1995; Hufford, 1996; Trotter, 2000). Little has been written specifically regarding appropriate methods for investigating massage as a therapeutic intervention. This chapter explores the methodological issues in designing and conducting research on massage therapy from the dual perspective of the research scientist and the clinical practitioner. Some of these arguments have also been made in the book *Making Sense of Research* (Menard, 2002), a guide to research literacy for complementary practitioners.

## PROBLEMS IN MASSAGE THERAPY RESEARCH

Despite assurances that existing research methods are sufficiently robust, it is not clear from looking at the bulk of the literature on massage therapy that the application of these methods has produced satisfactory results. Although a number of published studies have found statistically significant results, others have found ambiguous or negative results that are open to interpretation. Relatively few studies have used rigorous methods that can stand up to epidemiological scrutiny. Methodological flaws in many of the studies are obvious and have been noted by others (Cawley, 1997; Ernst & Fialka, 1994;

Field, 1998). Typical criticisms include: small sample size and consequent lack of statistical power; lack of a control or comparison group; lack of random assignment to group; inadequate outcome measure(s); and lack of standardization of the massage protocol used in the study. While there is promising evidence of the effectiveness of massage for certain health conditions (Field, 1998; Vickers, 1996), the small number of systematic reviews conducted on massage therapy have concluded that at present there are too few studies of sufficient quality to definitively say whether or not it works (Ernst, 1999; Furlan et al., 2000). A systematic review of the research on infant and preterm infant massage, one of the few areas where there are a sufficient number of relatively well conducted studies, recently concluded that while the evidence has demonstrated a positive effect, the effect size is too small to warrant its wider use in neonatal care settings (Vickers et al., 2000).

To some extent, these results are not surprising given that serious research on massage therapy is still in its infancy. A related factor is the comparatively small amount of money available to fund studies; thus the large number of pilot studies with small samples. However, other methodological issues in addition to those previously mentioned exist in much of the research conducted and are not always readily apparent to the nonpractitioner. These issues include: definitions and theoretical models of massage therapy; lack of involvement of skilled practitioners in the design and conduct of studies; appropriate control interventions and nonspecific effects; and a rush to conduct efficacy studies without a sufficient understanding of massage therapy based on adequate prior research.

## DEFINITIONS OF MASSAGE THERAPY

Few studies have explicitly defined just what the term 'massage therapy' means. In the well-known Eisenberg survey on the prevalence and patterns of use of unconventional therapies (Eisenberg et al., 1993), respondents identified more than 100 varieties of massage therapy. Perhaps one reason for this is that the term means different things to different people. I have noticed that within the profession 'massage therapy' tends to be used in a narrower and more technical sense to refer specifically to certain kinds of massage, as distinguished from 'bodywork,' which is separate and different from massage. Adding to this confusion is the fact that the vast majority (96%) of therapists, no matter what their primary discipline, define themselves as eclectic and work in more than one primary discipline (NCBTMB, 1997a,b). Outside of the profession, as the Eisenberg survey shows, 'massage therapy' is used in a broader and more inclusive way to indicate almost any form of touch-based therapy, even some that are energetic in nature and do not involve skin-to-skin physical contact, such as Therapeutic Touch. For the purposes of this chapter, I will use the

**Box 2.1** Categories of massage and bodywork modalities based on intended therapeutic effect

**Promoting structural or physiological change**

- Swedish massage
- Myofascial release
- Neuromuscular therapy
- Acupressure/shiatsu
- Muscle Energy Technique
- Thai massage
- Reflexology
- Rolfing/connective tissue massage
- Deep tissue/deep muscle massage
- Craniosacral therapy
- Manual lymphatic drainage
- Counterstrain/Positional Release
- Rosen Method

**Promoting comfort**

- Swedish massage
- Reiki
- Craniosacral therapy
- Therapeutic Touch/Healing Touch

**Promoting kinesthetic or neuromuscular education**

- Trager
- Muscle Energy Technique
- Alexander Technique
- Proprioceptive Neuromuscular Facilitation
- Feldenkrais/Awareness Through Movement

**Promoting energetic balance or flow**

- Acupressure/shiatsu
- Craniosacral therapy
- Reflexology
- Reiki
- Therapeutic Touch/Healing Touch

term in its broader sense to encompass a range of modalities, that is, both massage and bodywork.

One way to categorize the different kinds of techniques and modalities is on the basis of their intended therapeutic effect, as shown in Box 2.1. Note that a modality can belong to more than one category. The effect of a modality may vary depending upon the application of the technique. For example, Swedish massage can have a stimulating or sedative effect depending upon the rhythm, speed, and pressure with which the massage strokes are applied.

Some guidance regarding this issue may be found in the definitions put forth by two of the major professional organizations. On its website, the most senior professional association of massage therapists, the American Massage Therapy Association (AMTA), defines massage as the application of manual techniques and adjunctive therapies with the intention of positively affecting the health and well-being of the client (AMTA, 2000). The certifying agency for professional therapists, the National Certification Board for Therapeutic Massage and Bodywork (NCBTMB) has a broader practitioner job description supported by a formal job analysis of the field. It defines a practitioner as:

> One who employs a conceptual and philosophical framework, and uses knowledge of various systems of anatomy, physiology, and contraindications to facilitate the optimal functioning of individual human beings through the manual

application of various modalities. The practitioner assesses the client in order to develop a session strategy, applies relevant techniques to support optimal functioning of the human body, establishes a relationship with the client that is conducive to healing, and adheres to professional standards of practice and a code of ethics (NCBTMB, 1997a).

This is an ambitious definition that clearly states the presence of a theoretical framework supporting the practical application of technique by the practitioner, and it further implies that psychosocial factors are present by virtue of a client–practitioner relationship that is 'conducive to healing.' I do not know of any study to date, that has explicitly defined massage therapy in these terms, that is, as practitioners themselves do.

Definitions are important for several reasons, and the lack of definitions in the majority of studies is troubling. Studies that define massage, by implication or omission, as simply the rubbing of muscle tissue ignore crucial aspects of the therapy under investigation and may be more likely to result in findings that are ambiguous or difficult to interpret. On a more practical level, many studies do not define or describe the specific techniques used in the massage protocol in sufficient detail. As a result, it is impossible for the reader to determine exactly what was done or to evaluate whether or not the protocol was appropriate to the study hypothesis.

## STANDARDIZATION OF MASSAGE PROTOCOLS

Related to the issue of definitions is the question of 'standardization.' Massage therapy is not a drug any more than psychotherapy is, and in truth we cannot pretend otherwise, especially for the purpose of research. Those who have taught in a professional training program know that among beginning students, who typically learn a standard routine, qualitative differences are quite readily apparent among the massages they give. As students become proficient practitioners, each develops an individual style. When experienced practitioners are trained in a highly specific protocol, some discernible differences in style and application, such as the amount of pressure used or the timing and rhythm of strokes, will still be present. The implementation of a specific protocol cannot truly be 'standardized'.

An even stronger argument is that in many instances a standardized protocol is not appropriate given the study hypothesis. If the objective of a study is to evaluate the relative effectiveness of various manual approaches for a particular condition, then a more limited protocol specifying the types of techniques used for each approach without any overlapping between approaches would make sense. However, if the question involves evaluating the efficacy of massage generally, a standardized intervention does not represent massage therapy as it is actually practiced because, as the NCBTMB survey showed, practitioners typically combine elements of

more than one discipline. Results using a standardized protocol are then limited to that specific protocol and cannot be generalized more widely.

Worse still, standardized approaches do not allow the practitioner to tailor the treatment to the individual client, something that is by definition fundamental to the practice of massage therapy and necessary to make the treatment as effective as possible. The client or patient plays an active role in the therapy and is encouraged to give feedback to the therapist regarding patient preferences for the region(s) of the body to be worked with or to be avoided, the degree of pressure that is pleasant or tolerable, and the amount of time spent on a given region. For example, in one frequently cited study with ambiguous results, massage was tested as an intervention for cancer pain by giving ten minutes of light effleurage on the back, without regard to the patient's diagnosis, the source of pain, or the patient's preference (Weinrich & Weinrich, 1990). While this study has other flaws, a fundamental problem is that the intervention tested bears little resemblance to the way in which an experienced therapist who is familiar with the needs of cancer patients would choose to work with them.

Finally, standardized protocols may present an ethical problem in some situations. For example, participants who are trauma survivors may be uncomfortable with and distressed by having certain areas of their bodies touched. Because their reactions to touch can be highly idiosyncratic, no automatic assumptions can be made about which areas will feel safe to the patient. During 19 years of clinical experience, clients have, at least initially asked me to not touch their hands, feet, legs, arms, lower back, hair, neck, and face during massage. Individualized massage protocols respect the patient's physical and emotional boundaries, which may encourage higher rates of participation and greater adherence to or compliance with the study protocol.

Standardized protocols thus form a rigid straitjacket limiting the effectiveness of the intervention, and are invalid by definition of the therapy as it is practiced. Such studies are likely to avoid Type I error at the expense of promoting Type II error. It is analogous to testing the efficacy of surgery as an intervention by giving every study participant a tonsillectomy no matter what their medical situation requires.

Some may argue that an individualized protocol promotes dilution of treatment and introduces unnecessary variance or error into the study. According to Levin and his colleagues (1997), complex interventions like massage that include individualized treatment can be studied as 'gestalts,' that is, looking at the effects of the whole system of care, rather than breaking it down into its component parts. The virtue of this approach is that it avoids the conventional biomedical model's tendency to reductionism while remaining methodologically sound. In reality, an individualized protocol is more representative of the way massage therapy is practiced and thus has greater ecological or model fit validity (Cassidy, 1995). It also

permits greater generalizability of results, allows the therapy to be as effective as possible, and has greater ethical value because it respects the personal boundaries of study participants.

If the study hypothesis does not necessitate one approach or the other, a solution to the standardized versus individualized dilemma is to use a cafeteria style approach, where therapists may choose from a menu of several modalities commonly used or considered useful for a given condition, while other modalities or approaches that are not likely to be particularly effective are excluded. The selected modalities are then applied according to the therapist's judgment and the patient's needs or preferences. It does make sense, however, to standardize some aspects of the treatment such as its duration, time of day given, gender of the therapist relative to the patient, and treatment setting, in order to control these variables. More than one therapist should be used to provide the massage, in order to control for therapist effect as an alternative explanation for results. On a practical level, using more than one therapist anticipates potential scheduling conflicts and prevents therapist burnout. However, because therapeutic relationship between client and practitioner is by definition part of the intervention, the same participant should be treated by the same therapist to the extent that this is logistically possible. Investigating the role of relationship in massage therapy would make an interesting area of study, and one that has general relevance in today's system of health care.

Because we do not know at this point how much variation in individual treatment occurs, it would also be useful to have massage therapists keep detailed notes describing as specifically as possible what they did during each session, along with the rationale for their treatment decisions. These could then be compared among different therapists in a study to see whether significant differences in style exist, and whether or not these are correlated in any meaningful way with the study results.

## QUALIFICATIONS OF STUDY PERSONNEL

Where dilution of treatment does surface as an issue, however, is in the qualifications of research study personnel who perform the massage. A number of studies have used personnel with little or no training specifically in massage therapy such as nurses or physical therapists. Nurses and physical therapists typically receive little or no training in the use of specific manual therapy techniques used in massage and bodywork therapy, such as deep tissue work, neuromuscular massage, shiatsu or acupressure, craniosacral therapy, or counterstrain techniques. Although physical therapists do receive some training in rehabilitative manual techniques, schools of nursing no longer routinely teach massage techniques because it is no longer a standard part of evening or PM care, given other demands on nurses' time; massage is now limited to a few simple

techniques taught briefly as part of a survey course on complementary and alternative therapies. In contrast, the number of hours required for certification or licensure as a massage therapist in states that regulate massage as a health profession is at least 500 hours. A majority of US therapists (62.4%) report that they have more than 500 hours of entry level training in addition to annual continuing education hours (NCBTMB, 1997a) required to maintain certification and membership in professional associations. It is hardly surprising, then, that studies that fail to use professionally trained therapists to provide the massage treatment have negative or ambiguous results (Richards, 1998; Weinrich & Weinrich, 1990).

In addition, personnel without training or experience in massage cannot provide helpful information to investigators regarding proposed study protocols during the design phase of a study. The lack of such information may pose a potential risk to participants. In my experience, physicians, who are responsible for overseeing participants' medical care and who are often members of the institutional review boards responsible for protecting human subjects, as a group are largely unaware of contraindications and cautions associated with massage under certain health conditions. Many that I have met seem to believe that massage is something that feels pleasant to patients but has no real physiological effects. For example, a physician once asked me to perform Swedish massage on the leg of a patient confined to bed with a diagnosis of a deep vein thrombosis. This condition is one of the few absolute contraindications in Swedish massage because stimulating circulation under these circumstances can dislodge a blood clot, sending it traveling through the bloodstream where it can occlude a vital blood vessel in the heart, lung, or brain. Professionally trained and experienced practitioners can alert investigators to potential problems with protocols, make informed clinical decisions when working with seriously ill patients, and provide a higher standard of care to patients. All of this is not to say that nurses and physical therapists are not qualified, or that they should never provide massage interventions in studies. However, being qualified in one field does not automatically confer proficiency in another. Study personnel should have specific training and experience in the modalities or techniques that will be performed. For example, many physical therapists seek out additional training in modalities not taught in university programs, such as craniosacral therapy. Nurses sometimes complete professional training programs in massage and bodywork, and are eligible for certification or licensure as practitioners.

## BLINDING AND CONTROL INTERVENTIONS

It is impossible to use the traditional double blind strategy in studying massage therapy. Obviously, patients know whether or not they are being

touched, just as practitioners know whether or not they are touching them. However, study personnel collecting or assessing data can and should be blinded to group assignment whenever possible.

Control interventions pose an interesting challenge. Clearly, the question of what constitutes an appropriate control intervention is always determined by the research hypothesis being tested. In some studies, massage may be compared to an intervention that promotes relaxation but does not involve touch, while other studies may compare social or unskilled touch with the skilled touch that massage provides. The problem is that as a substantial body of research shows, touch in and of itself produces measurable, complex, and sometimes quite dramatic effects (Montagu, 1978), as does relaxation. But the rationale for this strategy assumes that a less active treatment is being compared with one that is more active. How much more active is unknown. If both treatments are active to a similar degree, the null hypothesis can appear to be true when in fact both interventions are effective. Any effects attributed to the intervention tested are wrongly assumed to be due to nonspecific effect, when each intervention may produce effects through other factors that have yet to be identified. However, this strategy is a useful one at present because so little is known regarding the magnitude of the difference, if any, between skilled and unskilled touch.

Sham treatments pose a similar difficulty in that creating a believable sham intervention resembling a true one closely enough runs the risk of eliciting the same effects, and the problem of comparing a less active to a more active intervention still exists. Because there is no such thing as placebo touch, practical difficulties in developing sham treatments are also a consideration. Only one study that I know of has used a credible sham treatment for massage. Evaluating the effectiveness of reflexology for relieving premenstrual syndrome symptoms, Oleson & Flocco (1993) used a sham treatment consisting of pressure applied either too lightly or too roughly to be considered effective on points thought to be ineffective for premenstrual syndrome. Participants in this group reported that they believed they were receiving the true reflexology treatment.

No study of which I am aware has quantitatively examined the possible role of nocebo effects in using sham treatments. Massage therapists usually expect to help people as a consequence of their work. If a practitioner is asked to give a treatment that he or she believes to be ineffective to study participants, the practitioner may unconsciously communicate his or her distress to participants, thus influencing the results. For the same reason, sham treatments are ethically dubious, because practitioners are being asked to knowingly provide an ineffective treatment while withholding a potentially beneficial one. It is also possible that deliberately withholding the intention to help has negative consequences for the practitioner. Janet Quinn (1996), a nurse with experience in designing and

conducting research on Therapeutic Touch, has described her own sense of discomfort experienced while giving a placebo Therapeutic Touch treatment as part of a research study, concluding that she would not do it again because it felt too unpleasant.

If the suggestive research on prayer and nonlocal healing compiled by Dossey (1993) is accurate, the practitioner's intention to be of help to the client may influence results in a meaningful way that is statistically measurable. Massage therapists often visualize the anatomical structures and physiological processes they wish to affect during their work with clients, particularly deeper structures that are hard to palpate directly. Perhaps such visualization, along with the desire to help, could be considered a form of focused intention that affects the energetic field of the client. It would be interesting to have data regarding this potential variable in massage research.

## NONSPECIFIC EFFECTS

This brings us to the role of nonspecific effects and expectation in massage. Nonspecific response, sometimes referred to as placebo response, has long been misunderstood in health care research. Contrary to the common misinterpretation of the well known study by Beecher (1955), the magnitude of nonspecific effects is not a constant 33% but varies considerably according to Moerman (1983), and can only be determined by measuring it in each study. Another estimate of the magnitude of nonspecific effects is as high as 80%, even when testing drugs and surgical interventions using objective measures (Jonas, 1994). Separating specific from nonspecific effects by the use of a placebo control group is often done in health care research to determine whether or not a given treatment is effective. However, placebo controls are not the only way to determine efficacy.

If a treatment is shown to have no specific effect but reliably induces a positive or desired outcome from nonspecific effects alone, that is no reason to abandon its use. The treatment is effective and may have the advantage of being cheaper or posing less risk of adverse response or side effects. For this reason, the best control may sometimes be a standard treatment group, depending of course on the hypothesis to be tested. It may not always be ethical, practically feasible, or desirable to test massage against a placebo or sham treatment. Also, the additive model, where nonspecific effects plus specific effects are assumed to equal total variance explained, may be much too simplistic. Kleijnen and colleagues (1994) reviewed a series of clinical trials to determine whether interactions between specific and nonspecific effects occurred. They concluded that nonspecific effects can act as a modifying variable, sometimes potentiating the specific effect and in other cases inhibiting it.

Given the difficulties regarding the use of control interventions described previously, it may prove to be impossible to separate the specific from the nonspecific effects of massage therapy. Massage is a highly personal intervention predicated upon touch, one that necessarily involves time and focused attention, and that has a certain amount of face validity, which Jonas (1994) argues is an essential factor in maximizing treatment efficacy. It seems probable that massage is a potent means of engaging nonspecific response. It is interesting that the body systems which have been demonstrated to show the most physiological responsiveness to massage — the integumentary, cardiovascular, autonomic nervous, and neuroimmune systems — are the same ones that are also highly responsive to psychological interventions such as guided imagery, hypnosis, and biofeedback. It is also certainly possible that massage does produce specific effects, such as an increase in the cytotoxicity of natural killer cells (Ironson et al., 1996), through the modulating activity of the higher perceptual centers and the limbic cortex of the brain. Using this line of reasoning, it is also possible that massage produces effects through learned behavior or conditioned response. Many massage therapists have recounted to me instances where clients have said to the therapist that they felt an increased sense of relaxation and well-being upon walking into the office or even knowing that they had an appointment that day. Indeed, as Box 2.1 shows, kinesthetic learning is the stated goal of several modalities, such as Alexander Technique and Feldenkrais. Here again is an argument for viewing research as a collaborative effort on the part of investigator and participant, for studying individual response to treatment, and for studying what factors can maximize treatment effectiveness. From a methodological perspective, it also illustrates the importance of collecting baseline data regarding the extent of previous experience with massage by study participants. In some instances naive participants may be preferable to those with more experience as massage consumers to rule out learning effects.

Because the effects of expectation have been so thoroughly documented in the health care and psychology literature, it is necessary to account for its role in evaluating the effectiveness of massage therapy. Clearly, patients who seek out massage must have some belief that it will help them or else they would not spend time and money to get it. Presumably, patients who choose to participate in research studies of massage must also have some degree of belief or else they would not consent to receive it. By the same token, patients who are averse to massage for whatever reason are likely to refuse it as an intervention. Expectation on the part of patients should be assessed whenever possible so that its role can be measured. Informed consent also raises a related issue: how to provide prospective participants sufficient information with which to make an informed decision without giving away too much information regarding the experimenter's expectations.

One solution is to not label one treatment as active and the other as a sham or placebo, but instead to tell prospective participants that they will receive one of two active treatments, and that each may have benefits.

A novel solution to these problems has been proposed by Cassidy (1994). In her cross-over design, participants are divided into two groups. One group is randomly assigned to receive first treatment A and then treatment B, and vice versa. The other group chooses which treatment they will receive and remains with it unless they become dissatisfied, at which time they are allowed to choose again. In addition, all participants are interviewed. Those who are randomly assigned are asked to respond to their assignment, and those allowed to choose are asked to explain their choice(s). The design is a powerful one because it not only separates the effects of expectation from specific treatment effects but through the use of the interview data examines the ways in which expectation can magnify treatment effects.

## TYPES OF RESEARCH STUDIES

A final problem with designing and conducting research on massage therapy has to do with the types of studies that have been conducted. Typically, when little is known about a subject descriptive studies are conducted first, to 'map out the territory' and provide a solid foundation of knowledge to build upon. Analytic studies then follow, and a knowledge base is constructed. Types of studies such as clinical trials or systematic reviews are conducted only when a substantial amount of knowledge has been amassed from previous studies.

With massage therapy, however, this sequence of events has not happened. Massage became popular as a medical intervention in the mid 1800s, thanks to the work of Per Hendrik Ling, Johann Georg Mezger, and their pupils (Kamenetz, 1976). Initial research on the effects of massage was performed by physicians in the Victorian era (Brunton & Tunnicliff, 1894–1895; Edgecombe & Bain, 1899; Jacobi & White, 1880; Mitchell, 1894) and focused on the physiological effects of massage on body functions such as circulation, including blood and lymphatic flow, and muscle function. Research in these and related areas continued until the early 1950s (Carrier, 1922; Drinker, 1939; Elkins et al., 1953; Pemberton, 1945; Wakim et al., 1949). These studies were mostly descriptive in nature, lacking true experimental design and tests of statistical significance. Much of this research has been largely forgotten or dismissed as being out of date, and is seldom referenced outside of massage therapy textbooks, despite its historical and descriptive value. A large percentage of what is currently taught in training programs about the effects of massage is based on these early studies, combined with a healthy dose of clinical observation and belief.

Although the early studies provide some evidence of massage's effects on body systems, evidence as to the usefulness of these effects in treating health care conditions or promoting wellness remains at an early stage. The majority of claims regarding massage's physiological efficacy have not been verified by more recent clinical research (Ernst & Fialka, 1994). Despite this lack of a solid foundation, poorly designed clinical trials of massage and systematic reviews concluding that there is insufficient data continue to proliferate. Proper design and conduct of a clinical trial poses its own challenges, and 'the evidence available to guide many aspects of the design, conduct, and analysis of trials is not always being applied' (Prescott et al., 1999).

While well-designed clinical trials are certainly necessary and help to advance knowledge regarding massage therapy, it also makes sense to focus research funding and efforts on appropriate descriptive and observational studies to create a broader knowledge base. For example, it would be interesting to verify early observed effects of massage on blood and lymphatic flow using modern technology. Because massage has a plausible biological basis, studies that identify and test potential mechanisms by which massage produces its effects are also important. Because massage clearly has significant psychological effects (Field, 1998), it offers a fertile field for investigating mind–body interactions. Studies should routinely collect data on both physiological and emotional variables, as well as the psychological characteristics of participants, all of which may help explain why some people respond more positively to massage than others. At a minimum, studies should collect baseline data concerning psychological factors that are known to affect physiological outcomes, such as anxiety and depression. Studies that examine neuropeptide responses to massage as well as areas of brain activity during and after massage would be valuable and might identify potential mechanisms.

In addition, qualitative studies that focus on patients' experience of massage and its meaning to them are particularly lacking. Qualitative studies are sometimes ignored as an important element of evidence-based medicine, yet they provide information that illuminates important aspects of the therapist–patient encounter which can also be used to improve the design of quantitative studies. Educational research on massage training is nonexistent and is badly needed as the profession continues to grow exponentially.

## RECOMMENDATIONS

Based on these arguments, I make several recommendations to investigators who are designing studies and reporting their results. Some of these recommendations apply to any kind of research, but bear reiteration. Firstly, assumptions about and definitions of massage therapy for the purposes of

the study should be clearly articulated. Design decisions should always be determined by the study hypothesis to be tested. Among those particularly relevant for massage research are the choice of an appropriate comparison group and whether to use a standardized or individualized massage protocol. Choices made should be congruent with the hypothesis tested, and their rationale explained. If a sham or placebo treatment is used, investigators should verify that blinding of participants was successful. Dependent variables or outcomes measured should be clinically and socially relevant. As a means to increase validity in research on massage generally, the proper use and implementation of random assignment is especially important.

Secondly, studies should use qualified personnel to provide massage interventions, particularly when individualized protocols are used, in order to maximize treatment effectiveness. Professionally trained and experienced practitioners can provide valuable information to investigators regarding the design of the massage intervention in studies using standardized protocols, again maximizing treatment effectiveness. In studies with individualized protocols, practitioners should keep a detailed record of the treatment provided at each session with an explanation of the rationale for their decisions, which can be analyzed and presented as part of the study results or as a separate paper. More than one therapist should be used to provide treatment, to control for therapist effect, and the same therapist should treat the same patient, to allow the development of a therapeutic relationship. From an ethical standpoint, therapists should also be paid for their time, knowledge, and skill as study collaborators, at a level comparable to other study personnel and commensurate with the work performed, rather than being expected to donate or volunteer their services. Qualifications of massage personnel should be stated in published studies. Such studies should describe the massage protocol used in sufficient detail, so that readers can have a clear understanding of what kind of massage was performed.

Next, study personnel who collect or assess data should be blinded. Data regarding participant expectation and prior experience with massage should be collected and measured whenever possible. Although numerous authors have made the following request before, it bears repeating because it has yet to become standard practice: published results should present estimated effect sizes and confidence intervals, in addition to $p$ values. Statistical tests of significance should be applied appropriately, particularly when multiple outcomes are measured.

It is also important that investigators conducting systematic reviews take some of the methodological issues discussed into account when evaluating or weighting studies for analysis. A systematic review is only as good as the quality of its individual studies will allow. I have yet to see a systematic review that considered the use of professionally trained and

experienced practitioners to provide the intervention or that considered whether the massage protocol used was congruent with the study hypothesis as a criterion for evaluating the quality of a study.

Finally, massage schools need to include research literacy as part of the curriculum so that future therapists are conversant with important studies, can distinguish high quality from poor quality research, and have a strong foundation from which therapists can assume roles as active collaborators in helping to design and carry out studies or from which they may pursue further training to design and conduct studies independently.

Having trained in both quantitative and qualitative research methods, I do believe that existing research methods are quite adequate to the task of evaluating massage therapy. However, quantitative methods in particular need to be applied thoughtfully, with attention to the issues discussed here. Health care research has traditionally relied on epidemiological methods and can only benefit from the inclusion of methods drawn from other disciplines such as psychology, anthropology, and education. Clinical trials play an important role but are not the only methodologically sound or rigorous type of study design. Other types of research have value and should be used to inform the design of such trials, and to create a more complete knowledge base in the field of touch-based therapies.

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## INTRODUCTION TO SECTION 2

The following four chapters address the utility of massage therapy for a number of conditions. Tiffany Field summarizes what is known about massage for immune disorders. Her chapter gives special attention to massage for HIV patients, leukemia patients, and for breast cancer patients. For each of these conditions, Field finds that natural killer cell number and cytotoxicity (activity) were increased after massage therapy. Her work with HIV patients includes both studies of adults and adolescents; for adults, Field's protocol included 45-minute massages five days per week for five weeks. In her study of HIV-positive adolescents Field found that after three months of massage treatment, the teenagers reported less depression. Depression is associated with immunosuppression. Field continues to describe her research with pediatric oncology patients. Children with leukemia who received massage therapy showed decreased anxiety and depression and increased immune function.

Field also describes a study she and her colleagues conducted on massage therapy for breast cancer, a cancer which strikes about one in nine women. Her sample of women, who had undergone simple mastectomy, received 30-minute massage sessions twice a week for five weeks. Among her many findings, Field found a reduction in anxiety, depression, and anger. As Field notes, future research should examine potential long-term (over many months) effects of massage therapy and should investigate underlying mechanisms.

In her chapter, Silvana Lawvere, like Tiffany Field, finds decreases in anxiety and depressed mood in a sample of cancer patients. Lawvere studied a small sample of seven ovarian cancer patients undergoing chemotherapy and found decreases in self-reported anxiety and depression and a decrease in self-reported pain. As Lawvere notes, ovarian cancer is the leading cause of death among gynecological cancers, and cancer patients often report anxiety, depression, and pain. Lawvere's study used a licensed massage therapist with over ten years of experience and 30-minute massage therapy sessions. Her study replicates a general finding (Field, 2000) that massage therapy reduces anxiety as measured by the Spielberger State Trait Anxiety Inventory.

In her chapter on immune disorders, Field indicates a need for cost-benefit analyses of massage therapy in the treatment of immune disorders. Buford Lively and colleagues study just this issue in their research on massage therapy for controlling chemotherapy-induced emesis in women undergoing treatment for breast or ovarian cancer. Lively and colleagues remind the reader that the emetic process includes vomiting, nausea, and retching. Anti-emetic drug therapy was given to 14 patients, while 17 patients received massage therapy as an adjunct to anti-emetic drug therapy.

When massage was used as an adjunct, the study found that total days of nausea and vomiting were reduced and that the length of hospital stay was also reduced. The study found that patients who did not receive massage therapy had extra costs averaging $2853.10. Such results are extremely provocative and one hopes to see similar studies for other conditions.

Finally, Sandra Rogers studies massage as a modality to improve health following spinal cord injury. Rogers reminds readers the spinal cord injury is common, and that there are 200,000 people with spinal cord injuries in the United States. Rogers notes that the immune system changes seen in acute spinal cord injury are similar to those found in patients with chronic stress conditions. Her research subjects received 60-minute massages three times weekly for four weeks. Massages were given by licensed massage therapists and advanced students, and subjects were randomly assigned to a therapist, each of whom was blind to the study outcome measures. Rogers reviews a number of immunological and psychological findings for her massage therapy group. Future studies might investigate the necessary duration of treatment as well as its cost-effectiveness.

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# 3

# Massage therapy for immune disorders

*Tiffany M. Field*



## INTRODUCTION

This chapter is a review of a selection of studies on massage therapy for immune disorders including HIV, leukemia and breast cancer. In all of these disorders natural killer (NK) cell number and cytotoxicity (activity) were enhanced following massage treatment. The decrease in stress hormones (for example, cortisol) is thought to mediate the altered NK cell function. Clinical improvement would be expected to follow from less opportunistic infection, inasmuch as NK cells destroy both cancer and viral cells.

Immune disorders involve dysfunction in the immune system — immune cells are destroyed by foreign cells (viral cells). It was expected that massage therapy would attenuate immune disorders such as HIV and cancer because massage therapy has been noted to lower cortisol (stress hormone) in many conditions (see Field, 1998 for review) and cortisol is noted to kill immune cells, for example, NK cells (Ironson et al., 1996), that in turn kill viral and cancer cells (Whiteside & Herberman, 1989). In this chapter a selection of massage therapy studies on HIV and cancer are reviewed. The data from these studies combined suggest that massage therapy positively affects immune function in immune disorders.

## HIV-POSITIVE PATIENTS

Although the effects of massage have rarely been studied in the context of immune disorders, the data from relaxation studies are suggestive. Progressive muscle relaxation has contributed to increased NK cell activity and decreased antibody titers in elderly adults (Kiecolt-Glaser et al., 1985). Helper T lymphocyte cells have also increased in medical students who

practiced relaxation more frequently (when they were undergoing exams), (Kiecolt-Glaser et al., 1986). Further, relaxation therapy has been associated with increased NK cell cytotoxicity (activity) and NK cell number in melanoma patients (Fawzy et al., 1990). Finally, HIV positive subjects who practiced relaxation more frequently had better immune functioning one year after their diagnosis, and slower disease progression two years later in at least two studies (Antoni et al., 1991; Ironson et al., 1996).

## HIV-positive adults

A study on massage therapy with HIV adults, assessed changes in anxiety and depression, in cortisol levels and immune function following five weeks of massage therapy treatment (Ironson et al., 1996). Twenty-three HIV-positive and ten HIV-negative men were recruited for the study. Over half the sample (14 of 23) had CD4 counts below 500. Most of the subjects were asymptomatic and only two subjects were on antiretrovirals (both on AZT). The 45-minute massage protocol, provided five days per week for five weeks, was a combination of stretching, rocking, squeezing, and holding applied to the head, neck, arms, torso, legs and back.

The massage therapy had no effects on the immune measures related to disease progression in HIV including CD4, CD4/CD8 ratio, beta 2 microglobulin, and neopterin. However, NK cell number and cytotoxicity (activity) increased for the massage therapy group. These changes may have related to the decreased cortisol noted during the massage period. Decreases in cortisol (and anxiety) were significantly correlated with enhanced NK cell number and cytotoxicity.

The importance of NK cell number and cytotoxicity (activity) in HIV positive persons is twofold. First, since the virus itself infects and destroys CD4 cells, the NK cells represent another type of immune cell that may still afford some protection. In later stages of HIV infection, persons with low CD4 counts, who remain asymptomatic may have greater NK cell function (Solomon et al., 1993). Second, NK cells repeatedly provide protection against both viruses and tumors (Whiteside & Herberman, 1989). Viruses (opportunistic infections like pneumonia) are often seen in AIDS patients, as are several malignant diseases (Epstein & Scully, 1992). Lower NK activity is associated with the development of metastases and shorter survival time in patients with cancer (see Whiteside & Herberman, 1989 for a review).

Inasmuch as elevated stress hormones (catecholamines and cortisol) negatively affect immune function, the increase in NK activity probably related to the decrease in these stress hormones following massage therapy. Because NK cells are the front line of defense in the immune system, combating the growth and proliferation of viral cells, the HIV patients who received the massage therapy would probably experience fewer

opportunistic infections such as pneumonia and other viruses that often kill them. Inasmuch as NK cells are also effective in combating cancer cells, cancer patients might also benefit from massage therapy.

## HIV-positive adolescents

The lack of change in the disease markers, the CD4 cells and the CD4/CD8 ratio, may have related to the patients being immune compromised (over half having CD4 counts below 500). Thus, our next study sampled less immune compromised adolescents. HIV-positive adolescents with a mean CD4 count of 466 were recruited from a large urban university hospital's outpatient clinic and randomly assigned to receive massage therapy ($n = 12$) or progressive muscle relaxation ($n = 12$) twice per week for 12 weeks (Diego et al., 2001). To evaluate the effects of treatment, participants were assessed for depression, anxiety and immune changes before and after the 12-week treatment period. The adolescents who received massage therapy reported feeling less anxious and were less depressed than those who experienced relaxation therapy. They also showed enhanced immune function by the end of the 12-week study. Immune changes included increased NK cell number (CD56 and CD56+CD3−). In addition, the HIV disease progression markers including CD4 number and the CD4/CD8 ratio increased for the massage therapy group only.

Following three months of treatment, the HIV-positive adolescents who received massage therapy reported feeling less depressed than the adolescents who participated in progressive muscle relaxation sessions. In addition, those in the massage therapy group showed improved immune function supporting previous research on decreased depression (Field et al., 1992; Ironson et al., 1996) and improved immune function (Hernandez-Reif et al., 2001; Ironson et al., 1996) following massage therapy.

HIV infection is commonly accompanied by psychological distress, often manifested as depression and anxiety, which may increase HIV symptomology (Jewett & Hecht, 1993). Stress and anxiety might overactivate the hypothalamic-pituitary-adrenal axis (HPA) resulting in the production of cortisol and neuropeptides that may further suppress the immune system, NK cells in particular (Lutgendorf et al., 1996; Zorilla et al., 1996; Madhavan et al., 1995). Although this study did not assess cortisol, the positive massage therapy effects on NK cell number and cytotoxicity might be explained by this treatment's ability to reduce stress and anxiety, which in turn might trigger a reduction of HPA activity, lowering cortisol levels and resulting in improved immune function. Increased NK cell number and activity signifies an important gain in HIV infection as NK cells have been shown to provide protection against common AIDS opportunistic diseases such as tumors and viruses (Whiteside & Herberman, 1989). In addition, it is believed that in advanced HIV cases characterized

by low CD4 counts, persons who remain asymptomatic may have greater NK cell functioning (Solomon et al., 1993).

The effect on the HIV disease marker (CD4/CD8 ratio) shown in this study but not in the study conducted by Ironson and colleagues (1996) might be explained by the high incidence of depression in our sample. Depression has been linked to immunosuppression through the effects that adrenaline (epinephrine) and noradrenaline (norepinephrine) have on immune function, including decreased CD4 number and CD4/CD8 ratio (Ravindran et al., 1995). Massage therapy then by reducing depression might also help to improve T-lymphocyte activity, including CD4/CD8 ratio and CD4 number, in HIV-infected adolescents.

## BREAST CANCER

Breast cancer is one of the most common cancers among women (one in every nine) (National Cancer Institute, 1999). Although breast cancer treatment depends on many factors, most particularly the stage of the disease, the most common treatments are surgery followed by chemotherapy or radiation therapy.

Because NK cells increased in our HIV studies and because they are thought to ward off cancer cells as well as viral cells, as already mentioned, massage therapy was explored as a potentially effective intervention for breast cancer patients.

The breast cancer study examined the effects of massage therapy on boosting the immune system by increasing NK cell number and cytotoxicity, and enhancing psychological status by reducing depression and anxiety. Because massage therapy has been effective with numerous physical and psychological conditions associated with breast cancer (anxiety, depression, elevated stress and stress hormones, compromised immune system, and pain), massage therapy was also expected to reduce these problems in breast cancer patients. Thirty-six women diagnosed with Stage I or II breast cancer who had undergone simple mastectomy (the removal of a breast) within the past 18 months were included in the study. The mean age of the group was 52 years. Because radiation therapy affects immune measures, the women were not entered into the study until completion of their radiation and chemotherapy treatment, which lasted for six to seven weeks following surgery.

The 30-minute therapy sessions were conducted by volunteer massage therapists three times a week for five consecutive weeks. The therapy was comprised of moderate pressure, smooth strokes, covering the head/neck, shoulder, chest, arms, legs and back.

The data analyses suggested the following: anxiety was reduced for the massage therapy group after the first and the last sessions; depressed

mood was also reduced for the massage therapy group after the first and last sessions and from the first to the last day of the study; and anger decreased for the massage therapy group from the first to the last massage day. Also, depressive and hostility symptoms decreased for the massage therapy group from the first to the last day. Biochemical changes included increased dopamine and serotonin levels from the first to the last day.

## Analysis of the immune measures

Paired sample *t*-tests, conducted separately for each group, revealed significant increases for the massage therapy group in NK cell numbers and lymphocytes.

## Correlations

A positive correlation was noted between avoidant coping and NK cell numbers and a negative correlation between intrusive coping style and urinary dopamine values. A negative correlation was also noted between anxiety scores and lymphocytes, suggesting that the lower the anxiety level the higher the lymphocyte numbers.

The immediate effects of massage therapy for women with breast cancer were decreases in anxiety, depressed mood and anger. Depressed mood on the Profile of Mood States (POMS) also decreased across the study period, as did depression and hostility on the Symptom Checklist 90R. Similar massage therapy effects have been reported for other chronic illnesses including HIV (Ironson et al., 1996), multiple sclerosis (Hernandez-Reif et al., 1998), fibromyalgia (Sunshine et al., 1996), and chronic fatigue syndrome (Field et al., 1997).

Surprisingly, the women in the massage therapy group did not show a decrease in cortisol stress hormone, noradrenaline (norepinephrine) or adrenaline (epinephrine) values, as has been shown in other massage therapy studies (Field et al., 1996, 1997; Ironson et al., 1996). In relation to the HIV men's study data, the women with breast cancer had higher catecholamine and cortisol values. That the women in the control group showed an increase in the stress hormone noradrenaline (norepinephrine) over the five weeks suggests that the women who did not receive massage were more stressed by the end of the five-week control period. The men in the HIV men's study received daily massage whereas the women in the present study were massaged three times a week. Perhaps more frequent massages or a longer intervention period is required to decrease catecholamine levels for breast cancer patients. The findings also suggest that massage therapy three times a week may be sufficient to keep stress hormone levels from rising.

The women in the massage therapy group showed increased dopamine and serotonin levels on the last day of the study. This increase may reflect the massaged group's improved mood and decreased depression as both serotonin and dopamine have been noted to increase in depressed individuals following massage therapy (see Field, 1998).

Of greatest interest in the current study was that women who received massage therapy showed an increase in NK cell number and lymphocytes. The increase in NK cell number supports an earlier HIV men's massage therapy finding (Ironson et al., 1996) and a recent HIV adolescent massage therapy study (see Diego et al., 2001 for review). That massage therapy increased NK cells and that NK cells specialize in destroying virus-infected cells and tumor cells (Brittenden et al., 1996) has important implications for massage as an intervention for immune compromised illnesses. The increase in lymphocytes following three times weekly massage therapy sessions had not been previously reported. Lymphocytes are precursor cells of immunologic function as well as regulators and effectors of immunity and play an important role in the activation of helper T cells (Hyde, 1992).

Also of interest in the study were the associations between coping style, biochemistry and immune response. Avoidant coping was associated with increased NK cell numbers and intrusive coping was associated with decreased dopamine levels. Women who avoid thinking about cancer may be less depressed or stressed and this may explain their better immune response, inasmuch as stress has been shown to impair immune function (Zorilla et al., 1994). Women who have intrusive thoughts or are preoccupied with their cancer diagnosis may be more prone to depression and lower dopamine (Rogeness et al., 1992). Higher anxiety scores were also correlated with lower lymphocytes, suggesting that greater anxiety negatively impacted the immune system. However, one unexplained finding was the negative correlation between anxiety scores and cortisol levels since typically higher anxiety is correlated with higher cortisol values.

The present study is limited with respect to assessing longer-term effects of massage therapy on breast cancer. Further research is required to examine whether extended massage therapy treatments (e.g., over six months) can keep the cancer in remission. Moreover, whether similar massage therapy benefits would be gained for other types of cancer or immune compromised conditions requires further study.

In summary, the self-reports of reduced stress, anxiety, anger/hostility and improved mood and the corroborating findings of improved immune function suggest that massage therapy has positive applications for breast cancer survivors. That elevated anxiety levels and coping style correlated with immune and biochemistry measures suggest the need for interventions, like massage therapy, that offer psychoneuro/immunological benefits for breast cancer patients.

## PEDIATRIC ONCOLOGY PATIENTS

Cancer treatment can cause distress in children related to the anxiety and pain associated with medical procedures (such as bone marrow aspirations, lumbar and venous punctures and chemotherapy) and nausea and vomiting (resulting from chemotherapy and from anticipatory anxiety associated with treatment). These repeated procedures may lead to anxiety and depression.

The potential benefits of relaxation therapy have been explored for stress management and pain reduction in leukemic patients (Pederson, 1996) and for reducing feelings of nausea and anxiety induced by chemotherapy in cancer patients (Arakawa, 1997). Distress levels in children with leukemia have been notably lower following a combination of pharmacological and psychological interventions (Kazak et al., 1996). One study reported the use of cognitive behavioral techniques from both parent and child as instruments to improve positive mood during painful procedures (Broome et al., 1998). Imagery using visualization has also resulted in fewer distress behaviors during painful procedures such as children undergoing cardiac catheterization (Pederson, 1995).

As noted above in the HIV and breast cancer studies, a significant reduction in anxiety levels and enhanced immune function (increased NK cell number and cytotoxicity) in HIV-positive men suggest that massage therapy positively affects the immune system. Thus, massage therapy was used with children being treated for leukemia to reduce the children's anxiety and depressed mood and enhance their immune function. Massage was the preferred therapy because other relaxation therapy techniques require more active participation and understanding by the participant. The parents were taught to give the massage therapy so that it could be given on a daily basis, could be cost effective and might reduce the parents' stress. For example, anxiety and cortisol levels have been reduced in elderly volunteers from giving children massage (Field et al., 1998). Teaching the parents to massage their child was expected to give the parents a more active role in their child's treatment, thereby reducing their own anxiety levels and sense of helplessness. Having the parents massage the children at home was also less likely to cause an association between massage and any painful, uncomfortable medical procedures at the hospital. In addition, having the parents as therapists was considered more cost effective and potentially helpful for the parent–child relationship.

Twenty children (mean age 7.2 years) with leukemia participated in this study. The children were randomly assigned to the massage or control group. The massage therapy training sessions were conducted by two massage therapists who guided the parents through the 20-minute massage by having them practice it on their child under the direction of the therapist. Once they felt comfortable doing the massage, the parents were

instructed to give the massage before bedtime every day for 30 days. The 20-minute massage consisted of applying moderate pressure for 30-second periods on the face, neck, shoulders, back, stomach, legs, feet, arms and hands.

Analyses of the data on the parents' and child's anxiety and depressed mood measures suggested that the massage therapy group parents had lower anxiety and depressed mood levels after the massage therapy sessions on the first day of the study. Similarly, the massage therapy group children had lower anxiety and depressed mood levels after the massage therapy sessions on the first day of the study.

The massage therapy group parents' depression also decreased across the course of the study. Most importantly, the massage group children's white blood count and neutrophil count increased significantly across the one month treatment period. The reduction of anxiety in the parents may have resulted from their having a more active role in their children's treatment. The children's lower anxiety following massage may have in turn contributed to their improved immune function.

## CONCLUSION

These then are the improved functions noted following massage therapy. In addition to the immune changes noted in each study — most commonly increased NK cell number and activity — anxiety, depression, stress hormones (cortisol) and catecholamines significantly decreased. Increased parasympathetic activity may be the underlying mechanism for these changes. The pressure stimulation associated with touch increases vagal activity which in turn lowers physiological arousal and stress hormones (cortisol levels). The pressure is critical because light stroking is generally aversive (much like a tickle stimulus) and does not produce these effects. Decreased cortisol in turn leads to enhanced immune function.

Further research is needed, however, not only to replicate these empirical findings but also to study underlying mechanisms. Until underlying mechanisms are known, the medical community is unlikely to incorporate these therapies into practice. In addition to mechanism studies, treatment comparison studies are important not only to determine the relative effects and combined effects of different therapies such as the massage therapy combined with aromatherapy, but also the within-therapy variations such as the best massage techniques for different conditions and the arousing versus the calming effects of different types of treatment, for example, the arousing effects of rosemary and the calming effects of lavender (Diego et al., 1998). Further, cost benefit analyses need to be conducted to establish the cost effectiveness of massage therapy for the treatment of immune disorders.

## ACKNOWLEDGEMENTS

*I would like to thank those individuals who participated in these studies. This research was supported by an NIMH Senior Research Scientist Award (MH#00331) to Tiffany Field and funding by Johnson and Johnson.*

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# 4

# The effect of massage therapy in ovarian cancer patients

*Silvana Lawvere*



## INTRODUCTION

Despite the increasing use of alternative medicine and specifically massage therapy (MT) among cancer patients, the efficacy of MT has not been evaluated in a clinical sample of ovarian cancer patients. Previous studies of MT in other samples have demonstrated a reduction in cancer-related symptoms. This randomized cross-over trial evaluated the effect of MT on self-reported anxiety (Spielberger State Anxiety Inventory), depressive mood (Visual Analogue Mood Scale), and pain (Memorial Pain Assessment Card) among seven hospitalized, white, aged 44 to 75, ovarian cancer patients undergoing chemotherapy at the Roswell Park Cancer Institute, Buffalo, NY. Six of the seven women (85.7%) self-reported using some form of alternative medicine.

Patients were randomized to one of the following sequence groups: first a 30-minute MT treatment followed the next day by a 30-minute rest period, ($n = 3$) or, first the rest period followed the next day by the MT treatment ($n = 4$). The mean percent change in scores from pre to post MT were: anxiety (33% reduction), depressive mood (38% reduction), and pain (9% reduction). These reductions were compared, using a paired $t$-test, to the corresponding percent changes for the rest period: anxiety (6% reduction), depressive mood (13% reduction), and pain (5% increase). The reduction in anxiety was statistically significant ($p = 0.002$). These initial findings, though drawn from a select sample, contribute to a growing body of research that suggests that MT may improve quality of life within a biopsychosocial approach to cancer care.

Many patients remain dissatisfied with management of anxiety, pain and/or depressive mood, despite the medical advancements that have been made in the diagnosis and treatment of cancer (Burke et al., 1994). This study was designed to examine the efficacy of massage therapy (MT) in alleviating anxiety, depressive symptoms, and pain in ovarian cancer patients undergoing chemotherapy.

A study published in the *New England Journal of Medicine* found that 34% of their representative sample had used unconventional forms of medical treatment in the previous year (Eisenberg et al., 1993). MT was found to be the third most frequently used alternative treatment. Alternative medicine is also being explored by cancer patients, and by ovarian cancer patients, who account for 4% of all cancer patients (Tortolero-Luna & Mitchell, 1995). With the growing use of MT in the US it is crucial to undertake scientific investigation regarding its effectiveness.

The purpose of this study was to demonstrate the possibility of conducting a randomized controlled clinical trial that would evaluate the efficacy of MT compared with usual care among ovarian cancer patients undergoing chemotherapy. Instrumentation was developed and tested to assess depressive mood, pain, and anxiety, as well as to collect background information. No past MT studies have investigated the efficacy of massage on anxiety, depressive mood and pain in this sample. The information derived from this study is crucial for both patients and clinicians alike.

The hypothesis of this study is that MT treatments will produce a short-term, less than 24-hour, 20% reduction of anxiety, depressive mood, and pain symptoms among ovarian cancer patients undergoing chemotherapy, when compared with the same patients receiving usual care in the form of a rest period.

## LITERATURE REVIEW

Ovarian cancer is the second most common cancer of the reproductive system in women (Tortolero-Luna & Mitchell, 1995). It is the leading cause of death for all gynecological malignancies (Tortolero-Luna & Mitchell, 1995). The US incidence rate between 1986–1990 of ovarian cancer was 14.3/100,000 women, the mortality rate for the same period was 7.8/100,000 women (Tortolero-Luna & Mitchell, 1995). These incidence rates have remained somewhat stable for the past 30 years. The five-year relative survival rate is still 39–46% (Tortolero-Luna & Mitchell, 1995; American Cancer Society, 1997). Ovarian cancer is more common among white women than among African American women and it increases dramatically after age 40 (Tortolero-Luna & Mitchell, 1995). Although age and race are known risk factors, the etiology is not well understood.

Portenoy et al. (1994) found the prevalent symptoms in the 151 ovarian cancer patients studied were: worrying (71.7%), lack of energy (68.8%), feeling sad (63.8%), pain (61.8%), feeling nervous (61.5%), having difficulty sleeping (57.3%). Another study showed that 85% of women experienced at least some anxiety during treatment of gynecologic cancers (Rollison & Strang, 1995). This may be associated with uncertainty about the outcome of the illness, fear of death, being in the hospital setting, as well as with the various invasive tests and treatments involved.

Depression and depressive mood are major problems among cancer patients, with prevalence estimates ranging from 40% to 64% (Portenoy et al., 1994; Spiegel, 1996; Middleboe et al., 1994). Though there is a high prevalence of depressive mood among cancer patients, it is often not diagnosed. The symptoms of depression may be attributed to the disease or to the treatment of the disease.

It is estimated that 30–40% of patients in the intermediate stages of cancer and 60–80% in the more advanced stages experience pain (Ferrel-Torry & Glick, 1993). Dorrepaal et al. (1998) found that 83% of the cancer patients they studied said that tension and nervousness increased the pain they were experiencing. Although cancer patients are treated with analgesics, Bonica (1990) reports that 20–40% of cancer patients are not successfully treated for pain. Montazeri et al. (1996) include pain relief as one of the most important areas for improving the quality of life for ovarian cancer patients.

The majority of the research on cancer pain reduction has looked at treatments that revolve around analgesics. Increased tolerance to analgesics can present several problems (Bruera & Lawlor, 1997). Patients are often in need of progressively higher doses, but the risk of side effects increases the higher the dose. As opioid exposure increases, many patients develop toxicities, like delirium, myoclonus, grand mal seizures and hyperalgesia (Bruera & Lawlor, 1997).

MT simultaneously acts in multiple ways. Soft tissue manipulation can improve circulation (Tappan, 1988) and can reduce pain caused by the accumulation of irritants, which are flushed away with increased blood flow between muscle fibers caused by the repeated motion of massage (Zerinsky, 1987). MT can stimulate large diameter sensory nerves that inhibit pain transmission (Melzack & Wall, 1965). One mechanism may relate to increased parasympathetic activity: 'The pressure stimulation associated with touch increases vagal activity, which in turn lowers psychological arousal and stress hormones' (Field, 1996). Touch is believed to stimulate the release of endorphins and enkephalins, which can increase a sense of subjective well-being (Tappan, 1988). Massage reduces muscle tension and spasm, and hence relaxes the patient (Tappan, 1988). It been shown to significantly reduce heart rate (McKechie et al., 1983), it can have a positive psychological effect (Field et al., 1996a), and may be associated with feelings of being nurtured and cared for (Tappan, 1988).

Much of the research on MT has had methodological problems including small sample size, lack of adequate control groups, varied treatment length, treatments which are too short, and massages which are of poor quality due to inadequate training and lack of standardization. The data from several studies has shown that MT can have an immediate effect on reducing both physiological and psychological symptoms (Ferrel-Torrey & Glick, 1993; Field et al., 1996a,b; Ahles, 1995; Fishman et al., 1995; Meek,

1993; Nixon et al., 1997; Weinrich & Weinrich, 1990). These outcomes have been measured both by established indices and through physiologic measurements. The research generated at the Touch Research Institute International in Miami, (Field et al., 1996a, b; Field, 1995) and at the Dartmouth Medical Center (Ahles, 1995) has been the exception. It has been able to overcome these methodological obstacles with larger sample sizes, standardized treatment lengths, appropriate control groups, and well-trained massage therapists.

Research on the effectiveness of MT has been completed with a range of samples, including cancer patients. A clinical trial by Weinrich & Weinrich (1990) on a sample of cancer patients investigated the effectiveness of MT, looking specifically at the effects of MT on cancer pain. Patients were randomly assigned to a MT and to a control group. The MT group received 10 minutes of massage to the back while the patients in the control group were visited for 10 minutes. A pain index was administered before, immediately after, one hour after, and two hours after, the massage treatment or visit.

Potential methodological problems in this study include: participants were undergoing various types of treatments for various types of cancer; and the time since receiving medication for pain within the control and treatment groups was variable. Such factors may produce inter-group variability as well as intra-group variability. The MT treatments were only 10 minutes long, and the instruments were administered immediately following the treatment. It has been shown that a therapeutic effect is not fully manifested immediately following the massage and at least a 10-minute period should be allowed between the end of the massage and the administration of indices and/or physiologic measurements (Ferrell-Torrey & Glick, 1993). Moreover, seven nursing students that had received only a one-hour training session had given the treatments. Another possible limitation of this study is that the treatment and control groups were not demonstrating equal pain levels prior to the intervention, and the initial baseline pain measures were quite low. A study strength appeared to be the use of a 10-minute visit with a nurse as the control treatment for the MT treatments. This strategy may address both the possible placebo effect as well as the potential effect of human contact alone.

Ferrell-Torrey and Glick (1993) found a statistically significant ($p = 0.05$) reduction in pain (as measured by visual analogue scales) and anxiety (as measured by the Spielberger State Trait Anxiety Inventory) in nine male cancer patients who received back massages. This study suggests a possible short-term benefit from just one 30-minute massage. However, this study was exploratory, had no control group, and used cancer patients at various stages and sites.

Corner et al. (1995) also evaluated MT in a cancer population. This study examined the interaction effect of MT and aromatherapy on 52

people. Participants were randomized to three groups. Group 1 received 30-minute massages once a week for eight weeks with almond oil, while Group 2 received the same massage schedule with essential oils (a blend of lavender, rosewood, lemon, rose and valerian). Group 3 received usual care. Study measures, the Holmes and Dickerson Distress Scale and the Zigmond Hospital anxiety and depression scale, were administered prior to, and 24-hours after, the massage treatments. Since the measurements were taken after 24 hours and not immediately after the MT sessions, this study was specifically looking at the longer-term cumulative effects. There was a peak reduction in anxiety after three or four sessions ($p = 0.05$) in both of the MT groups. However, the patients were not matched according to cancer site or stage of disease.

Wilkinson (1995) examined quality of life in 28 cancer patients and investigated MT and the interaction effect of MT and aromatherapy oil (i.e., chamomile oil). Fifty-one cancer patients (3 males and 48 females) were randomized into one of three groups. Patients had various cancer sites and stages of cancer. Both massage groups demonstrated a reduction in anxiety ($p < 0.001$), as measured by the State Trait Anxiety Inventory, and higher quality of life readings ($p < 0.05$), as measured by the Rotterdam checklist. The MT plus aromatherapy group had larger reductions on the above indices. This study also used a perception questionnaire that consisted of open-ended questions about patient satisfaction and perceptions about the benefits of massage. Although an open-ended questionnaire collecting information about perceptions may be helpful in a pre-study investigation, it is possible that these open-ended questions may have biased the participant when reading the other two standardized instruments.

One of the earlier studies was done by Sims (1986), who investigated the use of MT with six breast cancer patients. The McCorkle Symptom Distress Scale and Likert mood scales measured the outcomes of interest. The author indicated that there was a 15.4% improvement in distress scores ($p = 0.05$). This study was the only one to use a cross-over design. The design would have been appropriate, except for the extremely small sample size of six women and for the fact that there was no attempt to randomize volunteers. Having only volunteers may introduce bias, since these people may believe MT to be beneficial to them.

To summarize the state of the field, several studies examined cancer patients. Sims (1986) was the only investigator who looked at the effects of MT on a cancer population that included patients with only one cancer site (breast cancer) and the only one who used a cross-over design, but with only six participants. Ahles (1995) performed the only study on cancer patients with the use of licensed massage therapists. The findings from all these studies suggested that MT did produce positive results. Most of these studies however did not have a large enough sample size

to achieve sufficient statistical power and were preliminary or pilot studies. More research needs to be done in this area to investigate the efficacy of MT in a sample of cancer patients all experiencing the same type of cancer.

One problematic premise of most MT studies was that massage was performed as a nursing intervention. This poses many problems. The quality of the MT treatments is questionable. These nurses would need the time, energy, extensive training and physical and emotional space to achieve maximum success with MT. In many of these studies the nurses who performed the massage had only short training, and only for that particular study. The practitioner must feel at ease with his/her work, to be effective at calming the patient. The therapist's experience and familiarity with issues of inhibitions concerning touch is crucial. With a growing body of research that supports the effectiveness of MT, issues of the implementation of MT must be thought out.

The majority of the studies that utilized massage therapists were done at the Touch Research Institute International at the University of Miami Medical school (Field et al., 1996a,b; Field, 1995) and at the Dartmouth-Hitchcock Hospital (Ahles, 1995). These studies were among the most methodologically sound studies and all produced positive results.

## MEASURES USED

The State Trait Anxiety Inventory (STAI) (Box 4.1) was first developed by Spielberger in the 1960s when all available scales measured trait, rather than state anxiety, and was revised in 1983 (Spielberger et al., 1983). The STAI consists of two 20-item questionnaires that measure current anxiety (state) as well as the tendency to experience anxiety (trait). Only the State portion of the inventory was utilized, because the inventory was given to each patient four times in two days and change in current anxiety was the primary outcome of interest. Reliability and validity have been repeatedly demonstrated (Murphy, 1994; Thompson, 1989). This test has been sensitive to changes in anxiety levels after massage treatments in a cancer population (Ferrell-Torrey & Glick, 1993). Its advantages are: low cost, minimal time (5–10 minutes), and it is self-administered. No interviewer qualifications or training are needed to administer the STAI. Drawbacks include: the anxiety items are not specified for clinical morbid anxiety which is a drawback in clinical research, the test is most likely measuring perceived anxiety, and the scale has a number of somatic questions that can cause difficulties when used in a hospital setting.

First developed by Aitken (1969), the Visual Analogue Mood Scale (VAMS) (Box 4.2) has the advantage that the patient does not have to review his emotional status under numerous, and often painful, headings. A mark on the line toward the left represents 'as depressed as you have ever been',

**Box 4.1** Spielberger State Anxiety Inventory for adults scoring key

To use this, line up with test. Simply total the scoring weights shown on the stencil for each response category. For example if the respondent marked 3, then the weight would be 2. Refer to the manual for appropriate normative data. A decrease in score represents a decrease in anxiety.

| | NOT AT ALL | SOME-WHAT | MODER-ATELY SO | VERY MUCH SO |
|---|---|---|---|---|
| I feel calm | 4 | 3 | 2 | 1 |
| I feel secure | 4 | 3 | 2 | 1 |
| I am tense | 1 | 2 | 3 | 4 |
| I feel strained | 1 | 2 | 3 | 4 |
| I feel at ease | 4 | 3 | 2 | 1 |
| I feel upset | 1 | 2 | 3 | 4 |
| I am presently worrying over possible misfortunes | 1 | 2 | 3 | 4 |
| I feel satisfied | 4 | 3 | 2 | 1 |
| I feel frightened | 1 | 2 | 3 | 4 |
| I feel comfortable | 4 | 3 | 2 | 1 |
| I feel self-confident | 4 | 3 | 2 | 1 |
| I feel nervous | 1 | 2 | 3 | 4 |
| I am jittery | 1 | 2 | 3 | 4 |
| I feel indecisive | 1 | 2 | 3 | 4 |
| I am relaxed | 4 | 3 | 2 | 1 |
| I feel content | 4 | 3 | 2 | 1 |
| I am worried | 1 | 2 | 3 | 4 |
| I feel confused | 1 | 2 | 3 | 4 |
| I feel steady | 4 | 3 | 2 | 1 |
| I feel pleasant | 4 | 3 | 2 | 1 |

**Box 4.2** The Visual Analogue Mood Scale scoring key

The Visual analogue scale, question 21, will be scored on a ordinal basis from 1 to 10. An increase in score represents a decrease in self-reported depression. The line was divided equally in to ten parts and scored accordingly. One end has the value 10 stating 'Not at all depressed' and at the other end has a value of 1 stating 'As depressed as you've ever been'.

toward the right represents, 'not at all depressed'. In this study the scale was presented on an 8.5 by 11 inch piece of paper along with the other instruments. This scale is useful when measuring the change in depressive mood during the course of an illness rather than determining an absolute level (Little & McPhail, 1973). This scale can be used multiple times in a day, and has been used when repeated measures were needed. When this instrument was correlated to similar scales in hospital patients with various conditions, the results were between 0.61–0.8 (Aitken, 1969; Little & McPhail, 1973). However, after discharge the validity was extremely low.

Luria (1975) reported test-retest mean levels in the range 0.56–0.8. The medium $r$ range was 0.52–0.84 ($p < 0.001$). The across-patient test-retest reliability coefficients were significant in all diagnostic groups. The 2-hour

reliabilities were 0.73–0.91, the 24-hour reliabilities 0.52–0.72 (Luria, 1975; Folstein & Luria, 1973).

The advantage of the VAMS is its simplicity and the low cost of administration, since untrained personnel can administer it. It can be self-administered or read aloud to the patient who must put the mark on the line. It will take only approximately 15 seconds to answer the question. Note, however, that the definition of depression is nonspecific, since this instrument cannot provide a diagnosis of depression per se.

The Memorial Pain Assessment Card (Box 4.3) used in this study was first developed by the Analgesic Studies Section of the Memorial Sloan-Kettering Cancer Center to assess the relative potency of new analgesic drugs (Fishman et al., 1987). The card was an 8.5 by 11 inch card with eight pain intensity descriptors and three visual analogue scales (Fishman et al., 1987). It has been found to be valid, reliable, efficient and sensitive when used with cancer patients (Fishman et al., 1987; Kornblith et al., 1995), is inexpensive to administer, and can be self-administered in about 20 seconds.

This study was a pilot study for an eventual full-scale randomized clinical trial that utilized a two-period cross-over design. A randomized clinical trial (RCT) is an epidemiological experiment such that the participants in a study are randomly allocated into groups, usually called study

**Box 4.3** The Memorial Pain Assessment Card scoring key

An increase in score represents a decrease in self-reported pain.

Question 23 will be scored as follows:

8 No pain
7 Just noticeable
6 Weak
5 Mild
4 Moderate
3 Strong
2 Severe
1 Excruciating

The Visual Analogue Scales will be scored on a ordinal basis from 1 to 10. The lines were divided equally in to ten parts and scored accordingly.

Question 22

One end has the value 10 stating 'Least possible pain' and the other end has a value of 1 stating 'Worst possible pain'.

Question 24

One end has the value 10 stating 'Complete relief of pain' and the other end has a value of 1 stating 'No relief of pain'.

Question 25

One end has the value 10 stating 'Best mood ever' and the other end has a value of 1 stating 'Worst mood ever'.

The scores for the Visual Analogue Scales and question 23 will be added for one final score.

and control groups, to receive or not receive an experimental treatment or drug. The results are assessed by rigorous comparison of rates of disease, death, recovery, or any other outcome of interest. These trials are regarded as the most scientifically rigorous methods for hypothesis testing available (Fletcher & Fletcher, 1988; Last, 1995). The advantage of a clinical trial is that it can cut down on extraneous factors, and systematic error. Clinical trials, when done correctly, produce the strongest evidence for cause and effect (Hulley & Cummings, 1988). The information gained in a clinical trial cannot always be generalized to groups, except to the population from which the sample of the clinical trial was drawn. Interventions tend to be ideal in a clinical trial but are not ideal in common practice, hence clinical trials can only measure efficacy and not effectiveness.

A two-period cross-over study is a method of comparing two or more treatments or interventions such that when the patients complete the course of one treatment they are later switched to the another treatment. When investigating two treatments, A and B, half the study participants will be randomly allocated to undergo treatment A, followed by treatment B, while the other half will be randomized to undergo treatment B, followed by treatment A. An appropriate length of time separates these two treatments and is known as the wash-out period. Fleiss (1981) states that a cross-over design should be used only when the treatment under study is short-acting. If the treatments may be long-acting, a cross-over design should be avoided, because a long wash-out period may not preserve the homogeneity of various variables — most notably, stage of disease. The major advantage is that the number of patients needed for a two-period cross-over study with a specified power is one-fourth of the number needed with a parallel groups study with the same power (Fleiss, 1981). A disadvantage of this AB/BA design is the possibility that the effect of the first treatment will carry over and bias the data on the effects of the second treatment (Fletcher & Fletcher, 1988; Last, 1995).

## METHODS

The sample consisted of seven, white, ovarian cancer patients who were undergoing chemotherapy treatments. Patients were from the Roswell Park Cancer Institute, which is the first cancer research treatment and education center in the USA and is now the third largest in the country. Recruitment stopped at seven participants because there was a change in the clinic's protocol regarding which patients would receive their chemotherapy as outpatients and which would be inpatients. Effectively only the 'sicker' patients would have become inpatients under the new protocol.

All the patients included in this study had been diagnosed as having ovarian cancer. All were still under the original guidelines, which had the ovarian cancer patients remain in the hospital for two to three days after

each course of chemotherapy. They were in various stages of cancer and in various stages of treatment.

The exclusion criteria were as follows: (1) patients with visible skin problems or open sores; (2) patients who cannot read or write; (3) patients who had surgery in the last six weeks; (4) patients taking anticoagulants; (5) patients with broken bones or other acute musculoskeletal injuries; and (6) patients with known spinal cord metastasis. [Patients were previously excluded from chemotherapy if they had low platelet count (thrombocytopenia) or low white blood cell count (neutropenia).]

Information was collected by chart review by the clinic's research nurse prior to the chemotherapy treatment, to establish which patients were ovarian cancer patients, and which patients were eligible for the study. The investigator verbally reviewed the inclusion and exclusion criteria with each patient. She read aloud the consent form to the patients that both agreed to participate and met the inclusion criteria.

This study was a preliminary pilot study for an eventual randomized clinical trial that utilized a two-period cross-over design. This method has been described in detail in the literature review. The duration of the study was approximately one month. The first patient was recruited in June, 1998 and the last patient was seen in July, 1998. Each participant was followed for two consecutive days.

Patients who agreed to participate and who qualified were randomly allocated (block randomization) using a random numbers table to one of the following two sequence groups: MT treatment followed by a rest period treatment (M/R) versus a rest period followed by a MT treatment (R/M) (Fig. 4.1). One day separated the two treatments. This small time between intervals ensured that the patients were in the same stage of cancer and treatment, and under the care of the same physician.

A New York State licensed massage therapist gave one 30-minute MT treatment to every participant. The control treatment consisted of a 30-minute rest period. The sequence in group 1 was the MT treatment followed by the rest period (M/R), while in group 2 the rest period was first,

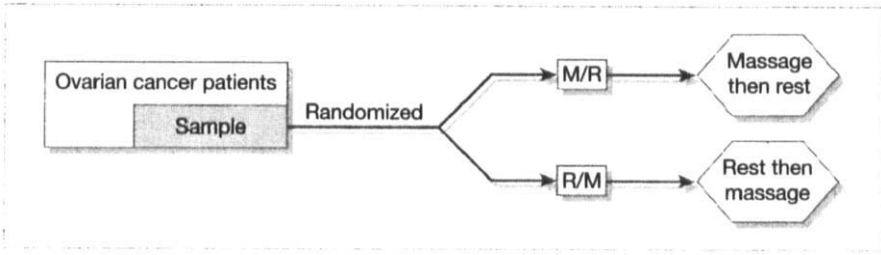


**Figure 4.1** Randomization of the sample into two treatment sequence groups.

followed by the MT treatment (R/M). There was a 20–26-hour wash-out period between sessions.

The volunteer New York State licensed massage therapist was a white, 43-year-old female with 13 years of experience giving MT treatments. She had been trained in a variety of bodywork and behavioral therapies. The massage therapist was trained for the study to ensure consistency. The training protocol involved learning the standardized MT (Lawvere, 1999) procedure mentioned later and administering this treatment several times to the investigator to ensure that the treatment was done consistently. A checklist made sure that each aspect of the massage was included in the treatment. In addition, procedures that had not been included in the protocol were systematically eliminated.

The massage therapist and study coordinator determined the operational definition of the standardized MT treatment used for the study. This treatment was an integrative approach that utilized both Swedish and connective tissue modalities of MT. Biotone dual-purpose massage lotion was used for all of the massage treatments. The massage therapist did not engage the patient in conversation, except to respond to the patient's inquiries or to address physical or psychological comfort levels. The pressure of the massage was adjusted to the patient's pain tolerance.

For the first 15 minutes the patient was prone. After coaching the patient in deep breathing the therapist began the massage using the following standardized procedure. The therapist first utilized the Swedish massage stroke effleurage on the back. Effleurage strokes are smooth, long, rhythmical strokes which glide over the skin without attempting to move the deep muscle masses (Tappan, 1988). These effleurage strokes on the back moved first from the neck down the sides of the spine over the erector spinae muscles. Then the stroke moved out over the hips, returned over the quadratus lamborum and trapezius muscles, and ended by moving around the shoulders and back over the suboccipitals of the neck. Approximately five of these strokes were performed. Connective tissue techniques were then used on the rhomboids, trapezius, erector spinae and on the attachments of the quadratus lumborum. Connective tissue massage is a slower, deeper massage and works on a more concentrated area. The goal of this technique is to break up adhered connective tissue in between muscle fibers.

The therapist utilized effleurage on the legs. Several strokes were done, beginning at the ankle and moving over the Achilles tendon, the calf, and the hamstrings. Friction (a Swedish technique) was then used on the Achilles tendon and on the insertions of the gastrocnemius, the biceps femoris, and the semitendinosous muscles. Friction strokes are small circular movements that are done with the tips of the fingers, the thumb, or the heel of the hand (Tappan, 1988). Like connective tissue massage, friction works the deep muscle masses. It differs from connective tissue massage in that the small circular strokes remain in one location, while connective tissue

strokes move more slowly and cover larger areas. Both these techniques are believed to break down the minor adhesions between the skin and the underlying tissue.

The patients then turned over and received the next 15 minutes of the treatment in the supine position. First, effleurage was used on the dorsal surface of the foot. Friction with the thumbs and knuckles was then used on the full plantar surface of the foot. Repeated effleurage and petrissage strokes were done on each of the legs. Petrissage is another Swedish massage stroke which works by milking and kneading the belly of the muscle (Tappan, 1988).

Next, the hands and arms were massaged. First the arm was put in an assisted stretch position. Then the hand was massaged using thumb friction. The forearm and upper arm were massaged using effleurage and petrissage, and this procedure was repeated on the other hand and arm.

The neck was massaged using effleurage strokes which originated at the rhomboids, with the massage therapist's hands under the patient and then moved over the upper trapezius muscles. Friction was used on the attachments of the muscles from the occiput to the ears. Light petrissage was then done on the upper trapezius muscles. Next, gentle friction was used on the scalp. Light effleurage and petrissage was also used on the face. After the massage therapist was finished with the standardized procedure, she instructed the patient to rest for a few minutes. After 5–10 minutes the study coordinator administered the post treatment indices. The study coordinator was instructed not to discuss the MT treatment with the patient.

All the participants of this study acted as their own controls. During the usual care portion of the study, data was collected with the same schedule as the MT treatment. Patients were instructed to 'rest and have quiet time' during the 30-minute 'treatment' and the staff was instructed not to interrupt patients unless medically necessary. To ensure quiet and no disturbances, the study coordinator closed the patients' doors. During this period patients were instructed not to watch television and not to have visitors. This procedure was followed in order to keep the patients in bed. These patients were not supposed to receive medical interventions during this treatment time. Although there was a standardized procedure for the control sessions, there was no significant deviation from usual care.

The dependent variables were symptoms of anxiety, depressive mood and pain, as measured by the following instruments: the Spielberger State Anxiety Inventory (a decrease in score represents a decrease in self-reported anxiety); the Visual Analogue Mood Scale (an increase in score represents a decrease in self-reported depressive mood); the Memorial Pain Assessment Card (an increase in score represents a decrease in self-reported pain).

A self-administered questionnaire collected background information prior to randomization and prior to any interventions. It provided information

on potential covariates; continuous data on age; and categorical data on education, income levels, race/ethnicity, marital status, zip code and employment status. Dichotomous information about past experiences with massage and other alternative medicine treatments was also collected. Each participant filled out a short health history including questions concerning past mental disorders. Before the interventions, the investigator collected information regarding primary site of cancer and the time since initial diagnosis.

The schedule for the administration of the background questionnaire, for randomization and for each of the three instruments which were each administered four times per participant is shown in Fig. 4.2. After it was established that patients had met the inclusion criteria, and had signed the consent form, the investigator then gave all patients the self-administered background questionnaire. The background questionnaire was administered prior to any experimental treatment. After the patients had completed the background questionnaire, they were allocated to one of the two sequence groups by the randomization scheme.

The above indices were administered both prior to, and again 5–10 minutes after, the massage treatment or control treatment was completed. The investigator presented the self-administered outcome instruments to the study participants. The instruments were presented in the following order: (1) State Anxiety Inventory, (2) Visual Analogue Mood Scale, (3) Memorial Pain Assessment Card.

All participants completed both treatment and control portions of the study. The Statistical Package for the Social Sciences (SPSS) was used to

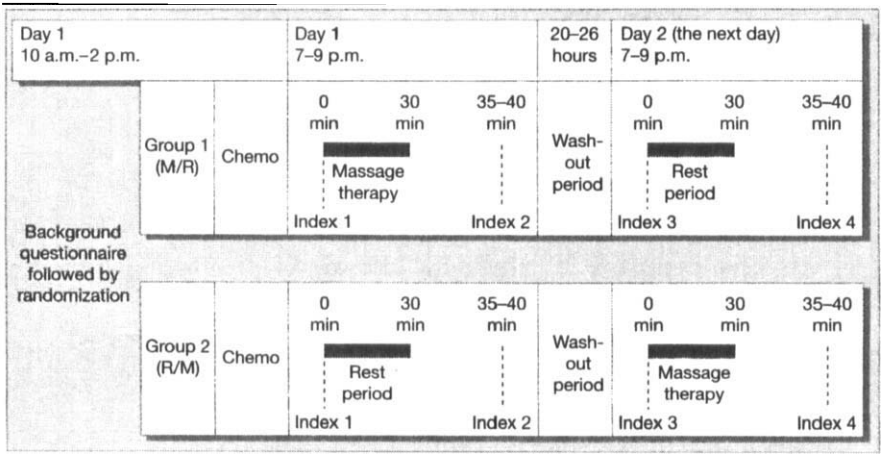


**Figure 4.2** Protocol schedule.

analyze the data. Each participant filled out each index four times, one each before the treatment or control period and one each after the treatment and control period. A paired *t*-test was used to compare the differences from the baseline of the treatment or control session to 35–40 minutes later. The primary outcome measured was the change between the pre- and post-treatment indices. This makes the assumptions that there are no period effects, no residual carry-over effect and no treatment period interaction. The *t*-tests were done again using the ratio of this above difference over the baseline measure (the percent change from baseline). This was done for each of the three instruments.

In order to combine the data from each of the sequence groups, an ANOVA was done to evaluate the variance of the percent change following the MT sessions during the M/R sequence and the R/M sequence. An ANOVA was also done to compare the rest periods of each sequence group. In order to access the possibility that there could be a residual carry-over effect resulting from the sequence of treatments, *t*-tests were used to compare the last index score from day one with the first index score in day two. In the M/R group this meant comparing the post MT index with the pre rest index. In the R/M group the post rest index was compared with the pre massage index. P-values and confidence intervals were then calculated for each of these paired *t*-tests.

After looking at the *t*-tests for the entire sample, the participants were stratified by sequence group (M/R versus R/M), and also by past experience with MT (yes versus no). The paired *t*-tests were done for both the absolute change in score and for the percent change of score on each of the three indices for the stratified samples. This was done in order to rule out the possibility that there could have been a residual carry-over effect resulting from the sequence of the treatments or a different response to treatment with different history of receiving massage.

## RESULTS

During the study period, seven eligible women were recruited and underwent a MT treatment and a rest period treatment. Of the ovarian cancer patients seen by the gynecology clinic during the study period only one was excluded from the study because of a past surgery within the six weeks prior to the intervention. All (100%) of the patients who met the inclusion criteria and were asked to participate agreed to be in the study and completed both the MT and rest period portions of the study. Sociodemographic characteristics of study participants are presented in Table 4.1.

Table 4.2 lists the type and number of alternative medicine practices used by the study participants. Six of the seven participants (85.7%)

**Table 4.1** Sociodemographic characteristics of study participants

| Characteristic | M/R[a] sequence group ($n = 4$) | | R/M[b] sequence group ($n = 3$) | | All patients ($n = 7$) | |
|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % |
| Age (years) | | | | | | |
| 44 | 1 | 25.0 | 0 | – | 1 | 14.3 |
| 51 | 1 | 25.0 | 0 | – | 1 | 14.3 |
| 52 | 1 | 25.0 | 0 | – | 1 | 14.3 |
| 56 | 0 | – | 1 | 33.3 | 1 | 14.3 |
| 58 | 1 | 25.0 | 0 | – | 1 | 14.3 |
| 70 | 0 | – | 1 | 33.3 | 1 | 14.3 |
| 75 | 0 | – | 1 | 33.3 | 1 | 14.3 |
| mean | 51.3 | | 67.0 | | 58.0 | |
| SD[c] | 5.7 | | 9.8 | | 10.9 | |
| Race | | | | | | |
| White | 4 | 100.0 | 3 | 100.0 | 7 | 100.0 |
| Marital status | | | | | | |
| Married | 1 | 25.0 | 0 | – | 1 | 14.3 |
| Not married/single | 2 | 50.0 | 0 | – | 2 | 28.6 |
| Divorced | 0 | – | 3 | 100.0 | 3 | 42.9 |
| Widowed | 1 | 25.0 | 0 | – | 1 | 14.3 |
| Household income (U.S. dollars)[d] | | | | | | |
| $< 5{,}000$ | 0 | – | 1 | 33.3 | 1 | 16.7 |
| $5{,}000 \leq 10{,}000$ | 1 | 33.3 | 0 | – | 1 | 16.7 |
| $10{,}000 \leq 15{,}000$ | 1 | 33.3 | 0 | – | 1 | 16.7 |
| $15{,}000 \leq 20{,}000$ | 0 | – | 2 | 66.6 | 2 | 33.2 |
| $30{,}000 \leq 35{,}000$ | 1 | 33.3 | 0 | – | 1 | 16.7 |
| Education (years completed) | | | | | | |
| 12 | 1 | 25.0 | 2 | 66.6 | 3 | 42.9 |
| 13 | 1 | 25.0 | 1 | 33.3 | 2 | 28.6 |
| 14 | 1 | 25.0 | 0 | – | 1 | 14.3 |
| 16 | 1 | 25.0 | 0 | – | 1 | 14.3 |

[a]M/R is the group receiving the massage therapy treatment followed by the rest period.
[b]R/M is the group receiving the rest period followed by the massage therapy treatment.
[c]SD = standard deviation.
[d]One participant had missing data regarding income.

reported having used some form of alternative medicine in the past. One participant (14.3%) reported using six different forms of alternative medicine. Three participants (42.9%) reported using MT in the last year, although none had received MT more than a year before the intervention.

Table 4.3 displays the characteristics of the distributions of scores on the Spielberger State Anxiety Inventory for the MT treatments and rest periods for all participants, regardless of sequence group assignment ($n = 7$). Note that the Spielberger State Anxiety Inventory has a possible range of score from 20 to 80 points. A decrease in score indicates a decrease in self-reported anxiety.

**Table 4.2** Type and number of alternative medicine practices used by study participants

| | In the last year | | More than a year ago | | Ever | |
|---|---|---|---|---|---|---|
| Type of practices[a] | *n* | % | *n* | % | *n* | % |
| Vitamins | 4 | 57.2 | 4 | 57.2 | 4 | 57.2 |
| Chiropractic | 2 | 28.6 | 2 | 28.6 | 4 | 57.2 |
| Massage therapy | 3 | 42.9 | 0 | 0 | 3 | 42.9 |
| Dietary changes | 1 | 14.3 | 1 | 14.3 | 2 | 28.6 |
| Exercise | 0 | 0 | 2 | 28.6 | 1 | 14.3 |
| Herbs | 1 | 14.3 | 1 | 14.3 | 1 | 14.3 |
| Acupuncture | 0 | 0 | 0 | 0 | 1 | 14.3 |
| Relaxation | 0 | 0 | 0 | 0 | 1 | 14.3 |
| Yoga | 0 | 0 | 0 | 0 | 1 | 14.3 |
| Spiritual healing/prayer | 1 | 14.3 | 1 | 1 | 1 | 14.3 |
| Meditation | 0 | 0 | 0 | 0 | 0 | 0 |
| Folk doctor | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of practices | | | | | | |
| 0 | | | | | 1 | 14.3 |
| 1 | | | | | 2 | 28.6 |
| 3 | | | | | 1 | 14.3 |
| 4 | | | | | 2 | 28.6 |
| 6 | | | | | 1 | 14.3 |
| ever | | | | | 6 | 85.7 |

[a]Not mutually exclusive.

**Table 4.3** Characteristics of the distributions of scores on the Spielberger State Anxiety Inventory for massage and rest among all participants[a]

| | *n* | Minimum | Maximum | Mean | Standard deviation |
|---|---|---|---|---|---|
| Massage | | | | | |
| Before | 7 | 27 | 57 | 43.43 | 11.87 |
| After | 7 | 20 | 34 | 28.14 | 4.95 |
| Raw change | 7 | −4 | −25 | −15.29 | 7.45 |
| Percent change | 7 | −0.15 | −0.44 | **−0.33** | 0.10 |
| Rest | | | | | |
| Before | 7 | 27 | 54 | 40.57 | 10.91 |
| After | 7 | 28 | 55 | 37.71 | 10.06 |
| Raw change | 7 | 7 | −11 | −2.86 | 6.04 |
| Percent change | 7 | 0.15 | −0.20 | −0.06 | 0.13 |

[a]The possible range of scores is from 20 to 80 points. A decrease in score indicates a decrease in self-reported anxiety.

The scores before and after the rest period ranged from 27 to 54 points and from 28 to 55 points, respectively. This resulted in a raw change in scores that ranged from −7 to 11 points (mean reduction ± SD = 2.86 ± 6.04). A 6% reduction in anxiety scores was noted following the rest period (mean reduction ± SD = −0.06 ± 0.13).

The range of scores before, and after, the MT treatment were from 27 to 57 points and from 20 to 34 points, respectively. The raw change in scores ranged from 4 to 25 points (mean reduction $\pm$ SD = $15.29 \pm 7.45$). A 33% reduction in anxiety scores was observed following the MT session (mean reduction $\pm$ SD = $-0.33 \pm 0.10$).

Table 4.4 presents the data for the comparisons of overall and stratified scores on the Spielberger State Anxiety Inventory. Combining the anxiety scores following treatment from the two sequence groups allowed for the overall comparison of the MT and rest treatments. This was done because there was no observable residual carry-over effect and the variances did not have statistically significant differences.

The *t*-tests comparing the last anxiety score from day one with the first anxiety score of day two were not statistically significant. Specifically, the *t*-test for the M/R group compared the anxiety score post massage with the anxiety score pre rest ($t = -0.930$, $p = 0.421$) and the *t*-test for the R/M group compared the anxiety score post rest with the anxiety score pre massage ($t = -1.567$, $p = 0.258$). Although a paired *t*-test has little power with

**Table 4.4** Comparisons of scores on the Spielberger State Anxiety Inventory: overall and stratified by sequence group and past experience with massage therapy[a]

| | *n* | Mean | Standard deviation | Confidence interval | *t*[b] | *p*[c] |
|---|---|---|---|---|---|---|
| Overall | | | | | | |
| Raw change | 7 | −12.43 | 7.85 | 5.17–19.69 | 4.19 | 0.006 |
| Percent change | 7 | −0.27 | 0.14 | 0.14–0.40 | 5.20 | 0.002 |
| Sequence group | | | | | | |
| M/R[d] | | | | | | |
| Raw change | 4 | −14.75 | 9.91 | −1.02–30.52 | 2.98 | 0.059 |
| Percent change | 4 | −0.31 | 0.18 | 0.02–0.59 | 3.45 | 0.041 |
| R/M[e] | | | | | | |
| Raw change | 3 | −9.33 | 3.51 | 0.61–18.06 | 4.60 | 0.004 |
| Percent change | 3 | −0.22 | 0.05 | 0.09–0.35 | 7.34 | 0.018 |
| Past experience with massage therapy | | | | | | |
| No | | | | | | |
| Raw change | 4 | −10.00 | 4.55 | 2.77–17.23 | 4.40 | 0.022 |
| Percent change | 4 | −0.21 | 0.05 | 0.13–0.29 | 8.40 | 0.004 |
| Yes | | | | | | |
| Raw change | 3 | −15.67 | 11.24 | −12.25–43.59 | 2.41 | 0.137 |
| Percent change | 3 | −0.35 | 0.19 | −0.11–0.81 | 3.31 | 0.080 |

[a] The possible range of scores is from 20 to 80 points. A decrease in score indicates a decrease in self-reported anxiety.
[b] Two paired *t*-tests were performed (raw change and percent change) on scores for each participant comparing the massage therapy and rest treatments.
[c] *p*-values are 2-tailed.
[d] M/R is the group receiving the massage therapy treatment followed by the rest period.
[e] R/M is the group receiving the rest period followed by the massage therapy treatment.

this limited sample size, there does not appear to be residual carry-over from day one to day two of the study in either sequence group.

ANOVA was used to compare the variances of the percent change in anxiety scores following the MT treatment ($F = 1.944$, $p = 0.222$) in each of the two sequence groups. This was also done for the rest period ($F = 0.019$, $p = 0.896$). Since the differences in the variances were not statistically significant, the data was combined, despite the limitations of an ANOVA with this limited sample size. This lack of difference in the variances may indicate that there is no period effect, but again it is difficult to interpret with this limited sample size.

The data was stratified by sequence group and by past experience with MT. Changes in anxiety during the MT and rest period sessions for all participants ($n = 7$) were compared using a paired $t$-test, a statistically significant difference was observed for both the raw change ($t = 4.19$, $p = 0.006$) and percent change ($t = 5.20$, $p = 0.002$).

Table 4.4 also presents data with patients stratified by sequence group (M/R or R/M). For the M/R group ($n = 4$), the percent change ($t = 3.45$, $p = 0.041$) demonstrated statistical significance, while the raw change ($t = 2.98$, $p = 0.059$) did not. In the R/M sequence group ($n = 3$), the percent change ($t = 7.34$, $p = 0.018$) and the raw change ($t = 4.60$, $p = 0.004$) remained significant.

Anxiety scores were also evaluated by past history of experience with MT (yes/no). Both the raw change ($t = 4.39$, $p = 0.022$) and the percent change ($t = 8.40$, $p = 0.004$) demonstrated statistical significance for participants with no past experience with MT ($n = 3$). No systematic differences were observed for participants with past experience with MT: raw change ($t = 2.41$, $p = 0.137$), percent change ($t = 3.31$, $p = 0.080$).

Table 4.5 displays the characteristics of the distributions of scores on the Visual Analogue Mood Scale for the MT treatments and rest periods for all participants, regardless of sequence group assignment ($n = 7$). The Visual Analogue Mood Scale has a possible range of score from 1 to 10 points. An increase in score indicates a decrease in self-reported depressive mood.

The range of scores before, and after, the MT treatment were from 1 to 10 points and from 5 to 10 points, respectively. The raw change in scores ranged from 0 to 10 points (mean reduction $\pm$ SD = $2.29 \pm 1.80$). A 38% reduction in depressive mood was observed following the MT session (mean reduction $\pm$ SD = $0.38 \pm 0.43$).

The scores before, and after the rest period ranged from 2 to 10 points and from 4 to 10 points, respectively. This resulted in a raw change in scores that ranged from $-2$ to 2 points (mean reduction $\pm$ SD = $0.14 \pm 1.35$. A 13% reduction in depressive mood was found following the rest period (mean reduction $\pm$ SD = $0.13 \pm 0.41$).

Table 4.6 presents the data for the comparisons of overall and stratified scores on the Visual Analogue Mood Scale. Combining the depressive mood

**Table 4.5** Characteristics of the distribution of scores on the Visual Analogue Mood Scale for massage and rest among all participants[a]

| | *n* | Minimum | Maximum | Mean | Standard deviation |
|---|---|---|---|---|---|
| Massage | | | | | |
| Before | 7 | 1 | 10 | 6.00 | 3.16 |
| After | 7 | 5 | 10 | 8.29 | 2.06 |
| Raw change | 7 | 0 | 5 | 2.29 | 1.80 |
| Percent change | 7 | 0.00 | 1.25 | **0.38** | 0.43 |
| Rest | | | | | |
| Before | 7 | 2 | 10 | 7.00 | 2.71 |
| After | 7 | 4 | 10 | 7.14 | 2.12 |
| Raw change | 7 | −2 | 2 | 0.14 | 1.35 |
| Percent change | 7 | −0.29 | 1.00 | 0.13 | 0.41 |

[a]The possible range of scores is from 0 to 10 points. An increase in score represents a decrease in self-reported depression.

**Table 4.6** Comparisons of scores on the Visual Analogue Mood Scale: overall and stratified by sequence group and past experience with massage therapy[a]

| | *n* | Mean | Standard deviation | Confidence interval | *t*[b] | *p*[c] |
|---|---|---|---|---|---|---|
| Overall | | | | | | |
| Raw change | 7 | 2.14 | 1.07 | 1.15–3.13 | 5.30 | 0.002 |
| Percent change | 7 | 0.25 | 0.55 | −0.26–0.76 | 1.18 | 0.282 |
| Sequence group | | | | | | |
| M/R[d] | | | | | | |
| Raw change | 4 | 2.25 | 1.26 | 0.25–4.25 | 3.58 | 0.037 |
| Percent change | 4 | 0.22 | 0.76 | −0.99–1.43 | 0.58 | 0.605 |
| R/M[e] | | | | | | |
| Raw change | 3 | 2.00 | 1.00 | −0.48–4.48 | 3.46 | 0.074 |
| Percent change | 3 | 0.28 | 0.19 | −0.19–0.75 | 2.58 | 0.123 |
| Past experience with massage therapy | | | | | | |
| No | | | | | | |
| Raw change | 4 | 2.50 | 1.29 | 0.45–4.55 | 3.87 | 0.030 |
| Percent change | 4 | 0.53 | 0.41 | −0.12–1.17 | 2.61 | 0.080 |
| Yes | | | | | | |
| Raw change | 3 | 1.67 | 0.58 | 0.23–3.10 | 5.00 | 0.038 |
| Percent change | 3 | −0.13 | 0.54 | −1.48–1.22 | −0.41 | 0.719 |

[a]The possible range of scores is from 0 to 10 points. An increase in score represents a decrease in self-reported depression.
[b]Two paired *t*-tests were performed (raw change and percent change) on scores for each participant comparing the massage therapy and rest treatments.
[c]*p*-values are 2-tailed.
[d]M/R is the group receiving the massage therapy treatment followed by the rest period.
[e]R/M is the group receiving the rest period followed by the massage therapy treatment.

scores following treatment from the two sequence groups allowed for the overall comparison of the MT and rest treatments. This was done because there was no observable residual carry-over effect and the variances did not have statistically significant differences.

The *t*-tests comparing the last depressive mood score from day one with the first depressive mood score of day two were not statistically significant. Specifically, the *t*-test for the M/R group compared the depressive mood score post massage with the depressive mood score pre rest ($t = 1.260$, $p = 0.297$) and the *t*-test for the R/M group compared the depressive mood score post rest with the depressive mood score pre massage ($t = -2.000$, $p = 0.184$). Although a paired *t*-test has little power with this limited sample size, there does not appear to be residual carry-over from day one to day two of the study in either sequence group.

ANOVA was used to compare the variances of the percent change in depressive mood scores following the MT treatment ($F = 1.097$, $p = 0.343$) in each of the two sequence groups. This was also done for the rest period ($F = 1.839$, $p = 0.233$). Since the differences in the variances were not statistically significant, the data was combined, despite the limitations of an ANOVA with this limited sample size. This lack of difference in the variances may indicate that there is no period effect, but again it is difficult to interpret with this limited sample size.

The data was stratified by sequence group and by past experience with MT. Changes in depressive mood during the MT and rest period sessions for all participants ($n = 7$) were compared using a paired *t*-test, a statistically significant difference was observed for the raw change ($t = 5.30$, $p = 0.002$), but not for the percent change ($t = 1.18$, $p = 0.282$).

Table 4.6 also presents data with patients stratified by sequence group (M/R or R/M). For the M/R group ($n = 4$), the percent change ($t = 0.58$, $p = 0.605$) did not demonstrate statistical significance while the raw change ($t = 3.58$, $p = 0.037$) was significant. In the R/M sequence group ($n = 3$), the percent change ($t = 7.34$, $p = 0.018$) and the raw change ($t = 4.60$, $p = 0.004$) remained significant.

Depressive mood was also evaluated by past history of experience with MT (yes/no). The raw change ($t = 3.87$, $p = 0.038$) was statistically significant while the percent change ($t = 2.31$, $p = 0.080$) did not demonstrate statistical significance for participants with no past experience with MT ($n = 3$). A systematic difference was observed for participants with past experience with MT in regards to raw change ($t = 5.00$, $p = 0.038$), but not for the percent change ($t = 0.41$, $p = 0.719$).

Table 4.7 displays the characteristics of the distributions of scores on the Memorial Pain Assessment Card for the MT treatments and rest periods for all participants regardless of sequence group assignment ($n = 7$). The Memorial Pain Assessment Card has a possible range of score from 1 to 37 points. An increase in score indicates a decrease in self-reported pain.

**Table 4.7** Characteristics of the distributions of scores on the Memorial Pain Assessment Card for massage and rest among all participants[a]

| | *n* | Minimum | Maximum | Mean | Standard deviation |
|---|---|---|---|---|---|
| Massage | | | | | |
| Before | 7 | 14 | 31 | 21.57 | 5.32 |
| After | 7 | 21 | 24 | 22.14 | 1.07 |
| Raw change | 7 | −10 | 9 | 0.57 | 6.86 |
| Percent change | 7 | −0.32 | 0.64 | **0.09** | 0.30 |
| Rest | | | | | |
| Before | 7 | 18 | 29 | 23.14 | 3.44 |
| After | 7 | 21 | 32 | 23.14 | 4.72 |
| Raw change | 7 | −3 | 1 | −1.00 | 1.73 |
| Percent change | 7 | −0.17 | 0.04 | −0.05 | 0.08 |

[a]The possible range of scores is from 1 to 37 points. An increase in score represents a decrease in self-reported pain.

The range of scores before, and after, the MT treatment were from 14 to 31 points and from 21 to 24 points, respectively. The raw change in scores ranged from −10 to 9 points (mean reduction ± SD = 0.57 ± 6.86). A 9% reduction in pain was observed following the MT session (mean reduction ± SD = 0.09 ± 0.30).

The scores before, and after, the rest period ranged from 18 to 29 points and from 21 to 32 points, respectively. This resulted in a raw change in scores that ranged from −3 to 1 point (mean reduction ± SD = −1.00 ± 1.73). A 5% reduction in pain was found following the rest period (mean reduction ± SD = 0.05 ± 0.08).

Table 4.8 presents the data for the comparisons of overall and stratified scores on the Memorial Pain Assessment Card. Combining the pain scores following treatment from the two sequence groups allowed for the overall comparison of the MT and rest treatments. This was done because there was no observable residual carry-over effect and the variances did not have statistically significant differences.

The *t*-tests comparing the last pain score from day one with the first pain score of day two were not statistically significant. Specifically, the *t*-test for the M/R group compared the pain score post massage with the pain score pre rest ($t = 1.093$, $p = 0.354$) and the *t*-test for the R/M group compared the pain score post rest with the pain score pre massage ($t = 1.375$, $p = 0.303$). Although a paired *t*-test has little power with this limited sample size, there does not appear to be residual carry-over from day one to day two of the study in either sequence group.

An ANOVA was used to compare the variances of the percent change in pain scores following the MT treatment ($F = 0.153$, $p = 0.712$) in each of the two sequence groups. This was also done for the rest period ($F = 0.713$,

**Table 4.8** Comparisons of scores on the Memorial Pain Assessment Card: overall and stratified by sequence group and past experience with massage therapy[a]

| | *n* | Mean | Standard deviation | Confidence interval | *t*[b] | *p*[c] |
|---|---|---|---|---|---|---|
| Overall | | | | | | |
| Raw change | 7 | 1.57 | 43.86 | −2.92–6.07 | 0.86 | 0.425 |
| Percent change | 7 | 0.13 | 0.26 | −0.11–0.37 | 1.34 | 0.228 |
| Sequence group | | | | | | |
| M/R[d] | | | | | | |
| Raw change | 4 | 1.25 | 2.21 | −2.28–4.78 | 1.13 | 0.342 |
| Percent change | 4 | 0.07 | 0.10 | −0.08–0.22 | 1.43 | 0.249 |
| R/M[e] | | | | | | |
| Raw change | 3 | 2.00 | 7.64 | −17.72–21.72 | 0.44 | 0.705 |
| Percent change | 3 | 0.22 | 0.41 | −0.81–1.24 | 0.91 | 0.460 |
| Past experience with massage therapy | | | | | | |
| No | | | | | | |
| Raw change | 4 | 0.00 | 4.69 | −7.46–7.46 | 0.00 | 1.00 |
| Percent change | 4 | 0.03 | 0.17 | −0.24–0.30 | 0.38 | 0.731 |
| Yes | | | | | | |
| Raw change | 3 | 3.67 | 5.13 | −9.08–16.41 | 1.24 | 0.341 |
| Percent change | 3 | 0.27 | 0.34 | −0.57–1.10 | 1.36 | 0.306 |

[a]The possible range of scores is from 1 to 37 points. A decrease in score indicates a decrease in self-reported pain.
[b]Two paired *t*-tests were performed (raw change and percent change) on scores for each participant comparing the massage therapy and rest treatments.
[c]*p*-values are 2-tailed.
[d]M/R is the group receiving the massage therapy treatment followed by the rest period.
[e]R/M is the group receiving the rest period followed by the massage therapy treatment.

$p = 0.437$). Since the differences in the variances were not statistically significant, the data was combined, despite the limitations of an ANOVA with this limited sample size. This lack of difference in the variances may indicate that there is no period effect, but again it is difficult to interpret with this limited sample size.

The data was stratified by sequence group and by past experience with MT. Changes in pain during the MT and rest period sessions for all participants ($n = 7$) were compared using a paired *t*-test; No statistically significant differences were observed; raw change ($t = 0.86$, $p = 0.425$) and the percent change ($t = 1.34$, $p = 0.228$).

Table 4.8 also presents data with patients stratified by sequence group (M/R or R/M). The differences in the raw change and the percent change did not demonstrate statistical significance for either sequence group.

Pain was evaluated by past history of experience with MT (yes/no). No systematic differences were observed for participants with or without a past MT history.

The massage therapist filled out a questionnaire regarding adherence to the MT protocol upon completion of each MT session. A visual analogue

scale with at one end the value 10 stating 'did not adhere to the protocol at all' and at the other end a value of 1 stating 'completely adhered to the protocol'. The therapist reported a score of 1 on six patients and a 6 on the seventh patient. Although there was an attempt to keep interruptions during the MT treatments and rest period sessions to a minimum, one diabetic patient was interrupted during the massage for a blood draw and a hospital priest visited another patient during the rest period in order to schedule an appointment.

## DISCUSSION

Preliminary findings from this clinical trial provide evidence to support that MT may produce a short-term (less than 24-hour), 20% reduction in anxiety and depressive mood among ovarian cancer patients undergoing chemotherapy, when compared with the same patients receiving usual care in the form of a rest period. In fact, there was a 33% reduction in anxiety and a 38% reduction in depressive mood. We also observed a 9% reduction in pain. If this level of reduction in pain can be repeated in a full-fledged clinical trial it will have clinical significance, regardless of statistical significance. These reductions were compared, using a paired *t*-test, with the following corresponding percent changes for the rest period: anxiety (6% reduction), depressive mood (13% reduction), and pain (5% increase). Only the reduction in anxiety was statistically significant ($p = 0.002$). These results support previous findings which have shown a reduction in anxiety (Ferrell-Torrey & Glick, 1993; Field, 1995, 1996; Field et al., 1996a,b, 1998a,b,c; Ahles, 1995; Corner et al., 1995; Wilkinson, 1995), depressive mood (Field et al., 1996a, 1998a,b; Corner et al., 1995; Sims, 1986), and pain (Ferrell-Torrey & Glick, 1993; Field, 1996; Weinrich & Weinrich, 1990; Field et al., 1998a) in relation to MT treatments. Although these other studies investigated various MT protocols (i.e. different MT techniques, lengths of treatments, numbers of treatments and varying samples) findings in terms of the direction of effect (i.e. reduction in symptoms) have been consistent. Only one study to date showed no effect when investigating MT (Dunn et al., 1996).

This study is one of the few known studies evaluating the efficacy of MT among cancer patients receiving the same chemotherapy treatment for the same cancer site. Use of a cross-over design dramatically increases the homogeneity of the covariates, when comparing the mean differences of the treatment and rest period indices, and theoretically produces less biased results (Senn, 1994). Moreover, this study has four times the power of a parallel designed study with seven participants, since the number of patients that are needed for a two-period cross-over study with a specified power is one-fourth of the number needed with a parallel group study design with the same power (Fleiss, 1986).

This study did not experience problems with non-compliance and attrition that frequently are a problem in the conduct of clinical trials. Perhaps due to the brevity of the time-frame of the study, this study had a 100% response rate and complete compliance with no drop-outs. Although the massage therapist reported only 60% completion of the standardized MT protocol with one patient, this patient's data was included in the analysis based on the intent-to-treat policy. All of the other treatments complied 100% with the protocol. No adverse side effects were evident in the use of MT. Contrary to what would appear to be the case, the patients' past experience with massage did not appear to produce a positive bias. Those patients who had a past experience with MT appeared to have less reduction in symptoms.

The main study limitation is the small sample size, but this sample may serve as a basis to establish an effect size to be used in a future, larger trial. Results are not generalizeable to patients other than white females with ovarian cancer that are undergoing chemotherapy. Patients were not all in the same stage of cancer or treatment. It is important to note, however, that since each patient acted as her own control, there were equal numbers of each stage of cancer in the treatment and control group means. In addition, the control group most likely did not adequately control the placebo effect, and the difference between a MT session and a control session was clear to patients, so they were subsequently not blinded. In addition, knowing the order of the sequence of treatments may have introduced bias.

Another possible limitation is the length of the wash-out period. Although this period, of 20 to 26 hours, has been shown to be sufficient in some studies, other studies have indicated that it may not be long enough. The *t*-test indicates that there is no residual carry-over effect after the wash-out period, however with this limited sample size, only a large residual carry-over effect would be able to be detected. This length was chosen so that the treatments could be given at the same time of day and because of the practical restrictions. In order to ensure a high completion rate, we had the patients complete both treatments during one stay in the hospital.

An additional potential bias is the fact that the floor nurses may have been introducing bias by saying things like 'you are so lucky to be getting a massage today', along with other positive remarks referring to MT.

Only self-reported subjective outcome measures were used in this study. It would be advantageous for a future study of this kind to incorporate objective physiologic measures (i.e. serum cortisol levels as a marker for anxiety).

Finally, bias may have been introduced due to the use of repeat measures. Each patient completed each of the indices four times. Patients may have remembered the answer they gave on a previous index, and it might have affected their answer on subsequent indices.

This preliminary pilot study provided us with an initial understanding of the efficacy of MT in the treatment of anxiety, depressive mood and pain in ovarian cancer patients undergoing chemotherapy. It demonstrated that it is feasible to use a cross-over study design. Although this pilot study did not have sufficient statistical power, it established an effect size which will be needed when calculating sample size and power for a future, full-fledged clinical trial. This study has been an important first step in investigating this specific clinical sub-group of women in relation to MT. Obviously, continued research will be needed to clearly define the efficacy, effectiveness and duration of effect of MT.

This study has clarified the specific direction future studies might take, both in regards to which endpoints to pursue (anxiety, depressive mood, and/or pain) and in regards to study design. Self-reported subjective measures will need to be supplemented with physiologic measures in future studies.

Future studies will also need to analyze the cost effectiveness related to the use of massage therapists in oncology settings. It is important for future research to include clinical trials with sufficient sample size that reach statistical power levels in the 80% and above range. This will enable future researchers to begin to stratify data to evaluate age, sex and other possible covariates. In addition, if at all possible, the methodological drawbacks that were outlined above in past studies and in this pilot study will need to be avoided. It is crucial that various applications of MT be rigorously tested and evaluated to assess the benefits, potential hazards and costs. Furthermore, prescriptive information needs to be established about duration of optimal individual treatment lengths, as well as about the differing effects of singular, versus multiple treatments. Since MT is a behavior utilized by a growing number of patients, and in particular cancer patients, this information is needed for both the patients and the clinicians.

In summary, preliminary findings from this study replicate and expand upon previous studies demonstrating, in other samples, the use of MT treatments for temporary reductions in anxiety, depressive mood, and pain. MT can improve the quality of life and subjective well-being of ovarian cancer patients enduring caustic cancer treatments and may be a welcome addition to oncology units and a useful adjunct to existing treatments.

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# 5

# Massage therapy for chemotherapy-induced emesis

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## INTRODUCTION

This study was an economic evaluation of the cost savings of massage therapy in alleviating high-dose chemotherapy-induced nausea and vomiting. The study sample was comprised of women undergoing peripheral stem cell transplant for breast or ovarian cancer. Alleviating such nausea and vomiting has become a highly desired goal in the treatment of cancer patients.

The goal of this study was to answer the following question related to controlling nausea and vomiting in women undergoing stem cell transplant procedures for breast or ovarian cancer. From the perspective of an institution, is massage therapy as an adjunct to anti-emetic drug therapy a more cost-effective treatment therapy than anti-emetic drug therapy used alone?

Nausea and vomiting are two of the three components of the emetic process described by Borison & Wang (1953). The three components of the emetic process are:

1. Emesis, or vomiting: the forceful expulsion of gastrointestinal (GI) contents through the mouth, accomplished by the coordination of diaphragmatic contraction, sustained abdominal muscle action, and the opening of the gastric cardia.
2. Nausea: a 'subjective, unpleasant feeling that may signal imminent vomiting.' Signs and symptoms of automatic nervous system stimulation, e.g., flushing, pallor, tachycardia accompany it. Other symptoms are diminished gastric tone, reduced peristalsis, and retrograde duodenal peristalsis.

Because nausea is such a subjective phenomenon, only the patient is able to describe its existence.

3. Retching: the synchronized movements of the diaphragm, chest wall, and abdominal muscles that may precede or follow emesis. Retching and nausea may occur independently of emesis; their frequency, severity, and duration are separable phenomena.

High-dose chemotherapy presents many risks to patients, some life threatening, others mundane. Among the most feared side effects are nausea and vomiting, which can be so distressing that their prospect often dominates discussions of the risks and benefits of high-dose chemotherapy and stem cell rescue (Meisenberg, 1997). Thus, the control of nausea and vomiting is an important factor predicting patient compliance and acceptance of high-dose chemotherapy regimens.

Cancer is one of the leading causes of mortality in America. One of every four deaths in the United States is from cancer (Center for Disease Control, 1998). Given such a high estimation of cancer prevalence, it is not surprising to know that cancer treatments consume a major portion of US health care expenditures.

Stem cell transplant after dose intensive chemotherapy is an increasingly used treatment modality for selected patients with hematologic or solid tumors. When the stem cells used for the transplant are obtained from the patients' circulating peripheral blood, it is called an autologous peripheral stem cell transplant (PSCT). Autologous PSCT enables patients to receive potentially lethal doses of chemotherapy and rescues them with a viable source of new blood cells. The transplanted stem cells migrate to the patients' bone marrow, where they repopulate the marrow, and reinitiate normal hematopoiesis. This in turn decreases the expected morbidity and mortality from the high doses of chemotherapy (Jassak & Riley, 1994).

Beyond the therapeutic benefit, the effective control of nausea and vomiting also leads to more cost-effective therapy. These costs include indirect consequences of nausea and vomiting, such as the need to provide total parenteral nutrition (TPN), since nutrients cannot be tolerated orally. Reduced costs could be translated into significant savings for managing the cost of cancer chemotherapy.

The increasingly accepted field of alternative medicine has had an impact on every facet of the health care system, including oncology (American Cancer Society, 1996). Massage therapy, a type of alternative therapy, offers one potential solution for reducing costs associated with high-dose chemotherapy-induced nausea and vomiting.

Cancer patients, particularly inpatients and those undergoing bone marrow transplantation, experience a significant amount of anxiety and emotional distress due to the intensity of treatment, the uncertainty of

response, and severe side effects of chemotherapy agents and immunosuppression. These side effects, especially when uncontrolled, exacerbate the unpleasantness of an inherently stressful situation and significantly affect patients' quality of life. Moreover, the psychological sequelae of rigorous cancer treatment can interfere with patients' performance of self-care behaviors, such as mild exercise and appropriate food intake, which are assumed to assist in recovery from stressful cancer treatment. Massage can be used in an effort to maintain or improve the patients' quality of life, especially during rigorous treatment (Massie & Shakin, 1993). In clinical studies, massage has been shown to help reduce anxiety and depression. Therefore, massage may also be a useful component in oncology settings.

## METHODS

The data analyzed in this study were collected at a large primary care and teaching medical center in Toledo, Ohio, during an 18-month period from September 1996 to February 1998. The research site has an active Oncology Department, including a peripheral stem cell transplant service. The small number of patients with breast or ovarian cancer who were undergoing PSCT procedures was 31, so the whole group was included in this study. Out of the total study population, a control group of 14 patients was treated only with anti-emetics for nausea and vomiting. An experimental group of 17 patients received massage therapy as an adjunct to anti-emetic drug therapy for nausea and vomiting.

An instrument was designed for collection of data for each of the two groups. The instrument is shown in Appendix A. The costs of hospital room and board, anti-emetic therapy, TPN, and massage therapy, shown in Appendices B-1 and B-2, were calculated separately for each group.

The data collection instrument contained four major sections that included data such as: the demographic characteristics of the sample; direct costs such as the cost of anti-emetic drugs; indirect costs associated with the therapies such as the cost of hospitalization; and information related to the effectiveness of drug therapy alone and massage therapy as an adjunct to drug therapy, which included the amount of total parenteral nutrition needed, reduced episodes of nausea and vomiting, and increased caloric intake.

Section I of the data collection instrument contained relevant patient information including demographic data. Demographic data assisted in documenting the relationship of factors such as age, race, marital status, and transplant physician to the emetogenic experience of patients.

The history of the patient before PSCT was collected in Section II. Information about the patients' admitting diagnosis (breast cancer stage I, II, III, or metastatic breast cancer; stage I ovarian cancer, or advanced ovarian cancer) was obtained. Other relevant variables such as the previous

chemotherapy and number of cycles of previous kind of chemotherapy were also noted. Previous chemotherapy sometimes causes anticipatory emesis that was considered an important variable.

Section III included information about the patients while they were undergoing PSCT procedures. Information about the patients' length of stay in the hospital was assessed. This section also consisted of variables used to identify the first day of nausea or vomiting, the total days of nausea and vomiting, and the extent of nausea and vomiting.

Section IV, massage therapy, contained relevant data for the experimental group only. Data obtained in this section included the first day of massage therapy, number of days of massage therapy, number of massage sessions, and the type of massage therapy applied.

An Excel chart was attached to the data collection instrument. This chart was used in listing the different anti-emetics given, the number of units per day, the cost per dose of each anti-emetic medication, the total cost of anti-emetic medication per day, amount of total parenteral nutrition (TPN) administered, and the cost for TPN.

The cost perspective adopted for the purpose of this study was that of the hospital. As a result, all the costs were obtained from the department of pharmaceutical care at the institution.

## DATA PROCESSING

The demographic data were analyzed using the PC version of the Statistical Package for Social Sciences (SPSS-PC). The cost data collected for this study were entered into the Microsoft Excel version 97. Microsoft Excel was used for the calculation of the total cost of treatment therapies, and to evaluate treatment effectiveness. Since the PSCT program was relatively new at the institution, the sample size was small. As a result, it was not possible to determine the content and criterion-related validity of the instrument.

A descriptive analysis, including frequency distributions, was done to characterize the demographic variables. An independent samples *t*-test was used to compare the days of nausea/vomiting, length of stay, and days of TPN. The independent samples *t*-test helped in determining significant relationships between the two groups' other variables such as the effect of massage on the days of nausea and vomiting.

Sensitivity analyses were performed to examine the sensitivity of the study results to potential changes in the cost parameters used. The cost for massage therapy, the cost for hospital room and board, and the cost for the anti-emetic regimen were the variables that were increased and decreased, while all the other costs were held constant. A range of values for these manipulated economic variables was obtained from the literature and from the research data using minimum, maximum, and average values.

Those simulated increases and decreases helped in assessing the study's impact to determine if future price fluctuations would still yield the same relative, significant costs savings.

## DATA ANALYSIS AND RESULTS

The ages of the patient population ranged from 32 years to 60 years. The mean age of the control population was 46 years, with a range of 34–60 years. The mean age of the treatment group was 45 years, with a range of 32–58 years. Both groups were primarily comprised of white women (92.9% in the control group, and 64.7% in the treatment group). The remaining subjects were African American. Most subjects were married (85.7% of the control group and 70.6% of the treatment group).

Most respondents had health insurance. Private insurance agencies covered the cost of care for 85.7% of the treatment group and 82.4% of the control group. The remaining respondents were covered primarily by government agencies. Only one patient paid for treatment with personal funds. One physician transplanted approximately 40% of all patients, and four additional physicians transplanted the remaining patients in almost equal numbers. Although different physicians performed the PSCT procedures, the same protocol was used for all the patients.

### Pre-peripheral stem cell transplant patient history

Patients with breast cancer in stages I, II, or III, accounted for 64.3% of the control group and 47.1% of the treatment group. Patients with metastatic breast cancer accounted for 21.4% of the control group and 35.3% of the treatment group. The remaining patients, 14.3% of the control group and 17.6% of the treatment group, were advanced ovarian cancer cases.

One of the criteria for a patient being selected to undergo PSCT is their response to chemotherapy. The underlying principle of PSCT is that if a patient is responsive to chemotherapy in small doses, subsequent treatment with high-dose chemotherapy can help in complete or a partial remission. However, since the patient was exposed to chemotherapy previously, it was important to measure the extent to which the previous chemotherapy might influence the incidence of nausea and vomiting.

The chemotherapeutic regimen followed by the patients before they underwent PSCT was classified into four groups:

1. cyclophosphamide, doxorubicin (Adriamycin) and 5-fluorouracil (CAF)
2. paclitaxel (Taxol), and doxorubicin (Adriamycin) (TA)
3. paclitaxel
4. CAF and paclitaxel.

A majority of the patients in both the groups (76.9% in the control group and 53.3% in the treatment group) had CAF as their chemotherapeutic drug regimen. TA was used for 7.7% of the control group and 13.3% of the treatment group. Approximately 15% of the patients in the control group were administered cycles of paclitaxel only, and 33.3% of the patients in the treatment group were administered cycles of CAF and paclitaxel.

The number of cycles of the different chemotherapeutic regimen was also recorded. Patients in the control group were administered an average of 3.92 cycles per patient. Patients in the treatment group were administered an average of 4.64 cycles per patient.

## Patient peripheral stem cell transplant record

The data collection instrument contained information about the patients' progress while they were undergoing PSCT procedures. Data concerning the total number of days in the PSCT program, days of nausea and vomiting, days of total parenteral nutrition, and number of sessions of massage were collected.

Independent samples *t*-tests were performed to determine any statistically significant differences between the two groups of patients in terms of: length of stay in the hospital, first day of nausea/vomiting, days with no vomiting, number of days where vomiting was controlled by anti-emetics, number of days with nausea and no vomiting, total number of days with nausea/vomiting, and days of TPN.

The total number of days in the PSCT program was calculated using the date of admission and the date of discharge, as shown in the medical records. The mean number of days in the PSCT program for patients in the control group was 20.29 days. The mean number of days in the PSCT program for patients in the treatment group was 17.82 days. The independent samples *t*-test for the total number of days in the PSCT program revealed a statistically significant difference between the two groups [$t(14.74) = 2.872$, ($p < 0.05$)].

Nausea and vomiting in the patients was assessed using a scale in which '0' indicated no nausea or vomiting during that day, '1a' indicated vomiting controlled by anti-emetics, '1b' indicated nausea without vomiting, '2' indicated intractable vomiting for less than two weeks, '3a' indicated intractable vomiting (unable to retain water in spite of maximal anti-emetic therapy) lasting for more than two weeks, and '3b' indicated Mallory-Weiss tear with life-threatening hemorrhage or esophageal perforation. There were no patients in either group with a score of '3'. There was only one patient in the treatment group with a score of '2' for 3 days.

Results of the independent samples *t*-test indicated that there was no statistically significant difference in the first day of nausea or vomiting for the control group (3.29) and the treatment group (4.12) [$t(29) = -0.945$,

($p > 0.05$)]. The total number of days with no nausea and vomiting for both groups of patients was also recorded. Patients in the control group had a mean of 8.86 days with no nausea or vomiting, as compared with 12.12 days for patients in the treatment group [$t(29) = -0.204$ ($p = 0.05$)].

Patients in the control group had a mean of 8.21 days of vomiting controlled by anti-emetics. Patients in the treatment group had a mean of 3.65 days of vomiting controlled by anti-emetics. An independent samples $t$-test revealed that patients in the control group had significantly more days of vomiting requiring control by anti-emetics than patients in the treatment group [$t(29) = 4.55$, $p < 0.05$)].

When the number of days of nausea without vomiting was compared, the control group had a mean of 3 days as compared with 2 days for patients in the treatment group. However, based on the $t$-test, there was no significant difference between the two groups [NS, $t(19.94) = 1.06$, ($p > 0.05$)].

The total number of days of nausea and vomiting was considered as the sum of the number of days with nausea or vomiting or both (days with scores of 1a + days with 1b + days with 2). The treatment group had approximately 50% fewer days of nausea and vomiting than the control group. The mean number of days of nausea and vomiting was calculated as 11.21 for the control group and 5.82 for the treatment group. This difference was significant based on the independent samples $t$-test [$t(28.37) = 4.41$, ($p < 0.05$)].

Some patients in the PSCT program were administered TPN because of the severe nausea and vomiting that limited their oral nutritional intake. As a result, the need for TPN served as an indirect outcome measure with respect to the severity of patients' nausea and vomiting. Therefore, data concerning the number of times that TPN was administered were collected. Only 29.4% of patients in the treatment group received TPN as compared with 92.9% of patients in the control group. Patients in the treatment group required TPN for a mean of 1.0 day, while those in the control group required TPN for a mean of 10.6 days. The $t$-test revealed a statistically significant difference in the number of days of TPN required for the two groups [$t(29) = 9.23$, ($p < 0.05$)]. A summary of all independent samples $t$-test with the means, statistical significance, and confidence intervals is given in Table 5.1.

## Patient massage history

Section IV of the data collection instrument noted the number of times that massage was administered to patients in the treatment group. All treatment group patients received massage along the vagal nerve pathway, and to the hands and legs. There were times when the masseuse went to administer the massage, but because of severe nausea and vomiting, some patients refused the massage. Refused sessions were not considered in the total

**Table 5.1** Independent samples *t*-test

| Parameter | Mean (patients without massage) | Mean (patients with massage) | Statistical significance | 95% confidence interval of the mean | |
|---|---|---|---|---|---|
| | | | | Lower | Upper |
| 1. Total number of days in the PSCT program | 20.29 | 17.82 | $t(14.74) = 2.672$, $p < 0.05$ | 0.50 | 4.43 |
| 2. First day of nausea/vomiting | 3.29 | 4.12 | $t(29) = -0.945$, $p > 0.05$ | −2.63 | 0.97 |
| 3. Days with no nausea/vomiting | 8.86 | 12.12 | $t(29) = -2.04$, $p = 0.05$ | −6.53 | 4.7 |
| 4. Number of days of vomiting controlled by anti-emetics | 8.21 | 3.65 | $t(29) = 4.55$, $p < 0.05$ | 2.51 | 6.62 |
| 5. Number of days of nausea without vomiting | 3 | 2 | $t(19.94) = 1.06$, $p > 0.05$ | −0.96 | 2.96 |
| 6. Total days of nausea/ vomiting | 11.21 | 5.82 | $t(28.37) = 4.41$, $p < 0.05$ | 2.89 | 7.9 |
| 7. Days of total parenteral nutrition | 10.64 | 1 | $t(29) = 9.23$, $p < 0.05$ | 7.51 | 11.91 |

number of massage sessions. When the massage was started on a trial basis, it was not noted in the medical records for the first four patients. A number of sessions equal to the mean number of sessions for the remaining 13 patients were allocated to those four patients. Slightly over 50% of patients in the treatment group were administered five massage sessions.

## Cost calculation and analysis

The cost data collected were analyzed using Microsoft Excel 97. Outcome costs were calculated based on the cost for anti-emetic medications, the cost for TPN, the cost for hospitalization, and the cost for massage therapy.

The average costs to the hospital for anti-emetic medications were obtained from the purchasing agent in the Pharmacy Department at the institution. The average cost of anti-emetic medications for patients in the control group was $2106.84, and the average cost of anti-emetic medications for patients in the treatment group was $1361.61.

The cost for TPN was calculated using the cost of the ingredients to the pharmacy and the hourly rate of the pharmacy technician and the pharmacist to the pharmacy. The average cost to the hospital for TPN was $865.59 for control group patients, and $66.00 for treatment group patients.

The cost for massage therapy was calculated as the cost to the hospital in reimbursement to the masseuse. The hospital paid $18 per massage session to the masseuse. The average cost to the hospital per patient for massage therapy was $90.

The total cost for nausea and vomiting treatment was the sum of the cost for anti-emetic medication, the cost of TPN, and the cost for massage therapy. The average cost for treating nausea and vomiting due to high-dose chemotherapy was $2972.43 for patients in the control group, and $1517.61 for patients in the treatment group. Table 5.2 shows the total cost to the institution and average cost per patient of nausea and vomiting treatment for both groups.

The length of stay in the hospital was another outcome measure compared between the two groups of patients. The average cost of a hospital room was obtained for the year 1990, and was calculated for 1998 using the inflation rates for hospital services provided by the Consumer Price

**Table 5.2** Calculated costs of nausea and vomiting treatment

| Patient group | Total cost of anti-emetic therapy, TPN & massage[a] | Average cost of anti-emetic therapy, TPN & massage per patient |
|---|---|---|
| Control group | $41,613.96 | $2972.43 |
| Treatment group | $25,799.39 | $1517.61 |

[a]Massage was only administered to the treatment group.

Index (CPI, 1998). The average cost of a hospital room was $567.90 per day for the North Central region in the United States. The average cost of the hospital stay per patient was calculated as follows:

| Total cost of hospital room | = | Number of days in the hospital | × | Cost to hospital per day |
|---|---|---|---|---|

The average cost of the hospital room was $11,520.26 per patient in the control group as compared with $10,121.98 per patient in the treatment group.

The average cost of nausea and vomiting treatment was then added to the average cost of the hospital room. When added together, these costs were $14,492.69 per patient for the control group, and $11,639.59 for the treatment group. The net incremental cost of not using massage therapy in patients, over using massage therapy as an adjunct to anti-emetic medications was found to be $2853.10 per patient.

## Cost savings

There were 31 women who were treated with PSCT for breast or ovarian cancer between September 1996 and February 1998. The total cost of nausea and vomiting treatment and hospital room and board for both groups was $400,770.65, as shown in Table 5.3.

For the 17 patients in the treatment group, the use of massage therapy for nausea and vomiting resulted in significant cost savings of $2853.10 per patient in cost avoidance to the hospital. Projections would indicate that had the 14 patients in the control group received massage therapy the potential cost savings to the hospital would have been an additional $39,943.40 ($2853.10 × 14).

## Sensitivity analyses

As mentioned earlier, sensitivity analyses were performed to examine the sensitivity of the study results to potential changes in the cost parameters

**Table 5.3** Total costs to the hospital

| Patient group | Total cost for nausea and vomiting (A) | Total cost of hospital room (B) | (A) + (B) | Total costs to the hospital |
|---|---|---|---|---|
| Patients without massage | $41,613.96 | $161,283.60 | $202,897.56 | $400,770.65 |
| Patients with massage | $25,799.39 | $172,073.70 | $197,873.09 | |

used. These analyses help in assessing the impact of different assumptions on the study's results.

### *Massage therapy*

Sensitivity analyses help in assessing the impact of different assumptions on the study results. The cost of massage therapy was varied, while other economic parameters were held constant. This calculation was done to reflect a more realistic dollar amount for the massage sessions. Since massage was started on an experimental basis at the hospital, the masseuse was reimbursed at $18 per session, a rate lower than the average rate for such therapy. The typical rate for massage therapy was calculated at $45 per session. Therefore, $45 was considered as the extreme negative value for the worst-case estimate. The best-case estimate considered the values obtained from the study. As revealed by the sensitivity analysis, the lower price scenario showed a net benefit of $2853.10, as mentioned previously. The higher price scenario showed a net benefit of $2718.09.

### *Hospital room and board*

A sensitivity analysis was also performed by varying the cost of the hospital room. Hospital room costs were varied, while other economic parameters, such as the cost of massage therapy, cost of TPN, and direct drug costs to the hospital, were held constant. Hospital room costs were allowed to shift simultaneously to their most positive value, and alternatively to their most negative value. The extreme positive and negative values of cost of hospital room for the United States were obtained from the Medstat (Hass, 1995) data. The 'best case estimate' and 'worst case estimate' were then calculated taking into account the cost to the hospitals at $386.35 and $755.24 per day, per patient, respectively. The higher price scenario projected a net benefit of $3309.15 for patients with massage therapy. Similarly, the lower price scenario projected a net benefit of $1660.98 for patients with massage therapy. Thus, the benefit in regard to savings in hospital room and board were found to be stable between the extreme ranges.

### *Anti-emetic therapy*

Only four patients out of the total 31 patients were given an ondansetron (Zofran) anti-emetic regimen, while the remaining patients were given granisetron (Kytril) anti-emetic regimen. Since ondansetron had a higher acquisition cost than granisetron, a sensitivity analysis was done to determine if there would still be an incremental cost benefit if the patients on ondansetron regimen were excluded. Sensitivity analyses showed that

when the patients on ondansetron were excluded, the net cost savings was $3016.11, as compared with the best-case estimate of $2847.89.

## Regression analysis

A regression analysis was done to determine the extent to which the independent variables accounted for the observed variability in the total number of days of nausea and vomiting. A multiple step-wise regression was done with a number of independent variables and total days of nausea and vomiting as the dependent variable. The independent variables used were patient group (massage vs no massage), age, race, marital status, insurance information, transplant physician, admitting diagnosis, previous chemotherapy, and number of cycles of previous chemotherapy. Table 5.4 summarizes the results of the stepwise multiple regression.

The results of the regression analysis indicate that 40.5% of the observed variability in the total days of nausea and vomiting was explained by the patient group. Thus, the presence or absence of massage therapy accounted for 40.5% of the observed variability in the total days of nausea and vomiting.

The regression model used was a stepwise multiple regression. This model helps in removing variables whose importance diminishes as additional predictors are added or removed. The first model used the group of patients as the predictor variable, as mentioned above. The second model used the transplant physician along with the group of patients as the predictor variable. The analysis indicates that 51.7% ($r^2 = 0.517$) of the observed variability in the total days of nausea and vomiting can be explained by patient group (massage vs no massage) and transplant physician.

The remaining independent variables (race, age, insurance information, previous chemotherapy, number of cycles of previous chemotherapy, marital status, and admitting diagnosis) were excluded by the stepwise multiple

**Table 5.4** Summary of regression analysis

| Model | Variable | *r* | *r* square | Adjusted *r* square | Standard error of estimate | Significance |
|---|---|---|---|---|---|---|
| 1 | Group of patients (massage vs no massage) | 0.636[a] | 0.405 | 0.381 | 3.40 | $p < 0.05$ |
| 2 | Transplant physician | 0.719[b] | 0.517 | 0.477 | 3.13 | $p < 0.05$ |

[a]Predictors: (constant), group of patients (massage vs no massage).
[b]Predictors: (constant), group of patients (massage vs no massage), transplant physician.
[c]Dependent variable: total days of nausea and vomiting.

regression model. This indicates that there was no significant accountability towards the observed variability in the total days of nausea and vomiting because of the remaining independent variables.

## DISCUSSION

The results of this study indicate that the cost to the institution for anti-emetic drug therapy and parenteral nutritional support (TPN) for the patient undergoing stem cell transplantation for the treatment of breast cancer averaged $2972.43. When thrice weekly massage therapy was added to the patient care plan as an adjunct to anti-emetic medication, the cost of anti-emetic therapy and nutritional support was $1517.61. The cost to the hospital for the massage therapy was an average of $90 per patient (five massage sessions @ $18 per session); thus, using massage therapy for nausea and vomiting in PSCT patients generated cost savings of $1454.82 per patient. This finding indicates that massage therapy is a valuable adjunct to anti-emetic medications in treating high-dose chemotherapy-induced nausea and vomiting in women undergoing PSCT procedures for breast or ovarian cancer.

Length of stay in the hospital was another index measured to determine the impact of massage therapy on the outcome of patients receiving high-dose chemotherapy for PSCT. There was a significant ($p < 0.05$) decrease in the total length of stay for patients with massage therapy as compared with patients without massage therapy. The average length of stay for the control group was 20.29 days as compared with 17.82 days for patients with massage therapy. Given that all other treatment variables were held constant, this infers that massage therapy was instrumental in reducing the length of stay in the hospital. When adding the cost of room and board for the patient to the cost of the anti-emetic medication, the cost of massage therapy and the mean cost for TPN therapy, there was a net incremental benefit to the hospital of $2853.10 per patient, or a cost avoidance of 19.69% associated with massage therapy.

Sensitivity analyses revealed that significant trends in cost avoidance associated with massage therapy held across a number of assumptions with each of the measured variables.

### Additional study observations

The total number of patient charts reviewed for this study was 31, out of which 14 patients received only anti-emetic medication, and 17 patients received massage therapy as an adjunct to anti-emetic medications. A majority of the patients in both the groups were breast cancer patients (85.7% in the control group and 82.4% in the treatment group). All other patients were diagnosed with advanced ovarian cancer. A subsequent study by

Anantharaman et al. (2000) extended the massage therapy population to include 34 patients receiving high-dose chemotherapy for PSCT. In the Anantharaman study 91% of patients received PSCT for the treatment of breast cancer while the remaining patients were treated for advanced ovarian cancer.

A majority of the patients in the present study were married women, and had private insurance agencies covering the expenses for the PSCT procedures. A majority of the patients from both groups were administered CAF (cyclophosphamide, doxorubicin, and 5-fluorouracil) as pretransplant chemotherapy.

Five physicians were responsible for contributing patients to the study. However, once enrolled in the PSCT program, patients were subject to the same procedures and conditions as agreed to by the entire group of physicians. Also, all the patients received the same chemotherapy (STAMP V) and the same dosage of the chemotherapeutic agents.

Multiple stepwise regression analyses were performed to determine the extent to which the demographic variables accounted for the variability in the total days of nausea and vomiting. The results indicated that the variable 'massage therapy' accounted for 40.5% of the observed variability in the days of nausea and vomiting while the second 'step' of the model indicated that the 'transplant physician' accounted for 11.2% of the remaining observed variability in the total days of nausea and vomiting. The stepwise regression model excluded the remaining variables.

The study by Anantharaman et al. revealed that the variable 'transplant physician' was related to pretransplant exposure to chemotherapy and the anti-emetic regimens used in that setting. Specifically, the use of a single agent therapy to control nausea and vomiting associated with the chemotherapy in the pretransplant phase of the program (which is individualized by the 'transplant physician' and performed in a private office setting) was directly proportional ($r^2 = 0.299$, $p < 0.05$) to the post-transplant days of nausea and vomiting. When pretransplant chemotherapy-associated anti-emetic therapy was further evaluated, singularly and in combination, the use of high-dose ondansetron (32 mg IV) was the only variable in addition to massage therapy that was significantly predictive of post transplant days of nausea and vomiting. Although not evaluated specifically in this study, these observations are consistent with literature that describes the increased likelihood of nausea and vomiting in patients with prior emetic experiences and may infer the presence of anticipatory nausea and vomiting.

The study by Anantharaman et al. also spoke to the durability of the findings in this study, in that the mean length of stay for patients receiving massage therapy was 18.25 days, and that nausea and vomiting were experienced in the massage therapy group for a mean duration of 4.92 days. Correlative studies of factors significantly associated with the presence of

massage therapy included fewer days of nausea and vomiting ($r^2 = 0.401$, $p < 0.01$), shorter length of stay ($r^2 = 0.433$, $p < 0.01$) and the likelihood to experience nausea, but no vomiting ($r^2 = 0.613$, $p < 0.01$). Slightly less than five massage sessions were provided to each patient in the intervention group. Cost analysis revealed that the net incremental cost avoidance in the massage intervention group compared with the control was $3727 in the study by Anantharaman et al. (2000).

## CONCLUSIONS

Massage therapy as an adjunct to anti-emetic medication was found to be more cost saving and effective in controlling high-dose chemotherapy-induced nausea and vomiting in women undergoing PSCT procedures for breast or ovarian cancer, under a number of assumptions. The extent of savings was dependent on the length of stay in the hospital, days of TPN, amount of anti-emetic medication administered, and number of massage sessions.

The realization by the health care administrators of the potential cost savings and effectiveness of massage therapy, as shown by this study, would prove to be beneficial for the institution. These savings could then be directed to other necessary treatment therapies in the health care system. This type of analysis helps institutional policy makers prioritize funding to maximize the net health benefit from a fixed amount of resources.

Besides the economic benefit of massage therapy, it has several other benefits. Nausea and vomiting are some of the most dreaded side effects of chemotherapy. Massage therapy, along with anti-emetic medication, alleviated these chemotherapy-related side effects to a certain extent, and thus helped the patient in better tolerating high doses of chemotherapy. Also, most patients are apprehensive about undergoing PSCT procedures because of the nausea and the vomiting associated with it. Massage therapy would prove to be beneficial in improving patient participation and compliance in such high-dose chemotherapy alternatives, which offer a hope for a potential cure or at least a partial remission from cancer.

### Assumptions

The assumptions made in the study are:

1. This retrospective study was done by an examination of medical records. Different physicians and interns noted these records. The study assumes that the different interns reporting the patient status and physician orders were consistent in recording the information about nausea and vomiting.

2. The study assumes that each physician was consistent in prescribing anti-emetic medications for all the patients. A protocol was established, but variances were allowed.

3. The same masseuse administered the massage to all the patients in the study, and the type of massage administered was also the same for all the patients. So it was assumed that the quantitative therapy rendered through the massage was the same in all the patients.

## Limitations

The limitations of the study are:

1. The sample size for this study was small. The study results could have been different in the presence of a larger patient population.

2. Only one masseuse administered the massage. Had the massage been administered by a different masseuse, there could have been a difference in the results.

3. The study did not take into account the cost of nursing for the episodes of nausea and vomiting. The extent of care required for the nausea and vomiting does not determine the nursing cost. This made it difficult to identify the exact time invested by the nurse for nausea and vomiting in these patients. It was assumed that since nursing cost is paid immaterial of the extent of care required, it must be proportional to the length of stay in the hospital, and hence the study was not biased in this respect. But the identification of nursing cost to the hospital may have changed the results of the study.

4. The reliability and validity of the study instrument could not be determined since the sample was too small ($n = 31$) to do a pre-test.

5. The study did not quantify the intangible aspects of massage therapy, such as the anxiety and stress relieved by massage.

6. Only one type of chemotherapy regimen (STAMP V) was considered. The results of the study could have been different if different types of high-dose chemotherapy regimen were used, because of the different emetogenic potential of the different therapies. Also, only breast and ovarian cancer patients were considered. The effect of massage could have been different for the different types of cancer.

7. The study did not investigate whether other factors, such as infection, could have affected hospital length of stay.

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# APPENDICES

## Appendix A: Instrument for data collection

**Patient Information**

1) Age — Patient Code
2) Date of Birth
3) Race
   1. White 2. Black 3. Hispanic 4. Asian
   5. Native American 6. Mixed 7. Other
4) Marital Status
   1. Married 2. Single 3. Widowed
   4. Divorced 5. Separated
5) Insurance Information
   1. Payer 1 (Government)
   2. Payer 2 (Private)
6) Transplant Physician
   1. Dr A. 2. Dr B. 3. Dr C.
   4. Dr D. 5. Dr E. 6. Dr F.

**Patient Pre-PSCT History**

7) Admitting Diagnosis
   1. Breast Cancer (Stage I, II, III)
   2. Metastatic Breast Cancer
   3. Stage I Ovarian Cancer
   4. Advanced Ovarian Cancer
8) Previous Chemotherapy
   1. CAF [cyclophosphamide, Adriamycin, Fluorouracil]
   2. TA [Taxol (paclitaxel), Adriamycin]
   3. Taxol (paclitaxel)
   4. CAF & Taxol
9) Number of Cycles of Previous Chemotherapy:
   1. 2. 3. 4.

**PSCT Information**

10) Date of Admission into PSCT Program
11) Last Date in PSCT Program
12) Number of Days in PSCT Program
13) First Day of Nausea/Vomiting
14) Days of Nausea/Vomiting
15) Anti-emetic Medication Regimen
   1. IV 2. Oral 3. Sublingual
   1. Ativan 2. Kytril 3. Compazine 4. Reglan
   5. Zofran 6. Haxadrol 7. Metacloprin 8. Torecan

**Massage Therapy**

16) First Day of Massage Therapy
17) Number of Days of Massage Therapy
18) Number of Massage Sessions
19) Kind of Massage Therapy
20) Additional Comments

## Appendix B-1: Cost calculations for patients with anti-emetic drug therapy without massage therapy

| PSCT No. | Length of stay | Hospital room & board (A) | Anti-emetic cost (B) | Cost of TPN (C) | Cost of massage (D) | Total Cost (A + B + C + D) |
|---|---|---|---|---|---|---|
| 1 | 19 | $10,790.10 | $1782.59 | $982.80 | $0.00 | $13,555.49 |
| 2 | 30 | $17,037.00 | $4219.71 | $1036.15 | $0.00 | $22,292.86 |
| 6 | 25 | $14,197.50 | $2351.10 | $1246.28 | $0.00 | $17,794.88 |
| 7 | 19 | $10,790.10 | $2400.39 | $1020.00 | $0.00 | $14,210.49 |
| 9 | 18 | $10,222.20 | $4207.14 | $688.50 | $0.00 | $15,117.84 |
| 10 | 19 | $10,790.10 | $2586.85 | $998.75 | $0.00 | $14,375.70 |
| 11 | 21 | $11,925.90 | $1154.67 | $851.95 | $0.00 | $13,932.52 |
| 12 | 19 | $10,790.10 | $2541.66 | $918.00 | $0.00 | $14,249.76 |
| 13 | 19 | $10,790.10 | $883.52 | $1035.30 | $0.00 | $12,708.92 |
| 14 | 19 | $10,790.10 | $1080.48 | $0.00 | $0.00 | $11,870.58 |
| 15 | 19 | $10,790.10 | $1322.47 | $683.40 | $0.00 | $12,795.97 |
| 16 | 20 | $11,358.00 | $2594.75 | $856.80 | $0.00 | $14,809.55 |
| 19 | 20 | $11,358.00 | $1233.22 | $882.30 | $0.00 | $13,473.52 |
| 21 | 17 | $9654.30 | $1137.18 | $918.00 | $0.00 | $11,709.48 |
| Sum | | $161,283.60 | $29,495.73 | $12,118.23 | $0.00 | $202,897.56 |
| Average | 20.28 | $11,520.26 | $2106.84 | $865.59 | $0.00 | $14,492.68 |

## Appendix B-2: Cost calculations for patients with massage therapy as an adjunct to anti-emetic drug therapy

| PSCT No. | Length of stay | Hospital room & board (A) | Anti-emetic cost (B) | Cost of TPN (C) | Cost of massage (D) | Total Cost (A + B + C + D) |
|---|---|---|---|---|---|---|
| 20 | 18 | $10,222.20 | $2725.39 | $0.00 | $90.00 | $13,037.59 |
| 22 | 18 | $10,222.20 | $590.89 | $102.00 | $90.00 | $11,005.09 |
| 23 | 20 | $11,358.00 | $1318.21 | $0.00 | $90.00 | $12,766.21 |
| 26 | 17 | $9654.30 | $1328.56 | $0.00 | $90.00 | $11,072.86 |
| 31 | 17 | $9654.30 | $1313.58 | $102.00 | $90.00 | $11,159.88 |
| 33 | 17 | $9654.30 | $1377.98 | $0.00 | $90.00 | $11,122.28 |
| 34 | 18 | $10,222.20 | $1460.45 | $0.00 | $90.00 | $11,772.65 |
| 36 | 17 | $9654.30 | $1314.33 | $0.00 | $90.00 | $11,058.63 |
| 38 | 17 | $9654.30 | $1325.95 | $0.00 | $90.00 | $11,070.25 |
| 39 | 18 | $10,222.20 | $1744.73 | $688.50 | $72.00 | $12,727.43 |
| 44 | 17 | $9654.30 | $812.94 | $229.50 | $90.00 | $10,786.74 |
| 46 | 20 | $11,358.00 | $1360.75 | $0.00 | $108.00 | $12,826.75 |
| 47 | 18 | $10,222.20 | $1337.09 | $0.00 | $90.00 | $11,649.29 |
| 48 | 18 | $10,222.20 | $1432.20 | $0.00 | $108.00 | $11,762.40 |
| 52 | 18 | $10,222.20 | $1332.76 | $0.00 | $72.00 | $11,626.96 |
| 54 | 18 | $10,222.20 | $964.67 | $0.00 | $90.00 | $11,276.87 |
| 56 | 17 | $9654.30 | $1406.91 | $0.00 | $90.00 | $11,239.72 |
| Sum | | $172,073.70 | $23,147.39 | $1122.00 | $1530.00 | $197,873.09 |
| Average | 17.82 | $10,121.98 | $1361.61 | $66.00 | $90.00 | $11,639.59 |

# 6

# Massage therapy following spinal cord injury

*Sandra L. Rogers*



## INTRODUCTION

Increased vulnerability of individuals who have sustained a traumatic spinal cord injury (SCI) to a host of potentially preventable illnesses including pressure ulcers, urinary tract infections, and respiratory tract infections is commonly recognized (Eastwood et al., 1999; Whiteneck et al., 1992). Considerable investigation has been undertaken by medical professionals to understand the causative factors underlying these conditions and to educate affected individuals and their caregivers on reasonable and cost-effective strategies to prevent these maladies. Typically, immediate causative factors are explored (i.e., incomplete bladder emptying, prolonged sitting, absence of cough) and countered with pragmatic solutions (i.e., intermittent catheterization, pressure relief, assisted cough). One thread common to all these illnesses is a failure of the immune system to adequately protect the individual following SCI. Unfortunately, there is sparse data on immunological changes which persist in chronic SCI, and even less on how the immune function might be augmented in following SCI.

### Long-term health consequences of spinal cord injury

Clinically, dysregulation of the autonomic nervous system is manifested by the occurrence of apneic bradycardia, autonomic dysreflexia,

thermoregulation, orthostatic hypotension, and endocrine dysregulation (Daverat et al., 1995). In cervical SCI, an additional disruption of the sympathetic nervous system signaling outflow to lymphoid tissues and their blood vessels is present (Cruse et al., 1996a). Other common occurrences of illness, which reflect immunosuppression, are respiratory tract infections, pneumonia, urinary tract infections and pressure ulcers. Depression, a psychosocial stressor, following SCI is also common, nearly 80% of individuals with SCI have mild to severe levels of depression (Heinemann et al., 1997; Kliesch et al., 1996; Lu & Yarkony, 1996; Saboe et al., 1997). Depression following neurological damage has been linked to further immunosuppression, placing the SCI population at greater risk for infection (Irwin et al., 1987; MacHale et al., 1998). All of these illnesses indicate that a dysregulation of sympathetic nervous system activity, impaired signaling from the periphery to the CNS, and multiple stressors may be present (Daverat et al., 1995). Taken together, the evidence for altered immune regulation following SCI is convincing. This places survivors of SCI at a greater risk for disease and thus encourages rehabilitation professions to design interventions which can improve health and wellness.

## Immunological consequences of spinal cord injury

Dysregulation of immune function is often caused by disruptions among the critical pathways between the nervous, endocrine and immune systems. Evidence suggests that individuals with acute SCIs have compromised natural and adaptive immune functioning as a result of their injuries (Cruse & Lewis, 1989, 1997; Cruse et al., 1992, 1993, 1996a,b; Kliesch et al., 1996; Smith et al., 1987). Neuroendocrine and cellular immune functions are altered following acute SCI (Cruse et al., 1996a). Alterations in the cellular immune functions following SCI indicate that there is a reduction in natural killer (NK) cell-mediated lysis and diminished lymphocyte transformation/IL-2R levels, with the tetraplegic subjects significantly more impaired than paraplegics (Cruse et al., 1993, 1996a; Kliesch et al., 1996). These changes persisted for up to 1 year following injury (Cruse et al., 1992). Furthermore, participation in a generalized rehabilitation program appeared to improve immune status in all subjects, however it is not clear what aspect of the rehabilitation program contributed to these changes (Kliesch et al., 1996).

Other reports indicate that adrenal reserve in men ($n = 20$) with chronic tetra- or paraplegia SCI was significantly impaired on a low dose (1 μg) adrenocorticotrophic hormone (ACTH) test when compared with controls, but reported no data for differences on level of injury (Wang, 1999). Cortisol and dehydroepiandrosterone sulfate (DS) were reported to be elevated in another group of chronic SCI participants when compared with controls, but no differences were seen between the tetraplegic participants

and paraplegic subjects (Campagnolo et al., 1999). Campagnolo and colleagues found no difference on measures of dehydroepiandrosterone (DHEA), ACTH or prolactin between SCI and healthy controls. Patterns of differences emerged however, when tetra and paraplegic response levels where compared, with individuals in the tetraplegic group showing higher levels of DS and DHEA, but no significant differences in cortisol, ACTH or prolactin levels. In another study, levels of adrenaline (epinephrine), noradrenaline (norepinephrine), and dopamine were measured at rest and during exercise in chronic SCI with the SCI population divided into four groups [C3–C7 ($n = 30$); T1–T4 ($n = 15$); T5–T10 ($n = 15$); T10 & below ($n = 15$)] and controls (Schmid et al., 1998). Only the C3–C7 group (tetraplegic) showed significantly lower E and NE at rest when compared with controls with only slight elevations with exercise. Individuals with T1–T4 levels of injury showed lower levels of E and NE at rest and exercise when compared with those with paraplegia distal to T5. Questions about the consistency of findings and clinical implications remain.

## Influence of perceived health, disability and immunological status

The above patterns of neuroendocrine and cellular immune dysfunction following chronic SCI are likely to be influenced by alterations in the neuroendocrine axis and by varying degrees of interruption of the tonic firing of the efferent and afferent fibers of the sympathetic nervous system as a direct result of SCI. However, emotional states/mood and levels of stress can also modify neuroendocrine and cellular immune. The occurrence of extraordinary stress and depression following SCI are unfortunately common (Daverat et al., 1995). And, as stated earlier, the immune system alterations seen following SCI are strikingly similar to those found in individuals who have chronic stress conditions (Cacioppo et al., 1998a; Coe, 1993; Dhabhar & McEwen, 1997; Esterling et al., 1994; Fleming et al., 1987; Irwin et al., 1987; Pike et al., 1997). Perhaps SCI, by its very nature, induces a state of chronic stress which then has a negative impact on overall health. For example, negative psychosocial states are known to influence immune competence, which may alter and delay wound healing, a critical issue following occurrence of pressure ulcers in SCI (Cruse et al., 1996b; Glaser et al., 1999a; Kiecolt-Glaser et al., 1995). There is striking evidence supporting the role emotional states play in ultimately affecting the immune system (Esterling et al., 1996; Glaser et al., 1990, 1998, 1999a; Kiecolt-Glaser et al., 1996, 1998). For example, depressive thoughts and moods depress neuroendocrine and autonomic functioning, which in turn has a significant negative effect on immunity (Irwin et al., 1987). Since there are consistent immunosuppressive effects across different populations and kinds of stressors, it is reasonable to assume that persons with

SCI who bear negative emotions would display immunosuppressive effects as well (Watkins & Maier, 1999). This is of paramount importance to therapists, since a great portion of SCI patients experience mild to severe depression after their injury. Taken together, individuals with SCI have multidimensional stressors, which make them ideal candidates for application of stress reduction modalities in therapy.

In addition, the immune system alterations seen in acute SCI are strikingly similar to those found in individuals who have chronic stress conditions (Dhabhar & McEwen, 1997). Furthermore, while there is extensive evidence that chronic levels of stress reduces the effectiveness of the immune system (Burleson et al., 1998; Cacioppo et al., 1998b; Dura et al., 1990; Esterling et al., 1994; Glaser & Kiecolt-Glaser, 1997, 1998; Glaser et al., 1998, 1999b; Kiecolt-Glaser et al., 1991, 1996; Uchino et al., 1992; Wu et al., 1999), there is little rigorous scientific evidence of what types of interventions could enhance the immune system responses once they have been altered (Rabin, 1999).

## Massage as a modality to positively enhance immune function

Spinal cord injured patients are an important part of the rehabilitation population. There are approximately 200,000 people alive in the United States today with spinal cord injuries, and approximately 11,000 new cases arise each year. Theoretically, a method of intervention to effectively and predictably decrease stress could also lead to improved immune responses in individuals with SCI (Cruse et al., 1996a,b). One therapeutic technique touted by popular literature to enhance immune system function is massage.

Despite the broad use of complementary and alternative medicine (CAM) treatments there is a relative paucity of data that convincingly demonstrates safety, efficacy, effectiveness, and mechanism of CAM practices (Eisenberg et al., 1998). Many of these remedies lack scientific evidence of their curative effects, discouraging health professionals from utilizing any medicine labeled 'alternative' (Rabin, 1999; Watkins, 1997). While massage may be an alternative, and therefore an unproven, treatment in rehabilitation medicine it is an often recommended and used intervention. Fortunately, there is some convincing evidence that suggests massage may enhance certain immune parameters (Field, 1995; Field et al., 1996a,b,c, 1997a,b, 1998a,b; Ironson et al., 1996; Prodromidis et al., 1995; Scafidi & Field, 1996; Scafidi et al., 1996). As health care approaches change rapidly, rehabilitation professionals need to document the impact we have on our clients. Little has been done to convince skeptics about how therapeutic techniques work, for whom they work best, and for how long these techniques

must be used in order to foster change (Fletcher & Fletcher, 1997; Ottenbacher & Maas, 1999).

Studies that used massage intervention report primarily psychological benefits to numerous patient groups. These benefits include enhanced positive emotionality, decreased anxiety, increased attention (to math computation), and induction of a state of relaxation which persists after the massage intervention ceases (Field et al., 1996a,b, 1997a,b, 1998a; Ironson et al., 1996; Lang et al., 1996; Scafidi & Field, 1996, 1997; Scafidi et al., 1996, 1997; Wheeden et al., 1993). The range of populations positively affected by massage includes healthy adults, infants in a neonatal intensive care unit, children with autism, depressed adolescents, adolescent mothers, healthy adolescents and mothers of sick infants (Field et al., 1996a,b, 1997a,b, 1998a,b; Ironson et al., 1996; Lang et al., 1996; Scafidi & Field, 1996, 1997; Scafidi et al., 1996, 1997; Wheeden et al., 1993). Since the reported psychological benefits are attributed to relaxation it is reasonable to infer that a state of lowered sympathetic activation is being induced. This inference is supported by the few studies that have utilized physiological outcome measures, which show reductions in the levels of norepinephrine and cortisol in depressed adolescents, HIV+ and HIV− gay men, child psychiatric patients, and healthy adults when treated with massage (Ironson et al., 1996). Other physiological evidence for the benefits of massage include enhanced effects on the circulatory system (Goats, 1994). Goats has demonstrated increases in the rate of blood flow and cardiac stroke volume, implying enhanced venous return. Critically, the immunological benefits to a group of HIV+ gay men following an intensive massage protocol significantly enhanced natural killer cell numbers and cytotoxicity, and the activity of the cytotoxic CD8 T cells (Ironson et al., 1996).

In order to investigate the relationship between immunological status following chronic spinal cord injury and to examine the effectiveness of massage on this population we have undertaken two studies. The specific aims of the first of these studies was to investigate whether altered immunological and neuroendocrine regulation deficits persists in chronic SCI, to determine whether an intensive massage treatment enhances cellular immunity, and if so, how long after treatment the effects persist. The second pilot study was developed to assess whether there are greater benefits for individuals who have a cervical verses a thoracic level spinal cord injury. Study 2 methodology was identical to the first study. However, in this pilot study we compared the long-term consequences of living with paraplegia and tetraplegic spinal cord injury (SCI) and examined the responses of two differing populations to massage. The data presented here represent a compilation of these two studies findings.

# RESEARCH METHODS AND MASSAGE PROCEDURE

## General research methods

### *Subjects*

Subjects were recruited through a database of active, wheelchair-reliant individuals with spinal cord injury. All participants signed an institutional review board (IRB)-approved informed consent prior to their participation in this study. Individuals who were age 18 years or older and initially injured at least 6 months prior to the study were invited to participate. To answer the question as to whether those with chronic SCI have different immunologic profiles than normals, a group of age (±3 years) matched, gender and life-style (smoking and marital status) matched controls were recruited. Controls were recruited from general advertisement. To ensure the selection of healthy controls and generally healthy SCI participants, potential subjects were screened using a slightly modified version of a self-report health questionnaire, the Survey of Immunological and General Health (SIGH) (Kang et al., 1997; Strauman et al., 1993). Any potential subject with a history of multiple spinal cord injuries, malignant, autoimmune, or chronic infectious disease, as well as those who were using immunosuppressive or anti-psychotic medications, was excluded. Seventeen SCI subjects with paraplegia and 12 SCI subjects with tetraplegia met these criteria and were recruited for the studies. Of this sample, 25 were male and four were female, representing the United States spinal cord injured population (82% male) (National Spinal Cord Injury Statistical Center, 2000). The mean age was 32.5 with a range of between 25 and 55. Thirteen of the participants had paraplegia, four had tetraplegia. Fifteen age and gender matched, healthy, non-spinal cord-injured individuals comprised the control group, and two individuals served as the control for two of the SCI participants, given the demographic similarities of the subjects (Table 6.1).

### *Design overview*

To determine whether immunologic profiles were different between subjects and controls, blood was drawn at the same time in the morning and compared. Both groups also completed health questionnaires at the same time of the day. The normal control subjects were not used again in any other part of this study. To test the effect of massage on immunologic profile amongst SCI individuals, a before and after intervention design was used. All SCI participants received the massage and were asked to provide a one month post-massage follow-up. The study was conducted in either a massage therapy clinic or in an outpatient rehabilitation clinic. Data was collected at three time points: prior to initiation of the study (baseline), at

**Table 6.1** Demographic information on participants

| | SCI participants | Controls |
|---|---|---|
| Age mean (SD) | 32.41 (4.53) | 31.65 (8.8) |
| Level of injury | | |
| Tetraplegia (C3–C5) | 12 | |
| Paraplegia (T1–T5) | 12 | |
| Paraplegia (T5–T10) | 5 | |
| Gender | | |
| Males | 25 | 13 |
| Females | 4 | 2 |
| SIGH Mean (SD) | | |
| UTI | 0.71 (0.59) | 0.00 (0.00) |
| RTI | 0.47 (0.51) | 0.00 (0.00) |
| Pressure Ulcers | 0.59 (0.62) | 0.00 (0.00) |
| FIM | 101.47 (25.41) | 125.60 (1.55) |

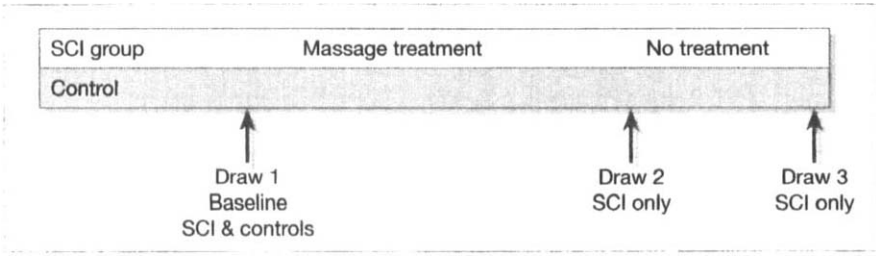


**Figure 6.1** Study design with blood collection time points.

the end of the month of massage (prior to the massage being given that final day to eliminate immediate treatment effects), and at the end of the no-treatment month (Fig. 6.1).

### *Survey of immunological and general health (SIGH)*

A modified version of a self-report health questionnaire, the SIGH, was used to screen participants. The SIGH is used to document demographic as well as a detailed health history and information about current health. The modifications included gathering information on the use of alternative therapies, herbs, and food/dietary supplements. Individuals report demographic data, the frequency of common respiratory and immune-related illnesses (e.g. dermatological, allergic) during the preceding two-month period at baseline with subsequent administrations using only the intervening one-month periods, as well as any family history of more severe immunological disorders (including asthma, autoimmune and neoplastic conditions (Kang et al., 1991; Strauman et al., 1993).

### *Functional independence measure (FIM)*

A FIM score was determined for each subject. The FIM is a widely-used standardized assessment tool designed to measure the functional abilities of individuals in six areas of self-care, including, grooming, bathing, dressing, toileting, bowel and bladder management, mobility, locomotion, communication, and social cognition. Levels of functional independence measurement include (1) total assistance, (2) maximum assistance, (3) moderate assistance, (4) minimum assistance, (5) supervision; (6) modified independence and (7) complete independence. Levels 1–5 require the assistance of a helper whereas level 6 and 7 do not require the assistance of a helper (Deutsch et al., 1996; Ota et al., 1996; Watson et al., 1995).

### *Profile of mood states (POMS)*

The POMS is a reliable and valid self-administered survey that is designed to measure individuals' transient, fluctuating affective states. It uses an inventory of 65 adjectives; each rated on a five-point scale, which measures six identifiable moods. The participant is asked to read each adjective and rate how often he or she has been feeling that mood over the past week with 0 = not at all, and 4 = always. The moods or affective states include anger-hostility, vigor-activity, fatigue-inertia, confusion-bewilderment, tension-anxiety, and depression-dejection (McNair et al., 1992).

### *Blood collection and cell preparation*

Ten ml of blood were drawn by venipuncture into a heparinized vacutainer tube for functional immune assays and 5 ml into vacutainer tubes containing EDTA for complete blood count (CBC) analysis and phenotypic analysis of lymphocyte subsets. A medical center clinical laboratory (Columbus, OH) performed the CBC analysis. All cellular assays were conducted on the day of sampling. Plasma extracts were frozen at −70°C until the day of assay for cortisol and cAMP assays. Peripheral blood mononuclear cells (PBMC) were isolated by centrifugation over Histopaque-1077. PBMC were washed twice in calcium- and magnesium-free Dulbecco's phosphate buffered saline (DPBS) and resuspended in Iscoves's modified Dulbecco's medium (IMDM) supplemented with 5% heat-inactivated fetal bovine serum, 1% GMS-S, and, 1% antibiotic/antimycotic solution (IMDM-C).

### *Lymphocyte proliferation*

Mitogen-stimulated peripheral blood lymphocyte (PBL) activity was assessed via a colormetric assay that determines the number of viable proliferating cells and results in data comparable with those obtained through

radioactive isotope incorporation procedures. Proliferative responses to phytohemagglutinin (PHA) were analyzed. PBMC ($1 \times 10^5$/ml) were cultured in quadruplicate in 96-well flat-bottom microtiter plates (200 μl total volume/well), in the presence of PHA at (2 doses of 25 μg/ml and 50 μg/ml) at 37°C/5% $CO_2$ for a total of 96 hours. At 24 h, 20 μl of a colormetric oxidation-reduction (RedoxA) indicator, AlmarBlue dye was added to each well. At 96 h, the cells absorbance was measured at 570 nm and 600 nm on a microplate. The mean specific absorbance OD of triplicates of respective groups was calculated. This assay indicates the amount of *t*-cell proliferation after stimulation that a population of *t*-cells is able to induce. The higher the proliferation the more effective the *t*-cells are against a pathogen.

### *Phenotypic analysis of lymphocyte subsets*

EDTA-treated whole blood (100 μl) was stained with 20 μl of the following fluorescein isothiocyanate (FITC) or phycoerythrin (PE) labeled antibodies in pairs: CD3-FITC/CD19-PE, CD4-FITC/CD8-PE, CD16-FITC/CD56-PE, and Pan gamma/delta-FITC/CD25-PE, along with the appropriate isotype controls. Samples were incubated for 15 minutes at room temperature in the dark. Lyse and Fix IO Test reagents were used to prepare the whole blood samples for flow cytometry. Percentages of cell subsets were enumerated within 1–3 days on a Coulter EPICS XL Flow Cytometry System (OSU Medical Center, Columbus, OH). Phenotypic analysis provides information regarding the number of different cell populations of lymphocytes that are present in the peripheral blood.

### *Plasma adenosine 3',5'-monophosphate (cAMP)*

Plasma cyclic AMP was quantified using a standardized radioimmunoassay (RIA). Cyclic AMP levels were determined by extrapolation from a standard curve of count bound cAMP in counts per minute/total counts per minute vs cAMP concentration (log scale in nmol/min). Radioactivity was measured using an Isoflex automated gamma counter. Cyclic AMP is believed to indicate the level of sympathetic nervous system activation occurring. Higher levels are indicative of greater sympathetic nervous system activation.

### *Cortisol*

Plasma levels of cortisol were measured by a standardized human cortisol enzyme-linked immunoassay (ELIZA). Absorbance was read at 450 nm, using a microplate reader. Cortisol levels were determined by extrapolation from a standard curve of absorbance vs cortisol concentration

reported in μg/dl. Cortisol is an indication of how much sympathetic nervous system reactivity is occurring.

### *sIL-2R Levels*

Plasma levels of sIL-2R were measured by the quantitative sandwich enzyme immunoassay technique. Optical density was read at 450 nm and 540 nm using a microplate reader and is reported in pg/ml concentrations. Higher levels of sIL-2R indicate that the immune system has recently been activated, one would expect low levels of sIL-2R in healthy adults.

### *Natural killer cell (NK) assay*

A whole blood chromium-release assay against K562 target cells (established from a patient with chronic myelogenous leukemia) is used. Briefly, $2 \times 10^6$ K562 cells are incubated with 100 μCi sodium chromate ($^{51}Cr$) at 37°C for 2 hours, washed twice with RPMI, and resuspended at a final concentration of $2 \times 10^6$ cells/ml in RPMI. Fifty microliters of target cells and 150 μl of effector cells are added in quadruplicate to a 96-well round-bottom microtiter plate. The concentration of effector cells (PBMC) is varied to produce four effector:target ratios (12.5, 25, 50, and 100:1). Spontaneous and maximal release is determined by incubating 50 μl of target cells with 150 μl RPMI or 5% triton-x, respectively. Plates are then centrifuged to create a buffy coat layer of leukocytes and target cells on top of the red blood cells. The plate is incubated for 4 h at 37°C in a humidified 5% $CO_2$ incubator. Plates are then centrifuged again and 10-μl aliquots of the supernatants are collected. The released $^{51}Cr$ was quantified using a gamma counter (TiterTek, Austin, TX). Lysis of target cells at each of the four ratios is calculated using the following formula:

$$\frac{(\text{cpm} - b) \times \dfrac{V_t - (V_b \times \text{Hct})}{V_t} - (\text{SR} - b)}{(\text{MR} - b) - (\text{SR} - b)}$$

Natural killer cells (NK) are believed to be more sensitive to psychological pertubations and indicates that the cells are functional and that they should be able to contribute to the resistance to viral infections and react appropriately should cells become malignant.

### *Data analysis*

A statistical analysis software program (SPSS) was used for data analysis. A one-way analysis of variance (ANOVA) was used to determine whether

statistically significant differences existed between the control group and the experimental group on the functional, immunological, and psychological data. Results are reported with means, standard deviations, and the *f*-statistic. To compare the variables within the SCI experimental massage group between the three trials (baseline, post-massage, post no-treatment), a general linear model-repeated measures ANOVA was used for both the immune and psychological and clinical health data. To avoid problems with violations of sphericity the statistical significance of the resultant *F* ratios were evaluated based on degrees of freedom that were corrected according to the Huynh-Feldt epsilon.

## Massage procedure and specialized techniques

Each massage therapist was instructed in and demonstrated competence in wheelchair transfer techniques, the signs and symptoms of autonomic dysreflexia, and the placement of urinary collection bags. Therapists who elected to participate in this study were provided with a two-hour mandatory training session to ensure that each therapist would follow a similar procedure. While we attempted to provide a uniform massage protocol there was no attempt to alter the typical therapeutic massage session. This frequently would include communication between the client and therapist, requests by the client to focus more intensively on painful tissues (i.e., neck, back), the use or disuse of lubricants, and the use of greater or less pressure. Unscented lubricants were typically offered to reduce the friction and a medium to deep pressure was applied and adjusted to each individual's comfort level.

The 60-minute, massage was eclectic in design. It included aspects of Swedish, Trager, Polarity, Accupressure, and Craniosacral Therapy (Fritz, 1999; Tappan & Benjamin, 1997). Several types of strokes were used, including effleurage, petrissage, stretching, holding, stroking, rocking, and squeezing. The subjects transferred to a mat table, and were situated in a supine position, alternating to a prone position during the massage. The subjects received a full-body massage, regardless of their injury level. The full body massage included, head, neck, upper and lower extremities, and trunk. Abdominal massage was excluded from this study because of its unpredictable effect on the gastrointestinal tract motility. The intent of the massage session was to provide a relaxing and soothing experience. Consequently, the massage was conducted with reduced lighting and soothing music.

## Baseline session

The evening prior to the first session, subjects were contacted by phone and reminded to refrain from caffeine, nicotine, alcohol, or cold medications on

the morning of the massage appointment. Subjects were scheduled between 9 am and 11 am to control for circadian rhythm variations. Upon arrival at the clinic for the first session, the SCI subjects and a healthy control were asked to provide a blood sample and complete the FIM, POMS, and SIGH evaluations. The SCI participants then received their standardized 45 minute massage. Control subjects were debriefed and dismissed from the study.

### Massage therapy sessions

SCI subjects received massages three times per week for 60 minutes each session, for four consecutive weeks. Massage session time did not include dressing or transferring time. While the initial massage took place in the morning, each subsequent session occurred at a convenient time for the participant. The subjects were scheduled with either a licensed massage therapist or a student who was in the advanced stages of training (completing residence training). The principle investigator and the clinical massage instructor supervised the massage therapy sessions. To reduce the influence of a single individual's response to a specific massage practitioner, subjects were randomly assigned to a massage therapist. Massage therapists were rotated among the participants. The massage therapists were blind to the study's outcome measures.

## RESEARCH FINDINGS

### General immunological findings with individuals with spinal cord injuries

In comparing the individuals with SCI with the healthy controls, immunological data analysis provided us with a greater understanding of the differences which persist in individuals with SCI. Analysis of the SIGH identified that the SCI population experienced significantly more incidents of urinary tract infections, respiratory tract infections, and pressure ulcers, $F\ [1, 43] = 21.54$, $p = 0.001$, $F\ [1, 43] = 12.50$, $p = 0.001$, and $F\ [1, 43] = 13.52$, $p = 0.001$, respectively. Means and standard deviations are presented in Table 6.2. No other areas identified by the SIGH were significantly different between the SCI and control group. The spinal cord-injured participants had significantly lower FIM scores than the control group, $F\ [1, 43] = 13.43$, $p = 0.001$. The differences in FIM scores were due to difficulties with mobility in the community and decreased independence in activities of daily living.

Differences seen on the lymphocyte subsets included a significantly lower percentage of NK cells seen in the SCI groups compared with the controls, $F\ [1, 43] = 16.10$, $p \geq 0.001$; as well as a significantly lower percentage of

**Table 6.2** Immune changes over the course of the month-long massage period

| Measure | Baseline Mean (SD) | Post-massage Mean (SD) | *N* |
|---|---|---|---|
| % NK cells[a] | | | |
| Controls | 16.47 (1.23) | | 15 |
| Paraplegic | 15.35 (1.32)[b] | 19.62 (1.19) | 17 |
| Tetraplegic | 10.60 (1.52)[c] | 14.26 (1.07)[c] | 12 |
| % CD3+ T cells[a] | | | |
| Controls | 74.15 (0.90) | | 15 |
| Paraplegic | 76.49 (1.20)[b] | 82.49 (1.42) | 17 |
| Tetraplegic | 65.80 (0.70)[c] | 79.35 (0.85)[c] | 12 |
| % CD4+ T cells[a] | | | |
| Controls | 50.59 (1.24) | | 15 |
| Paraplegic | 40.70 (1.28)[b] | 45.31 (0.83) | 17 |
| Tetraplegic | 29.60 (0.94)[c] | 34.58 (0.75)[c] | 12 |
| % CD8+ T cells[a] | | | |
| Controls | 24.16 (1.04) | | 15 |
| Paraplegic | 26.80 (1.14) | 32.85 (0.82) | 17 |
| Tetraplegic | 22.61 (1.22) | 28.23 (1.01)[c] | 12 |
| Mean % WB NK cytotoxicity ± SEM (E:T ratio 10:1)[a] | | | |
| Controls | 70.54 (11.68) | | 15 |
| Paraplegic | 60.24 (9.22) | 70.53 (8.07) | 17 |
| Tetraplegic | 44.90 (7.37) | 58.45 (8.27) | 12 |
| Lymphocyte proliferation | | | |
| Controls | 0.2245 (0.03) | | 15 |
| Paraplegic | 0.1656 (0.04)[b] | 0.2190 (0.03)[a] | 17 |
| Tetraplegic | 0.1437 (0.03)[b] | 0.2258 (0.06)[a] | 12 |
| sIL-2R levels | | | |
| Controls | 654.33 (251.16) | | 15 |
| Paraplegic | 1428.82 (633.09)[b] | 1499.64 (875.57)[a] | 17 |
| Tetraplegic | 2090.08 (690.03)[c] | 1323.58 (509.61)[a c] | 12 |
| CAMP | | | |
| Controls | 624.67 (475.92) | | 15 |
| Paraplegic | 3037.07 (282.13)[b] | 1881.93 (697.48)[a] | 17 |
| Tetraplegic | 4005.92 (500.97)[b] | 1473.33 (626.49)[a] | 12 |
| Cortisol | | | |
| Controls | 9.34 (4.74) | | 15 |
| Paraplegic | 12.36 (3.12) | 8.91 (4.68)[a] | 17 |
| Tetraplegic | 13.62 (4.38)[b] | 11.17 (3.19)[a] | 12 |

[a]Baseline to post-massage condition significant at 0.001.
[b]Significantly different from controls $p \geq 0.01$.
[c]Significantly different from controls and/or paraplegic group $p \geq 0.01$. WB NK = (E:T ration at 10:1) whole blood natural killer.

CD4+ T-helper cells compared with controls, $F$ [1, 43] = 261.37, $p \geq 0.001$. A significantly higher percentage of CD3+ T-cells for the SCI groups compared with the control group $F$ [1, 43] = 5.37, $p = 0.027$. On the cellular immune measures taken at baseline, the SCI group showed a significantly

higher sIL-2R levels than the control group, $F$ [1, 43] = 19.65, $p \geq 0.001$. The SCI groups also displayed significantly higher levels of cortisol than controls, $F$ [1, 43] = 4.64, $p = 0.04$. Furthermore, the SCI groups had significantly higher levels of cAMP when compared with the controls $F$ [1, 43] = 47.18, $p \geq 0.001$, and significantly lower lymphocyte proliferation verses the controls $F$ [1, 43] = 24.48, $p \leq 0.001$. (Fig. 6.2).

The baseline NK assay showed that both paraplegic and tetraplegic subjects showed significantly lower cytotoxicity than the healthy controls, $F$ [2, 42] = 5.52, $p \leq 0.001$, at all four effector to target ratios. Post hoc analysis revealed that the tetraplegic group had significantly lower levels of cytotoxicity when compared with the individuals with paraplegia (Fig. 6.3).

## Comparison of tetraplegic subjects to paraplegic subjects following massage intervention

Here we analyzed the data for significant effects of the massage treatment condition between baseline, treatment and follow-up, as well as for differences between tetra- and paraplegia. The means and standard deviations

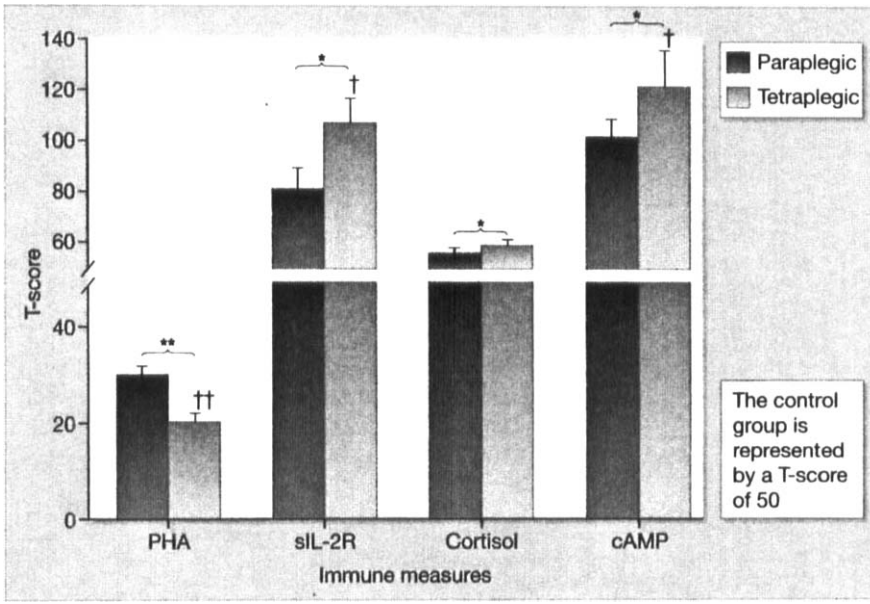


**Figure 6.2** Baseline comparison of tetra- and paraplegic participants across immune measures. The control group is represented by a score of 50, indicated by the horizontal bar. Individuals with SCI had significantly higher (*) cAMP, sIL-2R, cortisol levels, and significantly lower (**) levels of lymphocyte proliferation, when compared with healthy controls. Individuals with tetraplegia had significantly lower (††) lymphocyte proliferation, and higher (†) cAMP and (†) sIL-2R but not cortisol levels when compared with paraplegic participants.

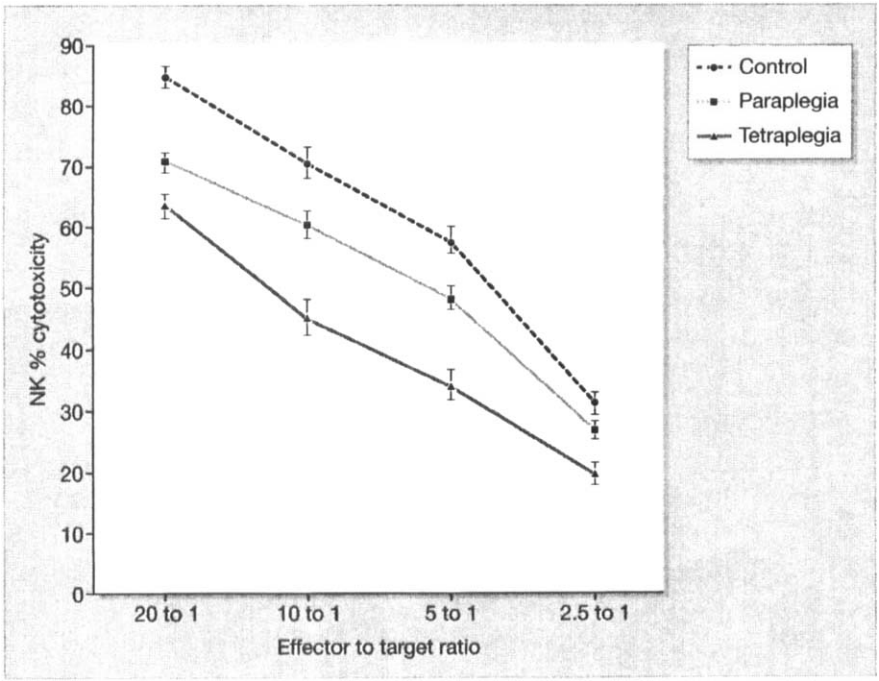


**Figure 6.3** Comparison of natural killer cell function in the baseline condition, at all four effector to target ratios, individuals with SCI in either the paraplegia or tetraplegic group are significantly lower than healthy controls.

for the immune measures at baseline and in the post-massage condition are displayed in Table 6.2. Changes identified on lymphocyte subsets included a significant increase in the percentage of NK cells seen following massage in the SCI group when compared with baseline, $F$ [1, 28] = 107.78, $p \geq 0.001$; as well as a significant increased percentage of CD4+ T-helper cells, $F$ [1, 28] = 85.54, $p \geq 0.001$, and CD3+ T-cells, $F$ [2, 30] = 25.76, $p \geq 0.001$. Tetraplegic participants were also significantly different than controls and paraplegics on CD8+ subsets, $F$ [1, 28] = 54.60, $p = 0.001$. Means for all the lymphocyte populations returned to baseline levels, yielding no significant differences by post hoc analysis between the post-treatment and baseline conditions.

The effects of the month-long intervention on cellular immune measures are presented in Figure 6.4. Cyclic AMP levels were significantly decreased after the month of massage and the no-treatment condition, $F$ [1, 28] = 48.55, $p = 0.001$, for both groups. Additionally, the tetraplegic subjects showed significantly different levels of cAMP at baseline and post-massage when compared with the paraplegic subjects. The levels of cAMP between post-massage and non-treatment were not significantly different,

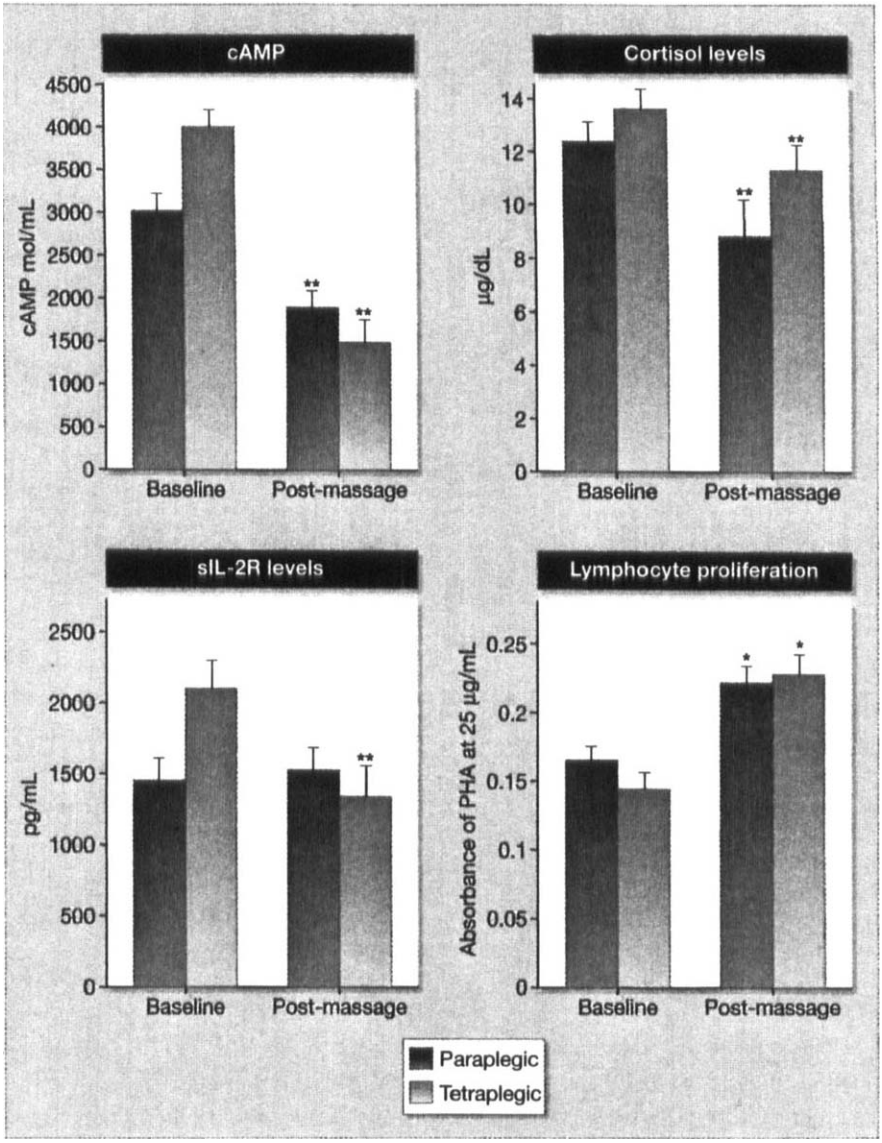


**Figure 6.4** Comparison of the SCI groups, paraplegic and tetraplegic participants at the post-massage time point. Both groups of SCI participants showed significantly lower (**) levels of cAMP and cortisol at the post-massage time point. Individuals with tetraplegia also showed a significant reduction (**) of sIL-2R levels that the paraplegic subjects did not show. Both groups also showed a significant improvement (*) of lymphocyte proliferation to PHA at the 25 µg/ml dose.

although the levels measured at non-treatment appeared to be returning to baseline levels.

SIL-2R levels show a significant decrease during the massage intervention for the tetraplegic but not the paraplegic subjects, $F$ [1, 28] = 10.55, $p$ = 0.003.

Panel C of Figure 6.4 displays the changes in blood cortisol level over the three samples. Cortisol levels decreased significantly from the baseline measure to the post treatment measure, $F$ [1, 28] = 11.96, $p$ = 0.002, of both subject groups. No differences were seen between groups at either condition. After the month of no treatment, cortisol levels were higher than both post-massage and baseline but not significantly so.

In panel D of Figure 6.4, lymphocyte proliferation to PHA at the 25 μg/ml dose increased significantly after the month of massage, $F$ [1, 28] = 33.18, $p \leq 0.001$, when compared with baseline. Again there were no differences between subject groups by condition. Post-hoc revealed no significant differences between proliferation levels from baseline and post-no treatment condition.

In Figure 6.5, panel B, shows the change in NK cytotoxicity following the massage protocol for both the paraplegic and tetraplegic subjects.

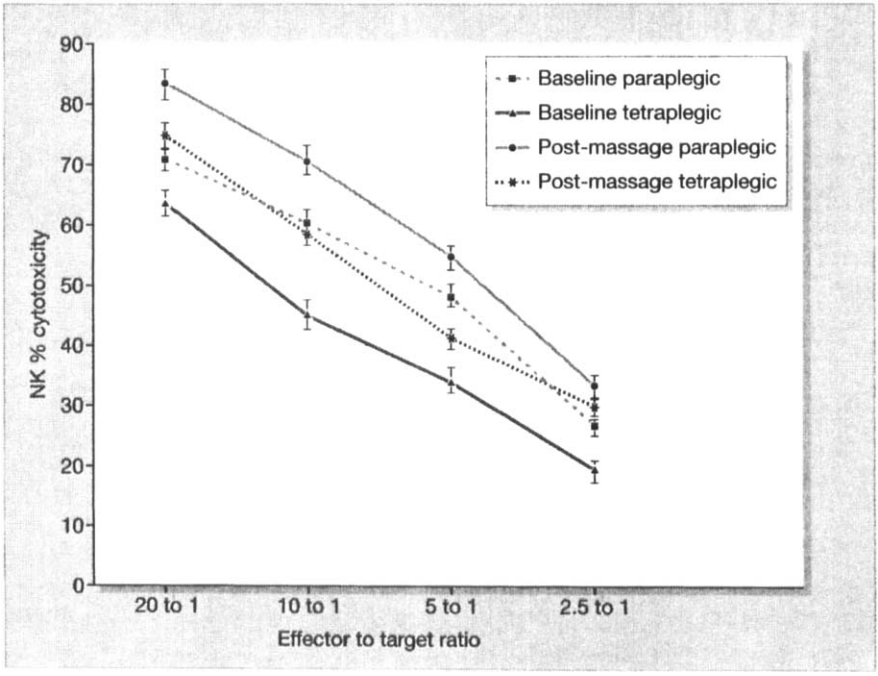


**Figure 6.5** Comparison of paraplegic or tetraplegic groups following the massage protocol also show a significant increase of cytotoxicity at all four effector to target ratios following massage.

There is a significant increase in cytotoxicity in both SCI groups following the massage intervention at all four effector to target ratios. There were no differences between the paraplegic or tetraplegic groups on the post-massage condition.

## Psychological profile and benefits of massage

The profile of mood states showed significant differences between the experimental and control groups on the axes of anger-hostility and vigor-activity. The SCI group had significantly lower anger-hostility scores with a mean 6.59 (s.d. = 2.62) compared with the control group with a mean of 11.73 (s.d. = 5.02), $F$ [1, 43] = 13.67, $p = 0.001$. Additionally, the SCI group had a higher vigor-activity score with a mean of 22.88 (s.d. = 3.22) while the control group had a mean of 18.80 (s.d. = 6.12), $F = 5.77$, $p = 0.023$ (Fig. 6.6).

In summary, the cellular immune responses and neuroendocrine functioning showed that the SCI participants displayed diminished proliferative responses to PHA, and higher soluble IL-2 receptor (sIL-2R) levels, plasma cortisol levels and plasma cAMP levels when compared with healthy controls (Fig. 6.3). Quantitative measures of T cells demonstrated differences in CD3+, CD4+, and NK cells (Table 6.2). Additionally NK cytotoxicity was significantly lower in the SCI participants. Furthermore, when SCI participants were divided into either paraplegic or tetraplegic groups, the individuals in the tetraplegic group were significantly lower on lymphocyte proliferation, NK cytotoxicity, sIL-2 and cAMP levels when compared with the paraplegic group (Figs 6.3 and 6.4). The massage protocol was associated with enhanced proliferative responses, diminished soluble IL-2 receptor (sIL-2R) levels, plasma cortisol levels and plasma cAMP levels.

## DISCUSSION

These results demonstrate that even fit, psychologically healthy, sports-active individuals with SCI have persistent alterations in immune function, which is consistent with other reports of cellular immune dysregulation following SCI (Campagnolo et al., 1999; Cruse et al., 1993, 1996a; Schmid et al., 1998; Wang, 1999). The elevations in cAMP and cortisol levels in the SCI group suggest chronic activation of sympathetic tone. Likewise the high levels of sIL-2R, cortisol, cAMP and low lymphocyte proliferation are consistent with chronic *t*-cell activation and sub-clinical illness (Nash, 2000), which the phenotypic analysis but not the hematology panels support. The SCI subjects had been screened to be otherwise healthy and at least based on self-report there was no overt evidence for higher levels of infectious illnesses during the preceding two months.

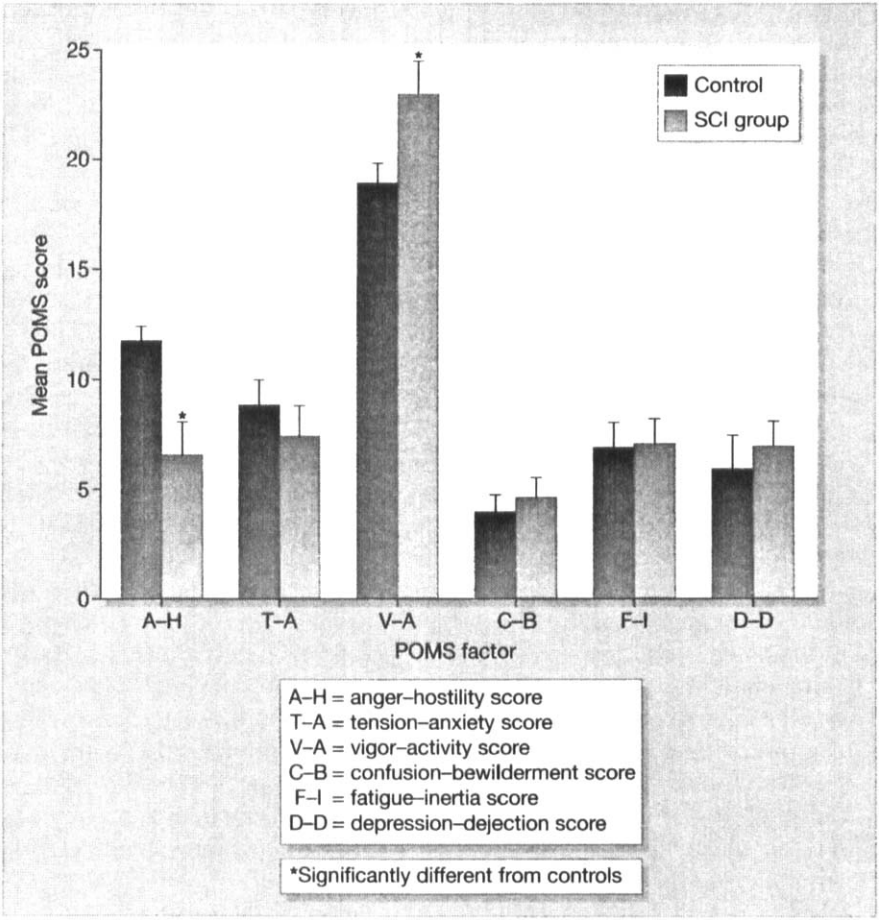


**Figure 6.6** Mean scores on the profile of mood states (POMS) (+SE) for controls and SCI group. Individuals with SCI scored significantly different (*) from healthy controls.

It is notable that the majority of the participants in this study were several years post-injury, suggesting that alterations in the immune profile can persist for long periods following the injury.

It is known that lymphocytes and monocytes will respond more poorly in vitro to interleukin and interferon stimulation, which may be associated with the increased cytokine activity in vivo (Esterling et al., 1996). Higher cortisol levels and dysregulation of immune function is routinely demonstrated in chronic stress conditions, supporting the notion that SCI can be equated to a chronic stress condition (Cruse et al., 1996a; Kliesch et al., 1996; Pariante et al., 1997). Disruption of the autonomic pathways and the subsequent loss of afferent signals from the peripheral sympathetic nervous

system to the central nervous system, as well as the additional burden of stress, could reduce the volume or intensity of immune signals to the central nervous system resulting in persistent immune alterations (Cruse et al., 2000). The immune alterations identified by this study represent multiple immune compartments; consequently this study supports the notion that SCI creates immune alterations by influencing the intensity and localization of immune responses versus influencing any specific immune component (Nash, 2000).

The psychological health of the SCI group is striking. Despite the group's spinal cord injuries, SCI subjects scored higher on vigor-activity and lower on anger-hostility than matched controls on the POMS (otherwise their scores were comparable). This contrasts with other studies that suggest that SCI increases vulnerability to depression which persists several years post-injury (Daverat et al., 1995). The key question remains: Are psychologically fit people with SCI more likely to participate in sports activity or does higher activity lead to psychological health in SCI? Since psychological health, fitness, and immune function are all inter-related it is difficult to tease out cause from effect (Cacioppo et al., 1998a; Glaser & Kiecolt-Glaser, 1997; Kiecolt-Glaser & Glaser, 1995). As expected, FIM scores were significantly lower than controls at baseline and levels of independence did not change throughout the study (Ditunno, 1997; Heinemann et al., 1995; Lu & Yarkony, 1996; Saboe et al., 1997). Likewise, the SIGH showed significantly higher incidences of urinary tract infection, respiratory tract infections and pressure ulcers at baseline. It is likely that the SIGH is not sufficiently sensitive to detect changes in health during or after the massage intervention because of the low incidence of illnesses in this unusually healthy group of SCI participants and the relatively brief treatment period.

Massage may be an effective tool to improve cellular immune responses in some individuals with chronic spinal cord injury, as is the case with HIV+ gay men (Ironson et al., 1996). Given that the massage protocol robustly improved the cellular immune responses in an unusually healthy sports active SCI population it would be important to study the effects on a more typical SCI population. Utilizing massage as a modality prior to purposeful activity or done by a massage therapist in conjunction with other therapies may decrease susceptibility to common illnesses associated with SCI. Massage may also lessen negative emotions, which can interfere with treatment. Massage may help to ready a patient for therapy, increasing his or her emotional and physical ability to participate fully.

Questions that must be answered before massage becomes standard therapy in SCI treatment include the required intensity and duration of treatment needed to produce a benefit and the cost-effectiveness of this treatment. Unfortunately, the immunological benefits of massage appear

to be short-lived, with most gains reversed four weeks following the cessation of treatment.

Informal reports from the participants showed excitement over the individual benefits massage had for them during the course of this study. SCI participants began to spontaneously offer reports of improvement during the course of the protocol. These comments, which can only be considered anecdotal, are none the less intriguing. Twelve subjects reported decreased pain at the level of injury and one subject reported being pain-free for the first time since his injury three years ago. Five participants noted an increased feeling of circulation in their legs, which was confirmed by therapist reports of increased warmth and color in the lower extremities of these subjects. Three patients noted that their range of sensation had broadened, seven reported less spasticity, and eight reported sleeping better as a result of reduced spasticity and/or pain. A more rigorous trial would be needed to confirm these findings and attribute them to massage as opposed to suggestion or placebo effects.

## Limitations

Because the SCI participants in these studies were all willing, highly motivated, sports-active individuals, it is difficult to generalize these results to the wider SCI population. However, the fact that these otherwise healthy and active individuals with SCI had immune dysfunction that resembled that of more typical SCI survivors, and that they responded to massage suggests that the general SCI population might show the same response. Because the design of this study did not include a group that received similar social and personal attention, one cannot exclude social support as the critical factor affecting immunologic change. Finally, this study did not explore the physiologic mechanisms that cause improved immunologic profiles nor was it demonstrated that massage actually led to improved function or decreased morbidity in SCI. These important questions await further large-scale investigations.

# CONCLUSIONS

One could predict the implications for improved health and wellness of individuals with SCI would be substantial, including shorter lengths of stay in rehabilitation programs or hospital settings, improved wound healing, fewer respiratory illnesses, fewer urinary tract infections, and a more swift transition to productive work. Research is critical in order to provide the evidential data needed to verify complementary rehabilitation modalities as a rational alternative to traditional rehabilitation medicine. Many treatment techniques theoretically foster a reduction in sympathetic

tone through their influence of the central nervous systems to allow for a greater impact of the specific treatment.

If one accepts this, then we should be able to see this change as a reduction in physiological reactivity and measure this change through physiological systems. Consequently, we should have a way to more directly evaluate central nervous system activity. Physiological measures have the potential to more directly measure underlying sympathetic tone, and are relatively noninvasive and easily measured. One of the ways to document the impact of rehabilitation is to have accurate ways for measuring the connection between nervous system activity and changes in physiological and psychological conditions. Development of immunological and physiological measures may guide therapeutic intervention and allow better prediction of which treatment modalities will be most effective in producing change. The findings of this project will provide us with information about how massage influences the health and wellness of a patient population frequently seen in rehabilitation.

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## INTRODUCTION TO SECTION 3

Developmental psychologists have established an extensive set of empirical studies demonstrating the physical, intellectual, personality, and social changes that occur as people develop from infancy through old age (Papalia & Olds, 1995). This 'cradle to grave' approach to development indicates that perhaps massage therapy will have different applications and different effects depending upon to which age group it is applied.

As usual, Tiffany Field at the Touch Research Institute has been a leader in the relevant research literature. Trained as a developmental psychologist, Field is keenly aware of developmental issues, and her studies have frequently focused on the use and impact of massage therapy for one age group or another (Field, 2000). For instance, Field has examined the effects of massage, or 'tactile-kinesthetic stimulation,' on preterm infants, on other high risk infants, such as cocaine-exposed and HIV-exposed infants, and on 'normal' infants. She has examined massage for labor in childbirth as well. In a fascinating study, she examined the impact of massage as an intervention for post-traumatic stress in children following Hurricane Andrew. In children and adolescents she has examined the utility of massage for other conditions, such as attention deficit hyperactivity disorder. In adolescents she has found beneficial effects of massage for clients with depression, and for teenagers with eating disorders such as anorexia and bulimia. In adults, she has examined massage therapy as a useful procedure for such populations as breast cancer patients and HIV positive adults. Finally, with the elderly, Field has found beneficial effects for elder volunteer lay massage therapists (mean age = 70) who gave massages to infants (Field, 2000). Clearly massage therapy is a procedure which has beneficial effects across the lifespan, though how and why it is used changes as a person ages.

The following two chapters examine two 'endpoints' in the lifespan. Dieter and Emory examine touch therapy for preterm infants, reviewing much of Field's seminal work in the area. Remington examines hand massage as an intervention for the agitated elderly in nursing home residents with dementia. Using an easy to administer 10-minute (five minutes for each hand) massage, Remington finds a decrease in agitation in comparison to a control group. The author notes that agitation is a common problem in nursing homes, impacting between 64% and 93% of residents. Her work suggests that her intervention may be useful for other types of people with agitation problems, such as AIDS dementia and brain injury patients, but further research will need to examine these hypotheses in detail. Her work also makes an interesting comparison to calming music interventions, which also appear to reduce agitation. Future studies, using other outcome variables such as anxiety, depression, and cognitive efficacy

measures, may point to differences in efficacy in the two types of treatments that were not apparent in the present study.

Since studies indicate that people over age 85 are one of the fastest growing demographics in the United States (Papalia & Olds, 1995), there will be an increase in demand for quality research on this age group. Much research indicates that many elderly are likely to suffer from chronic ailments, such as hypertension and diabetes (Taylor, 1999). Depression is also common among the elderly, and elderly men over the age of 85 have one of the highest rates of suicide (Papalia & Olds, 1995). While massage therapy is not a cure-all, already studies exist which show some positive effects for massage on glucose levels in children with diabetes (Field, 2000), and for mood in the elderly (Field, 2000). Some research indicates massage therapy may be useful for cardiac and hypertensive patients (Yates, 1999). Of course, future research should examine massage therapy for elderly populations in a systematic manner. Much anecdotal evidence from practicing clinicians suggests that effective techniques vary as clients and their bodies age. Theoretically techniques that are useful and appropriate with an adult population may be ineffective or dangerous with a pediatric or elderly population. Recent research on 'successful aging,' such as the seminal MacArthur Foundation Study of Aging in America (Rowe & Kahn, 1998), suggests that positive outcomes in late life are less determined by genetics, as was once believed, and are more influenced by lifestyle decisions regarding diet, exercise, intellectual stimulation, and social interaction. Perhaps massage therapy can become a standard component of the health intervention arsenal for the elderly. Certainly, studies with adults indicate massage therapy increases positive mood and boosts cognitive ability at least temporarily. And massage therapy is by nature a social interaction, an interaction many lonely widows and widowers lack. Future researchers and funders would be wise to consider the importance of quality research with this growing and understudied population.

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# 7

# Supplemental tactile and kinesthetic stimulation for preterm infants

*John N. I. Dieter, Eugene K. Emory*



## THE PROBLEM OF PREMATURITY

### Prevalence and etiology

A normal course of pregnancy lasts approximately 40 weeks. Between 5% and 15% of all live births in the United States are premature (Wittenberg, 1990). Preterm deliveries are disproportionately represented among African American women. Almost 20% of all live births delivered by Black women are premature, whereas less than 9% of live White births are preterm (CDC, 1992). Furthermore, African American neonates account for 31% of all preterm infant deaths.

The etiology of prematurity is not well understood. The contributors to preterm birth are multifarious and include: fetal abnormalities, maternal illness, the mother being very young, a short interval between pregnancies, multiple births, low socioeconomic status, parental education level, maternal cigarette smoking, alcohol and illicit drug use, and number of previous pregnancies (Goldberg & Divitto, 1983; Siegel et al., 1982). In addition, Levin & DeFrank (1988) suggested that poor prenatal care and stressful life events contribute to the over representation of preterm deliveries among African American and minority women. Despite such factors, there is no readily apparent cause for 50% of premature births (Wittenberg, 1990).

## The impact of prematurity on development

Modern neonatology, particularly the development of the neonatal intensive care unit (NICU), has substantially increased the survival rate of preterm infants. For infants whose gestational age is 25 weeks or more, the survival rate is between 15% and 66% (Hack & Fanaroff, 1989). The prognosis remains very poor if the infant's length of gestation is less than 24 weeks or the birthweight is less than 600 grams. Furthermore, these infants exhibit the most severe medical complications and developmental deficits (Pettett, 1986).

Over the last half century, numerous studies report that prematurity can be associated with substantial developmental impairment. Early postnatal difficulties include problems with autonomic nervous system control, behavioral state organization, and attentional regulation (Als, 1986; Doussard-Rossevelt et al., 1996). At 40 weeks post-conception, approximately 15% of preterm infants, across various gestational ages and birthweights, exhibit abnormal neurologic, motor, and cognitive functioning (Aylward et al., 1987). A wide range of long-term problems have been documented and include: delays in cross-modal transformations and auditory and visual deficits (Friedman et al., 1981; Herrgard et al., 1995; Luoma et al., 1998; Parmelee, 1985; Rose et al., 1978); motoric problems such as abnormal reflexes (Howard et al., 1976; Modanlou, 1988), hypotonia, and inferior grasping and hand use (Gorga et al., 1985, 1991; Prechtl et al., 1979; Touwen et al., 1988); cognitive deficits such as lower IQs, language and reading difficulties, and academic underachievement (Caputo & Mandell, 1970; Cohen et al., 1986; Francis-Williams & Davis, 1974; Kok et al., 1998; Lane et al., 1994; Wright, 1971), as well as emotional and behavioral problems such as hyperactivity and internalizing disorders (Chapieski & Evankovich, 1997; Rose et al., 1992; Schothorst & van Engeland, 1996). Understanding the etiology of these developmental problems has proved difficult. In many investigations, preterm infants with varying gestational ages, birthweights, and medical complications have been treated as a homogeneous group. Even when these variables are considered, it is difficult to determine to what degree factors such as the early extrauterine environment (e.g., the NICU), and subsequent family and socioeconomic factors, contribute to later developmental deficits.

## Preterm infant supplemental stimulation

In an effort to compensate for environmental deprivation, or to accelerate development, researchers have provided preterm infants with various forms of supplemental stimulation. Intervention is usually directed towards only one or two of the infant's sensory systems. The major types of stimulation have included tactile (e.g., extra holding, passive touch, gentle stroking,

rubbing), vestibular (e.g., spinning hammocks, rockerbeds, oscillating waterbeds), kinesthetic (i.e., passive limb movements), oral (i.e., pacifiers), and auditory (e.g., recorded heartbeat, intrauterine sounds, music, maternal speech). Supplemental stimulation is generally provided several times per day, for a period or days or weeks, while the preterm infant resides in the hospital.

Although the impact that supplemental stimulation has upon long-term development has been questioned (Ferry, 1981; Russman, 1986), the interventions do produce immediate and short-term benefits that include: decreased apnea, more stable behavioral state organization, increased weight gain, a decrease in abnormal reflexes, and enhanced sensory and motor performance on neurobehavioral assessments (Dieter & Emory, 1997; Field, 1980; Field, 1988; Harrison, 1985; Schaefer et al., 1980). Furthermore, supplemental stimulation has recently been shown to affect the biochemistry of preterm infants through increases in urinary excretion of noradrenaline (norepinephrine) and adrenaline (epinephrine), reductions in plasma cortisol levels, and increases in bone width, mineral density, and content (Acolet et al., 1993; Kuhn et al., 1991; Moyer-Mileur et al., 1995). A practical benefit reported by Field and her colleagues is that tactile/kinesthetic stimulation leads to earlier hospital discharge and a substantial reduction in hospital cost (Scafidi et al., 1986). Finally, supplemental stimulation of preterm infants is a salient research avenue for furthering our knowledge of the relationship between human brain plasticity and the impact of the environment on early development (Dieter & Emory, 1997).

## PRETERM INFANT TACTILE AND KINESTHETIC STIMULATION

### Historical perspective and the concept of maternal deprivation

It was only with the invention of the incubator, in the early part of the last century, that it became possible to save preterm infants from death by hypothermia. Prior to the 1960s, it was generally believed that preterm infants were too fragile to sustain any but minimal forms of handling (Korner, 1990). Findings from both animal studies and examinations of institutionalized children suggested that a more serious threat to preterm infants might be that their early environment is sensory deprived. Furthermore, it was this belief that precipitated the early supplemental stimulation studies (e.g., Hasselmeyer, 1964; Neal, 1968).

The argument that tactile supplemental stimulation is essential to development lies in the concept of 'maternal deprivation'. Both Ribble (1944) and Spitz (1945) found that children who were reared in orphanages, or were

separated from their mothers during infancy, demonstrated profound developmental and emotional retardation that Spitz labeled 'hospitalism'. This notion of maternal deprivation contributing to developmental problems and psychopathology was widely adopted and took on near mystical nuances, especially by psychoanalytic and object relational thinkers.

The idea of providing preterm infants with supplemental tactile stimulation was borrowed from research on institutionalized full-term neonates conducted by White et al. (1964). From the sixth to the 30th day of life, nurses administered up to 20 minutes of extra holding per day. Although the treatment had little effect upon growth or health parameters, extra holding appeared to soothe the infants and facilitate visual exploration. The benefits reported were interpreted as arising from supplemented 'maternal contact'.

From research with animals, the work of Levine (1958), Harlow (1958), and to a lesser extent, Mason (1968) has been offered as support that the preterm infant's early environment is maternally deprived and might be enhanced by extra handling or rocking. More recently, a group of rodent studies undertaken by Schanberg and his colleagues attempted to reconfirm that sensory deprivation is harmful to the human preterm neonate (Pauk et al., 1986; Schanberg et al., 1984; Schanberg & Field, 1987). Furthermore, these authors concluded that the specific absence of maternal contact is the pernicious agent as demonstrated in rats by reductions in ornithine decarboxylase (ODC — a primary growth hormone and sensitive index of tissue growth and differentiation). ODC reductions, which are normally corrected by the dame rat licking her pup, were elevated through supplemental tactile stimulation (i.e., stroking the pup with a brush whose texture was similar to that of the mother's tongue). Field (1988) accepted this finding as supporting the use of massage for stimulating human preterm infants.

## Research findings

### *'Touch Therapy' for preterm infants*

Varieties of techniques have been developed to provide supplemental tactile and kinesthetic stimulation to hospitalized preterms. Most protocols reflect minor derivations of the method introduced by White & Labarba (1976). Tactile (rubbing and/or stroking) and kinesthetic (flexing and extending the limbs) stimulation are administered sequentially during a session and the procedural sequence is often quite precise. Other researchers have relied upon less intense forms of tactile stimulation such as gentle strokes (Adamson-Macedo et al., 1994) or passive touch. Passive or 'gentle human touch' (GHT) consists of laying hands upon the infant's head, lower back, and buttocks for 10 or 15 minutes at a time (Harrison et al., 1996).

The most standardized approach for massaging preterms has been developed and investigated over a number of studies by Field and her colleagues (Field et al., 1986). Sessions of tactile/kinesthetic stimulation (T/K) are provided for three 15-minute periods per day, five days per week. The first treatment occurs about one hour after the morning feeding, the second about one-half hour after the mid-day feeding, and the third approximately 45 minutes after the completion of the second period. Each treatment session consists of five minutes of tactile stimulation [i.e., six 10-second strokes to the head, shoulders, back (no contact with the spine), arms, and legs], followed by five minutes of kinesthetic stimulation (i.e., six 10-second passive extensions/flexions of each arm and leg, followed by six extensions/flexions for both legs simultaneously), and concluding with another five-minute period of tactile stimulation.

### *The effect of T/K stimulation on the behavior and state regulation of preterm infants*

There has been some debate between researchers who study tactile stimulation over how disruptive it is to the preterm neonate. This debate is complicated since the forms of tactile stimulation provided to preterm infants have differed across studies.

Early tactile stimulation studies focused on stroking and rubbing. Although they failed to include formal state analysis, there was evidence that intervention led to heightened alertness and increased activity. Using a procedure that consisted of nonrhythmic massage of the neck, back, and arms for five minutes each hour of the day for ten days, Solkoff et al. (1969) found that stimulated low birth weight (LBW) infants were more often awake and moving than controls. Solkoff & Matuszak (1975) reported that participants who received ten days of stroking were more alert and changed state more often during the Brazelton neonatal examination (Brazelton, 1973). Adamson-Mecedo (1986) found that providing cephalacaudal massage to sleeping very low birth weight preterms produced a state change that ranged from drowsy to alert and led to some behavioral disorganization. Subsequently, she became a vocal advocate against rubbing preterms and now limits her intervention to a procedure of gentle strokes she calls TAC-TIC (Adamson-Macedo & Alves-Attree, 1994).

Recent studies suggest that tactile stimulation is quite safe for preterm infants. Acolet et al. (1993) found that massage was well tolerated by extremely low birth weight preterms (e.g., 630 g) once they were medically stable. Adamson-Mecedo and her associates (1994) found that gentle strokes failed to disturb oxygen tension in high-risk preterm infants. Harrison et al. (1996) found that during GHT, newly born preterm infants exhibited significantly less active sleep, motor activity, and behavioral distress.

Regardless of recent findings, tactile and kinesthetic stimulation have not been widely adopted on NICUs. This reflects a 'minimal touch' policy that still is maintained by many neonatologists and NICU staff (Morrow et al., 1991). This view arose from a frequently cited study conducted by Long et al. (1980) whereby procedures such as feedings, diaper changes, and examinations were sometimes associated with significant decreases in transcutaneous oxygen saturation. The widespread acceptance of these findings has hindered the introduction of procedures that are beyond standard nursery care.

To date, only Scafidi et al. (1986, 1990) and Dieter (1999) have undertaken comprehensive behavioral analyses of the effects of tactile and kinesthetic stimulation on preterms across the ten-day treatment period. Behavioral analyses used Thoman's (1975) criteria to define seven state categories: Quiet Sleep, Active Sleep, REM Sleep, Drowsy, Quiet Alert, Active Alert, and Fussy/Crying. A number of motor behaviors were also recorded including: single and multiple limb movements, head-turns, gross body movement, startles, smiles, mouthing, facile grimaces, and clenched fists.

The Scafidi et al. (1986, 1990) studies found that during T/K, preterms became more active as evidenced by significant increases in multiple limb movements and facial expressions. Furthermore, kinesthetic stimulation produced significantly greater alertness and motor behavior than did tactile stimulation (Scafidi et al., 1986). At the conclusion of 10 treatment days, Scafidi et al. (1986) conducted a single 45-minute observation and found that infants who received T/K exhibited active alertness 14% of the time, while non-stimulated control infants failed to show the state. Although more active, T/K infants did not demonstrate a significant increase in crying. Furthermore, T/K infants did not exhibit significantly more stress behaviors (e.g., startles, facial grimaces, or clenched fists) than did control infants.

Utilizing a repeated-measures design, Dieter (1999) observed the influence of 10 days of T/K on behavioral state on 15 preterm infants (mean gestational age 30.1 weeks; mean birthweight 1359 g; mean assignment weight 1655.1 g) residing in an intermediate care NICU nursery and compared findings against those obtained from 15 controls (mean gestational age 31.1 weeks; mean birthweight 1421 g; mean assignment weight 1621.2 g). Infants were medically stable at time of assignment and were no longer receiving gavage feeds. Table 7.1 provides the demographic variables and medical history for the two groups.

The effects of T/K during actual stimulation were similar to those reported by Scafidi et al. (1986, 1990). In comparison to baseline, T/K increased the amount of time that infants spent in Active Sleep (i.e., sleep with movement) and decreased the amount of time spent in Quiet Sleep (i.e., sleep without movement) (Table 7.2). In addition, during T/K infants

**Table 7.1** Means (and standard deviations) for the pre-assignment variables (Dieter, 1999)

| Measures | T/K | Control | *p* value |
|---|---|---|---|
| Maternal age | 26.9 (4.8) | 28.1 (5.6) | 0.52 |
| Parity | 2.0 (0.9) | 2.7 (1.6) | 0.23 |
| Gestational age (weeks) | 30.1 (2.5) | 31.1 (2.8) | 0.30 |
| Birthweight (grams) | 1359.3 (140.1) | 1421.5 (91.9) | 0.20 |
| Ponderal index[a] | 2.1 (0.3) | 2.2 (0.3) | 0.30 |
| Apgar 1 minute | 6.7 (1.7) | 7.4 (1.3) | 0.20 |
| Apgar 5 minutes | 8.1 (0.8) | 8.4 (0.6) | 0.36 |
| Obstetric complications[b] | 68.7 (14.7) | 70.7 (9.9) | 0.67 |
| Postnatal complications[b] | 75.1 (6.6) | 74.9 (5.3) | 0.93 |
| NICU days | 20.4 (12.3) | 18.9 (12.2) | 0.74 |
| Days $O_2$ therapy | 2.8 (1.6) | 3.5 (1.7) | 0.23 |
| Days-to-gavage feeds | 1.9 (1.5) | 2.3 (0.8) | 0.39 |
| Days antibiotics | 4.2 (1.0) | 4.5 (1.8) | 0.52 |
| Days phototherapy | 3.7 (1.4) | 4.4 (1.1) | 0.13 |
| Days since birth | 25.6 (11.7) | 22.0 (5.8) | 0.29 |
| Assignment weight | 1655.1 (89.9) | 1621.2 (54.4) | 0.21 |
| Assignment head circumference (mm) | 30.0 (1.2) | 29.7 (1.1) | 0.52 |
| Pre-assignment weight gain (1 day, grams) | 29.9 (14.0) | 25.3 (11.9) | 0.21 |
| Pre-assignment formula intake (1 day, ml) | 225.7 (51.9) | 211.3 (34.0) | 0.36 |
| Pre-assignment ml/kg/d | 149.5 (30.6) | 135.2 (27.1) | 0.36 |
| Pre-assignment bowel movements (1 day, number) | 1.9 (0.9) | 2.0 (0.5) | 0.63 |

[a]Ponderal Index = birthweight/length$^3$ × 100.
[b]Higher score is optimal.

showed an increase in the amount of multiple limb and gross body movements (Table 7.2). Contrary to the findings of Scafidi et al. (1986, 1990), kinesthetic stimulation was no more arousing than tactile stimulation. Of particular interest is that the immediate effects of T/K on behavior did not change significantly over the ten treatment days, suggesting that infants did not habituate to this form of supplemental stimulation. The theoretical implications of this finding are discussed below.

Dieter (1999) further examined the effects that ten days of T/K has on behavior during non-treatment periods in comparison to the control group. As shown in Table 7.3, there were no significant differences between the distribution of behavioral states across the two groups at assignment. Findings shed some light on the dose/response ratio with respect to the effects of T/K on the distribution of sleep/wake states. Following five days of treatment, T/K infants spent more time in the drowsy state (mean % time 16.8, SD 19.3) than did infants in the control group (mean % time 2.5, SD 3.8), $t$ (1, 30) = 2.91, $p < 0.01$. At the conclusion of ten treatment days, T/K infants were fully awake more often and spent significantly less time

**Table 7.2** Immediate impact of T/K on behavioral state and motor behavior (Dieter, 1999)

| | Mean % Time | | |
|---|---|---|---|
| Variable | Pre-T/K baseline | During T/K | *p* value |
| Quiet category[a] | 63.6 (15.1) | 48.5 (9.7) | $<0.01$ |
| Active category[b] | 26.7 (13.1) | 50.8 (9.9) | $<0.01$ |
| Quiet sleep[c] | 46.5 (20.7) | 32.0 (9.8) | $<0.05$ |
| Active sleep[d] | 13.3 (9.0) | 27.2 (10.2) | $<0.01$ |
| Multiple limb | 8.4 (5.3) | 12.7 (5.7) | $<0.05$ |
| Gross body | 7.9 (6.1) | 21.9 (9.9) | $<0.01$ |

[a]Consisting of the total % time spent in quiet sleep, drowsiness, and quiet alert.
[b]Consisting of the total % time spent in active sleep, active awake, and crying.
[c]Sleep without movement.
[d]Sleep with movement.

**Table 7.3** Between-group effects of T/K on behavioral state organization (Dieter, 1999)

| | Mean % time | | |
|---|---|---|---|
| Measures | T/K | Control | *p* value |
| Pre-assignment day | | | |
| Sleep[a] | 89.2 (17.0) | 90.4 (14.6) | 0.89 |
| Awake[a] | 4.7 (7.9) | 5.7 (10.6) | 0.79 |
| Day 10 | | | |
| Sleep | 53.0 (37.7 | 81.1 (34.5) | 0.04 |
| Awake | 15.2 (21.9) | 5.7 (9.2) | 0.25 |
| REM sleep | 9.8 (5.8) | 14.8 (7.9) | 0.05 |

[a]Summation of the sleep and awake categories will not equal 100% since state 4 (i.e., drowsy) is not included in either category.

in REM sleep (Table 7.3). That T/K appeared to reduce REM sleep is important since many studies have found greater amounts of REM in younger and sicker pre- and full-term infants (Dinges et al., 1980; Dittrichova et al., 1985; Emory & Mapp, 1988), therefore suggesting that T/K may foster better health and possibly neurobehavioral development.

In an effort to evaluate the degree to which T/K may affect behavior, Dieter (1999) examined T/K and control infants during mid-day bottle-feedings. Findings obtained on the fifth and tenth days of participation revealed that T/K infants spent less time in the Drowsy/Sleep state (T/K mean 33.1%, SD 22.29; Control mean 59.6%, SD 26.0; $p<0.05$) and more time in the Quiet Alert state (T/K mean 63.1%, SD 23.1; Control mean 39.1%,

SD 25.1; $p < 0.05$) than did control infants. However, there was no significant difference in the % time the two groups spent feeding. Because infants commonly scan and engage the environment during Quiet Alertness, the effects of T/K on bottle feeding may promote the infant-caregiver relationship and increase the opportunity for incidental learning. Future studies need to confirm this.

### *The effect of T/K stimulation on the physiological reactivity of preterm infants*

A few researchers studying tactile and kinesthetic stimulation have focused on physiological reactivity to assess the preterm infant. The immediate effects of stimulation have been examined through heart and respiration rate, and percentage of arterial oxygen saturation.

Tribotti (1990) found that during the first session, Gentle Human Touch (GHT) decreased arterial oxygen saturation and increased respiratory regularity in preterms whose gestational age ranged from 32 to 35 weeks. A second treatment session failed to disturb oxygen levels and continued to promote respiratory regularity. Using a systematized GHT protocol, Harrison found that passive touch had little influence on mean heart rate or oxygen saturation across the nine-day treatment period (Personal communication, L. Harrison, 1996). These findings suggest that GHT does not promote immediate physiological instability in very young preterm infants.

Several studies have examined the immediate physiological consequence of active tactile stimulation on preterm infants over the course of treatment. Kattwinkel et al. (1975) evaluated the effects of rubbing the extremities of six preterm infants for a total of 45 minutes per day from the second to the 35th post-natal day. Tactile stimulation reduced the occurrence of idiopathic apnea (i.e., the cessation of respiration longer than 15 seconds) by 35%. Oehler (1985) found no significant difference in heart rate response among 15 preterm infants following stroking; however, stroking did decrease transcutaneous oxygen saturation. Oehler concluded that active tactile stimulation might be too disruptive to preterm infants and might contribute to episodes of hypoxia. To the contrary, Morrow et al. (1991) found that T/K did not result in clinically significant decreases in transcutaneous oxygen tension when compared with a heel-stick procedure used for drawing blood from infants. Such contradictory findings may reflect more the clinical status of the preterms studied than any endemic dangers to tactile and kinesthetic stimulation. Dieter & Emory (1997) suggested that the effects a form of supplemental stimulation has upon the individual preterm should guide that infant's course of intervention. Adverse reactions to one form of simulation would herald the introduction of a less intense protocol. For instance, for preterms not tolerating T/K, GHT might be the appropriate first course of treatment.

Recent studies have shown that T/K does influence heart rate, but that the effects are safe for preterms residing in the grower nursery. Wheeden et al. (1993) found that preterms who received T/K exhibited significantly higher heart rates (i.e., T/K mean 158.8, Control mean 154.7), during non-stimulation periods, throughout the study. This finding suggests that the effects of T/K on physiological activity transcend the actual period of stimulation and further indicates that the benefits of stimulation may involve heightened arousal. A limitation of this study is that physiological data were obtained from daily nursing notes.

Dieter (1999) undertook a comprehensive examination of the effects of T/K on heart and respiration rate during both treatment and non-treatment periods. In comparison to baseline (mean 156.92 bpm, SD 7.05), T/K produced a significant increase in heart rate (mean 174.08 bpm, SD 9.57; $F$ [1, 2] = 81.98, $p < 0.01$). However, the effect was short-lived since there was no significant difference between the baseline and immediate post-stimulation periods (mean 163.06 bpm, SD 5.57). As was the case with behavior, the immediate effects of T/K on heart rate did not significantly diminish over the ten days of treatment and there was no difference between the tactile and kinesthetic phases. T/K was not found to have a significant effect on respiration rate.

While Dieter (1999) observed that the immediate effects of T/K were associated with a significant rise in heart rate, on average it represented only about a 10% increase and the mean heart rate during stimulation was far below the clinically significant level. Also found was that the mean heart and respiration rates exhibited during T/K were not significantly different that those observed during physical examinations and diaper changes. Thus, it is safe to conclude that T/K is no more stressful than standard nursery care, which is well tolerated by most preterms long before they reach the grower nursery. Contrary to the findings of Wheeden et al. (1993) no significant difference was found between the basal heart and respiration rates observed in T/K infants during non-stimulation periods when compared with the control group.

### *The effect of T/K stimulation on the biochemistry of preterm infants*

A few studies have examined biochemical variables assayed from preterm infant blood, urine, and saliva following stimulation. The aim of these investigations was directed towards determining if tactile and/or kinesthetic stimulation evokes or reduces stress responses and whether biochemical factors contribute to the observed weight gain and enhanced neurobehavioral performance.

In pilot work, Harrison (Personal communication, L. Harrison, 1996) found that nine days of GHT, provided for 15 minutes, three times per day, reduced salivary cortisol levels in three preterm infants. Since cortisol

is a hormone released by the hypothalamic-pituitary-adrenal (H-P-A) axis, often in response to stress (Hole, 1981), the conclusion drawn was that GHT comforts the preterm and enhances adaptation.

Cortisol assay studies of infants receiving Field's T/K protocol have yielded mixed results. Kuhn et al. (1991) found that preterms who received ten days of treatment exhibited no significant change in blood cortisol levels when compared with controls. In pilot work, Acolet et al. (1993) did observe that T/K caused a significant reduction in serum cortisol levels. Therefore, the question as to how T/K may affect cortisol remains unanswered. Future research should focus on repeated pre- and post-T/K measures across the treatment period. Determining the influence of T/K on cortisol has important theoretical implications. If cortisol levels consistently drop across treatment, this suggests that T/K's biochemical effect is predominately stress reducing, despite findings of heightened behavioral arousal and physiological reactivity. An immediate cortisol increase which then decreases over the treatment period would support the hypothesis that some of the benefits of T/K arise from adaptation to the challenges of stimulation.

Two of the above studies looked at additional biochemical variables. Acolet et al. (1993) found that T/K was associated with a significant reduction in levels of serum beta-endorphin. Lower endorphin levels were interpreted as further reflecting the infant's ability to better cope with stressful or painful events. While Kuhn et al. (1991) reported that T/K was associated with significant increases in urine noradrenaline (norepinephrine) and adrenaline (epinephrine), no change was found in the serum human growth hormone levels of treatment and control infants.

The Kuhn et al. (1991) interpretation that increases in the urine catecholamines noradrenaline (norepinephrine) and adrenaline (epinephrine) reflect maturation of the sympathetic nervous system requires further elaboration. These catecholamines are released by the adrenal medulla (Hole, 1981). In adults, concentrations of these catecholamines often increase in reaction to physical or psychological stress in order to initiate sympathetic nervous system responses such as elevated blood pressure and blood glucose levels. If T/K is contributing to nervous system maturation, it may be limited to the H-P-A axis since Kuhn et al. (1991) failed to show that T/K affected urine dopamine levels. Furthermore, the behavioral arousal observed in infants receiving T/K may be mediated by the mobilizing effects of catecholamines. If subsequent research finds that T/K does not affect cortisol, but leads to increases in these catecholamines, maturational effects may be primarily related to the adrenal branch of the H-P-A axis. In order to establish a comprehensive model explaining the benefits of T/K, it is imperative that future studies obtain multiple biochemical samples. The paramount question is to what degree, and in which directions, behavioral, physiological, and biochemical variables co-vary.

### *The effect of T/K stimulation on preterm infant weight gain*

As indicated, the most consistent benefit of T/K is the promotion of weight gain. At least seven investigations have demonstrated that treated preterms gained more weight than control infants over the ten-day stimulation period (Dieter, 1999; Field et al., 1986; Goldstein-Feber, 1997; Jinon, 1996; Scafidi et al., 1986, 1990; Wheeden et al., 1993). The average greater daily weight gains shown by T/K infants in these studies have ranged from 28% to 47%. That T/K promotes weight gain has great clinical significance, since once a preterm is medically stable, this variable determines when the infant is discharged. The faster a baby gains weight, the sooner it is released from the hospital. Indeed, both Field et al. (1986) and Scafidi et al. (1986, 1990) found that preterms receiving T/K left the hospital between five and six days earlier than control infants.

The question of how T/K promotes weight gain remains unanswered (Scafidi et al., 1990). Research has failed to support the most commonsensical explanations. For instance, studies have shown that infants receiving T/K do not consume more formula than control preterms (Field et al., 1986; Scafidi et al., 1986, 1990). Thus, the greater weight gain does not appear to be a function of increased caloric intake. Another discrepant finding discussed above is that preterms receiving T/K exhibit increased activity when compared with control infants. Intuitively, heightened activity might be expected to increase energy expenditure and lead to lesser weight gain (Scafidi et al., 1990).

The failure to find obvious reasons for explaining how T/K promotes weight gain has led researchers to propose hypotheses that entail a complex cascade of physiological and biochemical events. Field believes that T/K 'stimulates the vagus nerves which then triggers processes that aid digestion...' (Drummond, 1998). Others have suggested that vagal stimulation leads to an increase in growth hormones that then stimulate gastrointestinal growth, motor and secretory activity, and promote insulin release (Kuhn et al., 1991; Uvnas-Moberg et al., 1987).

Dieter (1999) also found that infants who received T/K showed a weight gain advantage. Across the 10 days of treatment, T/K infants gained an average of 334.6 grams (SD 48.2) and control infants 281.8 grams (SD 48.5), $F\ (1.28) = 7.12$, $p < 0.05$ (Fig. 7.1). Once again, no significant differences were observed between the amount of formula or kilocalories consumed across the two groups (Table 7.4). A previously unreported finding was that T/K infants showed a greater number of bowel movements per day than controls (Table 7.4). While possibly spurious, that T/K infants showed a greater number of bowel movements refutes the notion that the weight gain merely reflected fluid retention.

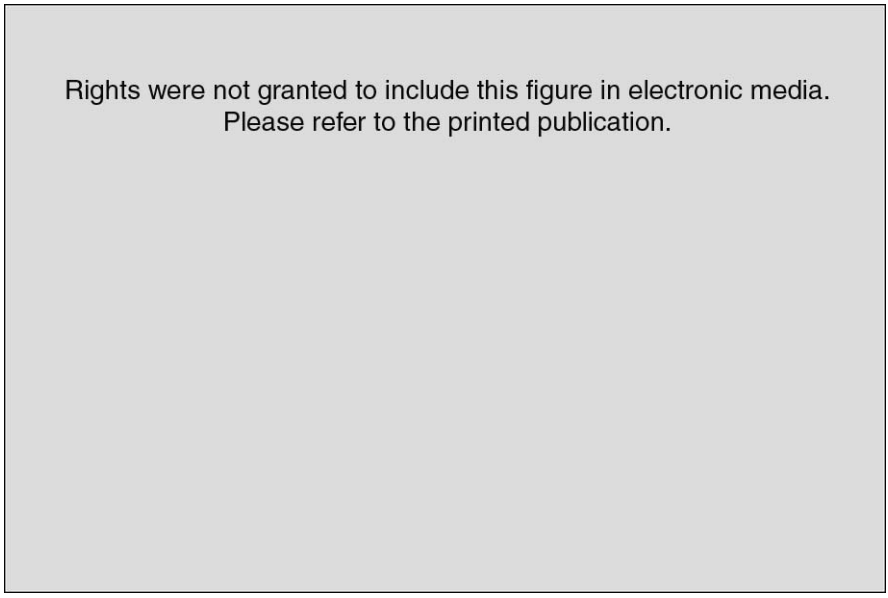


**Figure 7.1** Effect of 10 days of T/K on weight gain (Dieter, 1999).

**Table 7.4** Effects of T/K on daily weight gain and input/output variables (Dieter, 1999)

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### *The effect of tactile stimulation on preterm infant neurobehavioral maturation*

The majority of investigations support that tactile stimulation promotes global development as measured by neurobehavioral examinations. Active forms of touch, such as T/K, may be superior to passive forms (e.g., GHT).

Little formal research has evaluated the influence of GHT on development. From preliminary pilot work, Harrison et al. (1996) found no difference in performance on the Brazelton Neonatal Behavioral Assessment Scale (BNBAS) between infants who did or did not received GHT from the 7th to the 16th post-natal day.

Post-treatment findings, from the early active tactile stimulation studies, all showed that infants receiving massage exhibited behaviors indicative of

general maturation of the central nervous system (CNS). After examining participants who were discharged between six to nine months earlier, Solkoff et al. (1969) reported that each of the five stimulated preterms obtained scores on the Bayley Scales (Bayley, 1969) that indicated that they were 'active and physically healthy'. Contrarily, only one of the control infants was considered normal. The scores of the other four control infants were below the mean for their age on motor development; two were suspected of having cerebral palsy. Kramer et al. (1975) reported that at time of transfer from the incubator to the crib, healthy low birth weight preterms who received full body nonrhythmic stroking for 48 minutes per day for two weeks obtained significantly higher Bayley scores than control infants. Enhancement of motor development was also reported by Rice (1977). At four months, preterm infants who received 30 days of treatment exhibited fewer phylogenetic reflexes (i.e., those reflexes inherent at birth that indicate CNS immaturity) than controls.

Only Field and her colleagues have examined the effect of combined tactile and kinesthetic stimulation on neurobehavioral development (Field et al., 1986; Scafidi et al., 1986, 1990; Wheeden et al., 1993). While T/K has been shown to have a positive effect on development, statistically significant findings have varied somewhat across investigations.

At two days after the end of the ten-day treatment period, Scafidi et al. (1986) found that stimulated infants performed significantly better on the Lester Cluster Scales (Lester et al., 1982) of the BNBAS that measure habituation, orientation, motor behavior, and range of behavioral state. In their replicative effort, Scafidi et al. (1990) observed that treated preterms exhibited a superior performance only on the Habituation Scale. In their examination of cocaine-exposed preterms, Wheeden and her collaborators (1993) once again found that T/K infants exhibited superior motor maturity; additionally, these infants showed fewer stress behaviors than controls. In their one-year follow-up of the sample from the first study (i.e., Scafidi et al., 1986), Field et al. (1987) reported that T/K infants achieved a mean Bayley Mental Scale score of 101, while the mean score of the control group was 90. Treated preterm infants continued to exhibit superior motor performance (T/K motor scale mean 105, Control motor scale mean 90).

There may be several reasons for the inconsistent BNBAS findings across investigations. That there are seven separate BNBAS cluster scores, and that the sample sizes of T/K studies are relatively small (i.e., 15 to 20 participants per group), probably reduces the likelihood of obtaining statistically significant multivariate findings. In addition, it may be that the behaviors measured by the BNBAS are too complex, and therefore unlikely to consistently change with only 10 days of intervention, especially if there are no significant pre-treatment deficits. Perhaps the best test to what degree T/K improves BNBAS performance would be to examine a larger sample of preterms who clearly demonstrate improvised performance on the

pre-treatment exam and then compare subsequent post-treatment findings against a matched control group. Furthermore, more than ten days of stimulation may be required to consistently improve BNBAS performance.

## POSSIBLE MECHANISMS OF ACTION

### Increased physical activity for promoting weight gain

As detailed previously, the most consistent findings across studies of active tactile stimulation are increased movement and alertness, and greater weight gain. Scafidi et al. (1990) were the first to suggest a causal relationship between weight gain and the increased alertness and movement observed in T/K infants during stimulation and nonstimulation periods. Although such a relationship appears intuitively paradoxical, there are a small number of animal and human studies supporting a link between increased physical activity and weight gain.

In two animal studies from the 1970s, Borer observed that free access to horizontal disc exercisers induced weight gain in adult hamsters (Borer, 1974; Borer & Kooi, 1975). In comparison to sedentary hamsters, the exercising animals showed an upward displacement of weight, length, and percentage of body fat. The onset of weight gain was rapid, and initially was not accompanied by an increase in food intake. Furthermore, the weight gain advantage persisted for three months after the cessation of exercise. These findings are remarkably similar to those observed in human preterms who received T/K.

Borer & Kooi (1975) argued that exercise reset the hamsters' weight regulatory mechanisms. Because the exercising hamsters demonstrated both increased weight gain and body length, Borer (1974) suggested that the underlying mechanism might include a rise in the secretion of growth hormone by the pituitary. If there is a casual relationship between physical activity and the enhanced weight gain observed in human preterms receiving tactile or kinesthetic stimulation, it is unlikely that the mediator is human growth hormone (HGH) since Kuhn et al. (1991) failed to find changes in HGH levels in those infants who received T/K.

Increased activity has been shown to promote weight gain in humans. A recent study by Kardel & Kase (1998) demonstrated greater weight gain in pregnant women carrying girls who exercised during the late second and third trimesters. Exercise consisted of muscle strength training, interval training, and endurance training. Results indicated that the more intense the exercise regimen the greater was the maternal weight gain. Furthermore, the weight gain advantage was not accounted for by the weight of the infant at birth.

In a well-controlled study, Moyer-Mileur et al. (1995) examined the effects of physical activity on bone mineralization and weight gain in preterm

infants. The 'physical activity program' consisted of range of motion exercises and passive resistance to all extremities for 5 or 10 minutes a day for four weeks. This procedure appears comparable to the kinesthetic portion of T/K. Despite similar nutritional intake, treated preterms gained more weight than control infants (mean 17.8 vs 13.4 grams per day), and exhibited greater radial bone mass and density.

Moyer-Mileur et al. (1995) found that exercised preterms demonstrated lower serum levels of alkaline phosphatase (PTH). PTH plays an important role in calcium homeostasis by regulating the concentration of ionized calcium. Moyer-Mileur et al. reported that previous rodent studies found that exercising rats showed a positive calcium and phosphorous balance and an increase in skeletal mass. Furthermore, exercised rats did not eat more and did not differ from control rats in their urinary excretions of calcium and phosphorous. Similarly, the exercised human preterms did not differ from control infants in food intake, calcium intake, and urinary calcium output. The authors concluded that the increase in bone mineralization demonstrated by the exercise group might have resulted from enhanced metabolism, mediated by PTH, which promoted greater calcium absorption.

Dieter (1990) found mixed support that the weight gain advantage demonstrated by T/K infants is causally linked to the heightened physical activity observed during stimulation and non-stimulation periods. As predicted, infants did demonstrate a significant increase in active sleep, gross motor behavior, and heart rate during stimulation. However, no support was gained for the prediction that T/K infants would also show greater activity during non-stimulation observations. T/K infants were more often awake during non-treatment periods, but they were no more active than control infants and they did not demonstrate higher tonic heart and respiration rates. Finally, trend analyses failed to demonstrate any significant relationship between greater levels of physical activity and higher heart rates during stimulation and the weight gain advantage demonstrated by T/K infants. To the contrary, a significant linear relationship was found between the amount of time infants spent in the quiet alert state during T/K and the amount of weight they gained, $F\ (1, 13) = 5.07$, $p < 0.05$ (Fig. 7.2).

The above findings are preliminary and from a relatively small sample. Replication from a larger group is necessary and subjecting results to regression modeling vital. Because heightened physical arousal during T/K has been observed so consistently, it may be premature to dismiss it as a possible contributor to the weight gain advantage. Greater efforts should be dedicated to formulating the specific causal pathway between heightened physical activity and weight gain. The most obvious contender is the calcium absorption model proposed by Moyer-Mileur et al. (1995).

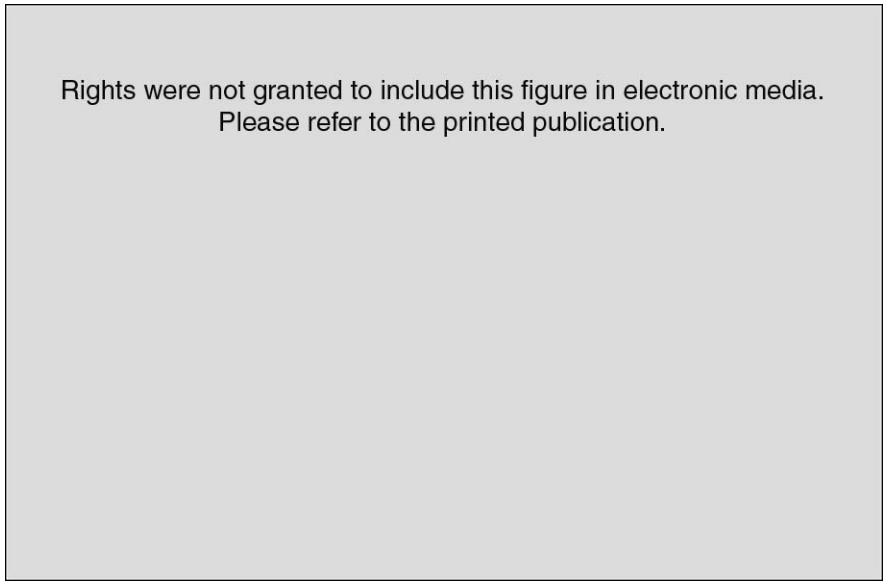


**Figure 7.2** Relationship between the % time infants were in the quiet alert state during T/K and weight gain (Dieter, 1999).

## Extra handling as a 'stress inoculator'

Since the early findings of Levine (1959, 1960) numerous animal studies show that supplemental stimulation or environmental enrichment accelerates development. The 'handling' paradigm has been widely applied in these investigations. Handling is a general term used to describe a variety of neonatal environmental alterations that are later found to modify adult animal behavior (Costela et al., 1993). Such studies usually consist of the experimenter separating the animal from its mother and literally holding it for a period of time. Subsequently, when handled young reach adulthood they are subjected to an environmental challenge, and their behavioral responses are compared with non-handled animals. Both animal groups are usually sacrificed and biochemical assays obtained. While most handling experiments study rats, other animals including mice and chickens have been examined (Cross & Labarba, 1978; Salvatierra et al., 1997).

The effects of handling on animal behavior appear far-reaching. Handled rats have been shown to demonstrate less fear in novel situations, greater exploratory behavior, shorter escape latencies from aversive stimuli, better performance during stressful challenges, lower emotional reactivity, greater weight gain, and even superior cognitive, learning, and memory performance in old age (Ader et al., 1968; Costela et al., 1993; Fernandez-Teruel

et al., 1991; Gonzalez et al., 1990; Levine & Mullins, 1966; Meaney et al., 1988; Rocha & Vendite, 1990).

Handling is usually conceptualized as a form of stress that includes maternal separation and confinement. Biochemical assays frequently focus upon stress hormones produced by the H-P-A axis. Many studies have shown that handled rats secrete less corticosterone in adulthood than do non-handled rats, exhibit permanent increases in hippocampal glucocorticoid receptors, and show lower levels of corticotropin-releasing factor (CRF) and plasma adrenocorticotropin (ACTH) following stressful challenges (Denenberg et al., 1967; Meaney et al., 1987, 1988, 1989; Plotsky & Meaney, 1993). The effects of handling on the nervous and endocrine systems do not appear to be limited to the H-P-A axis. A recent study of chicks found that handling was associated with increases in forebrain GABA receptor density that ranged from 17% to 47% and was accompanied by superior performance on a food discrimination task (Salvatierra et al., 1997).

Habituation is a common explanation for the effects of repeated handling on the endocrine system. Initial handling is usually accompanied by a heightened H-P-A response that then diminishes over repeated exposures. For instance, Dobrakovova and colleagues observed that initial exposure of rats to brief handling led to rapid rises in ACTH, epine-phrine (EPI) and norepinephrine (NE) (Dobrakovoa et al., 1993). While EPI and NE elevations quickly returned to baseline, ACTH remained elevated throughout the 15-minute observation period. However, repeated handling during the three-hour experiment virtually eliminated the endocrine response.

Essentially, handling is viewed as a 'stress inoculator' whereby both the behavioral and endocrine reactions of the animal are shaped and this attenuated response generalizes to other stressful situations. While it might be expected that any form of repeated stress would inoculate the animal, handling appears to possess a unique quality. When compared with other forms of stress, only handling seems to promote superior behavioral and endocrine adaptation. In an early study, Ader et al. (1968) compared handling with electric shock. Rats who were repeatedly handled demonstrated an attenuated corticosterone response while rats who were repeatedly shocked failed to show habituation. More recently, Plotsky & Meaney (1993) compared handling with maternal separation (MS) on a restraint test. As adults, handled rats demonstrated significantly lower CRF levels than either MS or non-handled rats. Furthermore, restraint stress produced significantly lower plasma corticosterone in handled rats than in either MS or non-handled rats. These findings suggest that the tactile component inherent to handling may be key to its benefits. As will be discussed later, recent animal studies have found that sensorial

qualities of touch, such as warmth and pressure, lower stress hormones and promote adaptation (Uvnas-Moberg, 1997).

That many of the immediate and subsequent effects of handling on animals are similar to those observed in human preterm infants receiving T/K are obvious. As reported above, studies have shown that infants demonstrate heightened behavioral and physiological arousal during T/K, but later exhibit greater weight gain, fewer stress signs, and superior performance on challenging neurobehavioral examinations. Therefore, procedures such as T/K may inoculate the infant against stress and promote general adaptation, presumably through their impact on the H-P-A axis. Crucial support for this model depends on how the preterm accommodates to tactile and kinesthetic stimulation over time.

Handling studies show that while animals initially exhibit both heightened behavioral and biochemical responses, repeated stimulation produces habituation and generalized adaptation. Scafidi et al. (1990) and Dieter (1999) found that preterms' behavioral reaction to T/K changed little over the 10 days. The few studies of the effects of T/K stimulation on the biochemistry of human preterms provide mixed support for the stress inoculation model. While Acolet et al. (1993) did observe that T/K caused a significant reduction in serum cortisol levels, Kuhn et al. (1991) reported that preterms who received 10 days of treatment exhibited no significant change in blood cortisol levels when compared with controls. Furthermore, Kuhn et al. found that post-treatment, T/K infants exhibited significantly higher epinephrine and norepinephrine levels than controls, a finding in direct contradiction to that observed in the animal model.

Dieter (1999) found little support for the stress inoculation model. As predicted, during T/K infants did show a significant rise in arousal as evidenced by increased heart rate and motor behavior. Contrary to the findings of animal studies, these behaviors did not diminish with repeated stimulation suggesting that the infants did not habituate to the arousing aspects of T/K. Furthermore, trend analysis failed to find any significant relationship between the arousal and few signs of stress demonstrated by infants during T/K and their weight gain advantage.

While Dieter (1999) failed to find behavioral support for the stress inoculation model, additional biochemical studies are needed to render a more definitive conclusion. In particular, the relationship between T/K and cortisol must be established. The two existing T/K studies have failed to demonstrate consistent results (Acolet et al., 1993; Kuhn et al., 1991). Biochemical support for the stress inoculation model would rest on two findings: T/K infants would initially show increased cortisol following stimulation which would diminish over time; when compared with controls, T/K infants would exhibit lower cortisol levels following stressful challenges.

## The vagus nerves as the bridge between the nervous and endocrine systems

In recent years, much has been said about the role of the vagus nerves in behavior. The vagus or 10th pair of cranial nerves is mixed, containing both sensory and motor efferents (Tortora & Anagnostakos, 1990). The vagus has the greatest proliferation of branches throughout the body than any of the other cranial nerves. The motor portion originates in the medulla and terminates in muscles of the respiratory passages, lungs, esophagus, heart, stomach, intestines, and gall balder. Parasympathetic fibers innervate the involuntary muscles and glands of the gastrointestinal (GI) tract.

Porges (1983, 1995) maintained that since the vagus nerves are involved in the bidirectional communication between the heart and the sympathetic and parasympathetic nervous systems, heart rate variability has value as 'a potential diagnostic window to the brain'. Porges (1985) has developed a time-series method to measure cardiac vagal tone (CVT) through the quantification of respiratory sinus arrhythmia (RSA) amplitude. RSA arises from naturally occurring increases and decreases in heart rate that are associated with inhalation and exhalation. CVT values reflect proportional increases and decreases in RSA amplitude.

CVT has been widely applied to infant research as a physiological index of development, stress, emotional reactivity, and attachment (Fox, 1989; Izard et al., 1991; Porter et al., 1988). These studies have shown that vagal tone is highly correlated with autonomic reactivity and that infants with high CVT are better at regulating emotional and attentional processes; furthermore, these babies perform better on intellectual assessments such as the Bayley scales (Fracasso et al., 1994).

Cardiac vagal tone has been assessed in preterm infants. Findings indicate that preterm infants commonly exhibit lower CVT in comparison to full-term cohorts (e.g., 4.72 in healthy preterms vs 5.75 in healthy full-terms at 40 weeks); furthermore, preterm infants with lower CVT have been shown to be at greater risk for subsequent developmental deficits (Fox & Porges, 1985), and exhibit less adaptive behaviors (e.g., exploratory play) (DiPietro et al., 1992).

Field & Schanberg (1995) were the first to observe increases in vagal tone during T/K. Studying a sub-sample of preterms, Dieter (1999) found that during T/K vagal tone rose significantly from baseline levels and remained elevated during the 15-minute post-treatment period (Pre-T/K mean 2.2, SD 0.4; T/K mean 2.9, SD 0.7; Post-T/K mean 2.4, SD 0.5; $F\,[2, 24] = 3.51$, $p = 0.05$). Furthermore, trend analysis yielded a significant quadratic relationship between vagal tone activity during T/K and weight gain during the first treatment week, $F\,(1, 6) = 20.69$, $p < 0.05$ (Fig. 7.3). As already presented, a significant linear relationship was also found between weight gain and time spent in quiet alertness (a state positively

correlated with higher CVT) during T/K. These findings preliminarily suggest that the promotion of weight gain may be best facilitated if some optimal range of vagal activity is achieved and maintained through the T/K session and the infant receives stimulation while in the quiet alert state. Gaining support for this hypothesis is possible by closely examining the relationship between behavioral state and CVT during T/K and the subsequent weight gain observed.

Uvnas-Moberg and colleagues proposed a vagal model of how tactile stimulation promotes weight gain (Uvnas-Moberg et al., 1987). They suggested that massage stimulates the activity of the vagus via peripheral afferent pathways. This heightened activity facilitates communication between the vagus and gastrointestinal (GI) tract through the efferent branch that terminates on, and is distributed across, the anterior and posterior surfaces of the stomach. Uvnas-Moberg et al. argued that vagal nerve parasympathetic activation stimulates the release of several peptide hormones including gastrin that then precipitates acid secretion and glucose-induced insulin release, the growth of the gastric mucosa, heightened GI functioning, and subsequent greater weight gain.

This vagal model can be elaborated upon by considering additional biochemical factors. Besides gastrin, insulin-like growth factor-I (IGF-I) is another peptide hormone that may be stimulated through heightened vagal activity. IGF-I has been implicated as mediating GI metabolism and

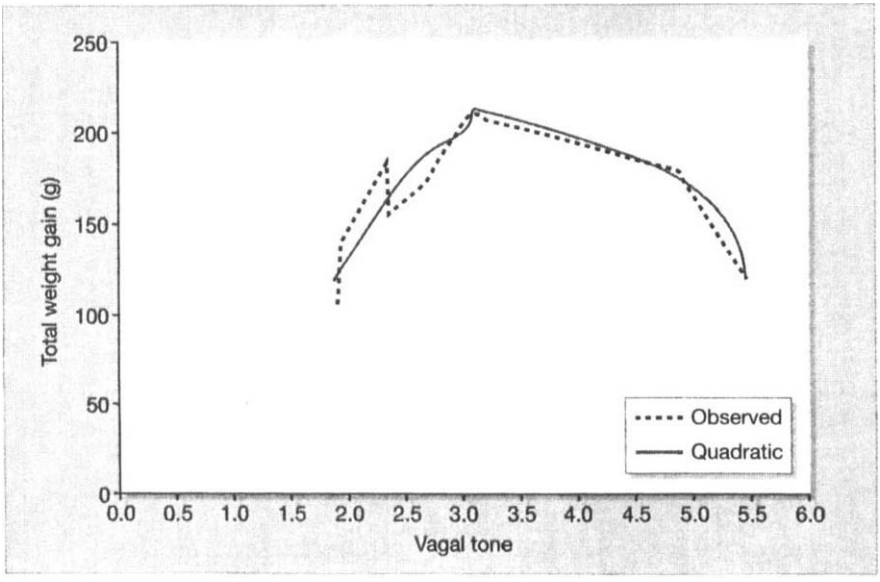


**Figure 7.3** Relationship between the vagal tone during T/K and weight gain (Dieter, 1999).

growth. In both full-term and preterm infants, IGF-I is strongly correlated with placental weight, birthweight, body length, Ponderal index, and nutritional factors (Bennett et al., 1983; Colonna et al., 1996; Osorio et al., 1996; Yamasaki et al., 1989). Of relevance to the Kuhn et al. (1991) T/K study (see earlier) is that a strong inverse relationship has been demonstrated between IGF-I and human growth hormone (HGH) (Colonna et al., 1996). This may be why Kuhn et al. failed to find HGH increases in massaged preterms.

Xu (1996) proposed that IGF-I plays a role in the growth, morphological changes, and functional maturation of the GI tract during the immediate postnatal period. Furthermore, a positive relationship has been observed between levels of IGF-I, nutrient intake, and subsequent weight gain, suggesting enhanced metabolism (Díaz Gómez et al., 1996; Giniès et al., 1992; Smith et al., 1997). Collectively, these findings suggest that IGF-I might be another factor mediating the greater weight gain observed in massaged preterms.

Another peptide hormone that may mediate the benefits of preterm infant massage is oxytocin. Findings indicate that oxytocin is present in the human fetal pituitary glands as early as 14 weeks, and increases 50-fold over gestation (Khan-Dawood & Dawood, 1984). There is a significant positive correlation between birthweight and maternal oxytocin levels (Uvnas-Moberg et al., 1990). Oxytocin is produced by newborns and is released in a pulsatile fashion, reflecting fluctuations in hypothalamic cell activity (Marchini & Stock, 1996). Oxytocin has been implicated as playing a role in the maternal, attachment, feeding, bonding, and sexual behavior of both animals and humans (Insel, 1997; Nelson & Panksepp, 1998).

The rodent literature suggests that the stress encountered by human preterms on the NICU may lower levels of oxytocin that could then be elevated through massage therapy. Noonan and colleagues found that hippocampal oxytocin receptors decreased in rat pups following periods of maternal separation (Noonan et al., 1994). Uvnas-Moberg (1997) reported that repeated administration of oxytocin inoculated rats against stressful stimuli. This study also found that touch, light pressure, and warmth increased levels of both blood and cerebral spinal fluid oxytocin. Such increases in oxytocin were also linked to greater weight gain that persisted for several weeks. That increases in serum oxytocin are inversely related to cortisol secretion is also relevant since this adrenocorticotropic hormone inhibits IGF-I and subsequent growth (Chiodera et al., 1991). Uvnas-Moberg further suggested that oxytocin might mediate the effects of specific vagally controlled GI hormones such as gastrin and insulin that promote growth. In pilot work, Field & Schanberg (1995) found higher serum insulin levels in T/K infants following ten treatment days.

The potential effect that oxytocin has on attachment behavior may explain the finding that massaged preterms demonstrated superior

performance on the Orientation Cluster of the Brazelton Neonatal Behavioral Assessment Scale: Massaged preterms were more engaged and exhibited a greater response to human and non-human stimuli (Scafidi et al., 1986). One year later, Field et al. (1987) found the massaged preterms performed better on the Mental and Motor Scales of the Bayley, suggesting that their post-discharge behavior enhanced the mother-infant relationship that facilitated development. That oxytocin is related to lower serum cortisol may also contribute to the enhanced neurobehavioral performance observed in massaged preterms. Considering the findings of animal studies that document the neurotoxic effects of adrenocorticotropin on the brain and particularly the hippocampus (Weinstock, 1997), a reduction of free cortisol within human preterms might not only reflect improved H-P-A axis function but also foster a hormonal environment that enhances neurobehavioral development.

Although inconclusive, one study has shown that preterms who received T/K demonstrated lower cortisol levels than controls (Acolet et al., 1993). The findings of Kuhn et al. (1991) of increased catecholamines levels may be additional evidence that massage enhances maturation of the neuroendocrine system, especially the H-P-A axis. Furthermore, Uvnas-Moberg and associates proposed that enhanced secretion of catecholamines might further increase the release of gastrin since it can be liberated by beta-adrenoreceptor stimulation (Uvnas-Moberg et al., 1984). In addition, it is known that increases in epinephrine and norepinephrine promote the release of fatty acid and enhance the rate of glycogen breakdown, thus increasing blood glucose levels (Hole, 1981). That massaged preterms have been observed to be more active than controls may be explained by the mobilizing effects of catecholamines.

The above research can be consolidated into a more comprehensive vagal model of how massage therapy promotes greater weight gain and neurobehavioral maturation in preterm infants:

1. Tactile stimulation transmitted via afferent peripheral nerves promotes parasympathetic vagal activity.
2. Direct communication between the vagus and GI tract is enhanced via the gastric branch thus evoking an increased release of hormones (e.g., gastrin and cholecystokinin) that stimulates insulin production, motor and secretory activity, inhibits somatostatin release, and promotes GI growth.
3. GI maturation and metabolic efficiency is further promoted through increases in both IGF-I and oxytocin.
4. The stress reducing benefits of oxytocin contribute to a reduction in serum cortisol levels and promote functioning of the H-P-A axis and neurobehavioral maturation (e.g., improved BNBAS performance and enhanced infant-caregiver relations).

5. Enhanced H-P-A axis functioning yields a greater release of catecholamines that in turn support the increase in GI peptides such as gastrin and may underlie changes in behavioral state organization (e.g., increased alertness).

The vagal model outlined above is complex and proposes a relationship between the activity of the vagus nerves, the H-P-A axis, the GI tract, and several peptide hormones. Conclusive support of the vagal model depends on future research. Along with vagal tone monitoring, these studies must include sophisticated biochemical assays in order to determine the relationships between CVT, cortisol, catecholamines, and peptides such as IGF-I and oxytocin. Regression or structural equation modeling is needed to explore the interrelations between these variables and T/K benefits such as weight gain.

## CONCLUSIONS AND CLINICAL GUIDELINES

Collectively, numerous studies strongly suggest that tactile and kinesthetic stimulation are safe for preterm infants and improve their hospital course. Passive forms of touch therapy have been shown to soothe young and sick infants residing in the NICU. For grower nursery infants, T/K facilitates weight gain and appears to enhance neurobehavioral maturation.

The value of passive tactile stimulation such as the Harrison et al. (1996) 'gentle human touch' (GHT) protocol should be investigated further. No research has examined the effects of supplemental stimulation that begins in the NICU and continues until the preterm infant is discharged from the hospital. A conjoint GHT and T/K regimen might be the first step in this direction since both procedures are easily administered. Infants would receive GHT as they resided in the NICU. T/K would begin upon transfer to the progressive care unit (PCU) or grower nursery and continue until discharge. Singular and additive treatment effects could be evaluated through three treatment conditions: singular NICU GHT, singular PCU/grower nursery T/K, and conjoint NICU GHT and PCU/grower nursery T/K. Treatment findings such as weight gain, neurobehavioral performance, and days to discharge could be compared with a control group.

Unfortunately, recent years have seen the number of supplemental stimulation studies diminish. Renewed efforts should be taken to revitalize this field of research. Preterm infant supplemental stimulation is of scientific interest for the contribution that it can make to our understanding of the relationship between the environment and early neurobehavioral development. It is also clinically relevant for its potential to shorten the hospital course of preterm infants and aid in the amelioration of some of the adversities of premature birth.

## ACKNOWLEDGEMENTS

*Dr. Dieter expresses his appreciation to Tiffany Field PhD and Maria Hernandez-Reif PhD for their invaluable assistance in completing the dissertation presented in this chapter.*

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# 8

# Hand massage in the agitated elderly

*Ruth Remington*



## BACKGROUND AND SIGNIFICANCE

Agitation is a widespread problem in the elderly that negatively affects their quality of life (Cohen-Mansfield & Billig, 1986; Teri et al., 1992). The effects of their agitation are also felt by their family caregivers for whom the presence of agitated behaviors predicts caregiver burden (Hamel et al., 1990) and increases the likelihood that the older person will enter a skilled nursing facility (Cohen-Mansfield, 1995; Cohen-Mansfield et al., 1989; Teri et al., 1992). There, agitation affects the cost of care by increasing the need for staff and for special environmental designs of nursing homes (Cohen-Mansfield et al., 1989).

Agitation is prevalent in the nursing home, affecting between 64% and 93% of residents (Cohen-Mansfield et al., 1989; Zimmer et al., 1984). The frequency of agitated behaviors is related positively to the level of cognitive impairment (Cariga et al., 1991; Cohen-Mansfield et al., 1990; Cooper et al., 1990; Swearer et al., 1988) and may serve as a dysfunctional coping mechanism to protect the cognitively impaired person from real or imaginary threats in the environment (Cohen-Mansfield et al., 1990).

Once in the nursing home, the quality of the agitated older person's life is imperiled still further. The presence of agitated behaviors increases the likelihood that the elderly resident will be physically restrained (Evans &

Strumpf, 1990; Werner et al., 1989), and/or chemically restrained by the use of psychotropic medications (Cariga et al., 1991). Research has shown that nursing home residents who experience falls are found to be more agitated (Cohen-Mansfield, 1986; Marx et al., 1989). Agitated residents are likely to be restrained to prevent falls. An estimated 66% of agitated nursing home residents are restrained at some time and the mean number of restraint days was 87 per year (Tinetti et al., 1991). In addition to loss of dignity and potential for injury (Lipowski, 1992), residents who are restrained exhibit the same or more agitated behaviors, disorientation, more incontinence and more falls than residents who are not restrained (Tinetti et al., 1991; Werner et al., 1989). These data indicate that agitation in nursing home residents leads to the use of restraints, which in turn leads to a further increase in agitation. Ironically, studies have shown that restraints do not prevent falls associated with serious injury in ambulatory nursing home residents (Evans & Strumpf, 1990) and restraint reduction can actually result in fewer falls and injuries (Meyer et al., 1994). Additionally, restraint use exposes residents to consequences of immobility such as urinary retention, constipation, osteoporosis, muscle atrophy, limb ischemia, protein-energy malnutrition and dehydration, as well as the potential for strangulation (Meyer et al., 1994; Werner et al., 1989).

The effectiveness of pharmacological interventions to control behavior is documented in the literature, however age-related changes in the older person may result in a longer duration of activity of the drug, a variable drug effect, and an increased incidence of adverse drug reactions (Chutka, 1997). Pharmacological interventions as a form of chemical restraint may paradoxically exacerbate the very behaviors they are intended to moderate, causing further cognitive or functional decline (Carlson et al., 1995). Additionally, these interventions introduce the potential for side effects such as gait impairment, falls, difficulty swallowing, anorexia, sedation, hypotension, diminished cognitive function and increased agitation (Carlson et al., 1995; Corrigan, 1989; Gardner & Garrett, 1997; Knopman & Sawyer-Demaris, 1990).

The Omnibus Budget Reconciliation Act (1987) requires that the nursing home resident's regimen be free from unnecessary physical and chemical restraint, but these standards did not address alternative measures to regulate agitated behavior. Thus, progress in the treatment of agitation has been slow (Williams-Burgess et al., 1996).

Several non-pharmacological management strategies for the reduction of agitated behaviors in nursing home residents that have been investigated include therapeutic touch and hand massage (Snyder et al., 1995a,b), the use of music (Gerdner & Swanson, 1993; Goddaer & Abraham, 1994; Ragneskog et al., 1996; Tabloski et al., 1995), restraint release (Moorse & McHutchion, 1991; Werner et al., 1989), and environmental modifications such as electronic security systems (Negley et al., 1990) and visual barriers (Chafetz, 1990; Dickinson et al., 1995; Hussian & Brown, 1987). While these

studies consistently demonstrated a reduction in agitated behaviors in nursing home residents, most studies used differing definitions and measures of agitation, thereby limiting generalization about the effectiveness of these interventions in reducing agitation.

Nurses, in providing direct care to agitated nursing home residents, are in the position to identify agitated behaviors and intervene promptly, minimizing the escalation of agitation and the use of physical and chemical restraints. Reduction in agitated behaviors of nursing home residents would likely result in decreased costs associated with medications and associated adverse side effects, falls, special environmental designs, and increased staff-to-patient ratios. Because agitation is costly in terms of quality of life for the agitated nursing home resident, as well as in the direct and indirect costs of providing residential care for these persons, the purpose of this study was to compare hand massage and calming music as interventions to reduce agitated behavior in agitated nursing home residents with dementia. These interventions are feasible, cost-effective, easily administered, non-pharmacological treatments that can be administered by non-professional, as well as professional caregivers.

## Agitation

The concept of agitation, its etiology and manifestations are not consistently defined in the literature (Cohen-Mansfield & Billig, 1986) and this is evidenced by the multiplicity of definitions and measures of agitation in the intervention research. Cohen-Mansfield & Billig (1986) proposed that agitation may be a construct of interrelated behavior problems, rather than a unified concept. They defined agitation as inappropriate verbal, vocal or motor activity that is not explained by needs or confusion. Although agitation may result from unmet needs or confusion, these may not be evident to the observer (Cohen-Mansfield & Billig, 1986). Agitation is manifested in three syndromes: physically aggressive behaviors, physically non-aggressive behaviors and verbally agitated behaviors (Cohen-Mansfield et al., 1989; Miller et al., 1995).

Agitated behaviors are a common occurrence in nursing home residents. In a sample of 408 nursing home residents in a single facility, irrespective of the presence of dementing illness, 93% exhibited agitated behaviors at least once a week and the mean number of agitated behaviors exhibited per resident, per week was 9.3 (SD = 8.6) (Cohen-Mansfield et al., 1989).

## Touch

Healing through touch has been practiced in many cultures since ancient times. Philosophical and cultural differences have had a profound influence on the development of touch as a healing modality in different parts of the world. For example, the Oriental approach to healing touch involves

the belief that healing energy is directed through the practitioner's hands to the patient. This is in stark contrast to the Western view of physiological effect of cellular changes that influences healing. The Puritan belief that equated touch with sex initiated the move away from the use of touch as a therapeutic intervention. This was furthered by the scientific advances in the nineteenth and twentieth centuries (Dossey et al., 1995). With the increasing complexity and demands of care involving life preserving machinery, nurses are faced with finding the right balance between 'high tech' and 'high touch' (Barnum, 1994).

In recent research, touch has been shown to produce a variety of therapeutic effects in diverse populations. Therapeutic touch was associated with a decrease in pain and increased relaxation in community residing adults (Heidt, 1991). When administered to psychiatric inpatients, therapeutic touch resulted in a significant reduction of anxiety, similar to that obtained with guided relaxation therapy. This supports the use of touch as a passive technique that can be used for the reduction of anxiety which can be utilized when the patient is unable to participate (Gagne & Toye, 1994).

In a descriptive study examining the relationship between agitation and touch in nursing home residents, results were differentially related to particular agitated behaviors. Verbally agitated and physically aggressive behaviors were manifested more often when the person was being touched, suggesting that this was in relation to a sense that their personal space was violated. Physically non-aggressive agitation was exhibited less frequently when the person was being touched, supporting the hypothesis that touch is a comforting form of communication (Marx et al., 1989). In this study the type of touch was not controlled for and included both comforting touch as well as touch involved in administering care and treatments, which may have influenced the differing response.

It has been suggested that the elderly are the most deprived of touch, particularly if they are dependent on others for physical care in nursing homes (Fraser & Kerr, 1993). The need for affective touch continues throughout life and increases with age (Stanley & Beare, 1999). Nursing home residents perceived that nurses who used comforting touch on the arm of the patient communicated more affection and immediacy than the nurses who did not use touch (Moore & Gilbert, 1995).

Physiological and psychological effects of back massage on anxiety were examined among elderly nursing home residents. Using an experimental design with pre-test/post-test control group conditions, back massage was compared with conversation and no intervention. Results indicated that back massage and conversation were more effective than none, in reducing agitation as evidenced by reduced electromyographic readings, blood pressure, and heart rate and by self-report. These differences, however, did not reach statistical significance. The authors note that despite the fact that the statistical analysis did not clearly answer the research question, there

was strong evidence of the positive effect of the interventions (Fraser & Kerr, 1993).

The effect of slow-stroke back massage on agitated behaviors was examined in community dwelling individuals with Alzheimer's disease. Verbal agitation, the most frequently manifested type of agitation in this group was not reduced following back massage. Physical displays of agitation did show a reduction in frequency when back massage was applied (Rowe & Alfred, 1999).

Critically ill, hospitalized older men showed improved sleep as measured electronically, following a six-minute back massage. Subjects receiving back massage slept one hour longer than those who received relaxation training and music at bedtime or those who received no intervention. These results did not reach statistical significance, however, the author did conclude that back massage is useful for promoting sleep in critically ill older men (Richards, 1998).

Using a quasi-experimental design, physiological parameters of relaxation were examined in terminally ill adults being cared for in the home. Results included a reduction in heart rate of 4.2 beats per minute on average. Additionally, reductions in both systolic and diastolic blood pressure (9.17 and 6.14 mmHg respectively) and skin temperature (1.45° Fahrenheit) persisted for five minutes after the intervention. These small reductions in physiological parameters were adequate to demonstrate relaxation in subjects, however they were not sufficient to pose danger of bradycardia, hypotension or hyperthermia (Meek, 1993).

The effectiveness of hand massage therapeutic touch and presence for reducing agitation was examined in 17 residents of an Alzheimer's care unit. Results showed an increase in relaxation and a decrease in anxious behaviors among the subjects who received either treatment. Greater increase in relaxation was observed in the group who received hand massage for ten minutes than the group who received therapeutic touch. No indication of relaxation was observed with presence alone. There was however, no change in the frequency of agitated behaviors. The authors proposed that the relaxation response was too brief to affect the overall levels of agitation (Snyder et al., 1995a). In a subsequent study, the authors examined whether a five-minute hand massage before care activities would reduce the frequency and intensity of agitated behaviors during care in residents of three Alzheimer's care units. Results showed that agitation was decreased during the baseline period with inconsistent results during care activities. It was suggested that decreasing the length of the hand massage from ten minutes in the first study to five minutes in the subsequent study may have accounted for the less significant results in the second study (Snyder et al., 1995b).

Commonalities of the type of touch found in these studies include light pressure, even rhythm and slow strokes. Studies dealing exclusively with

therapeutic touch were not considered relevant to this study involving cognitively impaired nursing home residents, as therapeutic touch is described as a reciprocal communication process (Heidt, 1991), and the communication ability of the subjects is likely to be impaired. Additionally, extensive training and practice is necessary to master therapeutic touch. Hand massage was chosen as the form of touch to be used in this study because it is felt to be less threatening in that it is similar to familiar social touch and does not require removal of clothing as is necessary with back massage.

### Music

As noted with the touch literature, music had been shown to produce a variety of therapeutic effects in diverse populations. Music was effective in pain control (Schorr, 1993; Whipple & Glynn, 1992), improving sleep in older persons (Mornhinweg & Voignier, 1995), promoting relaxation in mechanically ventilated patients (Chlan, 1995), reducing anxiety in surgical patients (Winter et al., 1995) and in patients who had an acute myocardial infarction (White, 1992), as well as reducing heart rate (Chlan, 1995; White, 1992). Additionally, a music intervention resulted in an increase in positive behaviors and a reduction in restraint use in an acute care setting (Janelli & Kanski, 1997).

Examples specific to agitation in nursing home residents include the descriptive study by Cohen-Mansfield & Werner (1995) in which agitated behaviors were decreased when music was present in the environment in a sample of agitated nursing home residents. Music chosen for calming qualities was shown to reduce agitation on the nursing unit (Tabloski et al., 1995) and during mealtime (Goddaer & Abraham, 1994; Ragneskog et al., 1996). An individualized, preferred music intervention provided during peak agitation periods was consistently effective in reducing the frequency of agitated behaviors in agitated nursing home residents (Gerdner, 2000; Gerdner & Swanson, 1993).

While both calming and individualized music have been shown to reduce agitation, this study used a standardized piece of calming music to eliminate potential confounding of results by memories or emotions that may be evoked by a familiar tune and the possible influence on agitation.

## PURPOSE AND HYPOTHESES

Hand massage or calming music each have been shown to reduce agitated behaviors in nursing home residents with dementia. This study investigated the effectiveness of these interventions in reducing agitation, including identifying whether each is equally effective and whether there is an additive or synergistic effect of the combination of interventions on the

reduction of agitation in nursing home residents with dementia. The purpose of this study was to compare the effect of hand massage, or calming music, or a combination of hand massage and calming music on the level of agitation in nursing home residents with dementia.

The six hypotheses were that:

1. Agitated nursing home residents with dementia who are exposed to ten minutes of hand massage exhibit fewer manifestations of agitation immediately following intervention than those who receive no intervention.
2. Agitated nursing home residents with dementia who are exposed to ten minutes of calming music exhibit fewer manifestations of agitation immediately following intervention than those who receive no intervention.
3. Agitated nursing home residents with dementia who are exposed to ten minutes of a combination of hand massage and calming music exhibit fewer manifestations of agitation immediately following intervention than those who are exposed to hand massage alone, calming music alone or no intervention.
4. Agitated nursing home residents with dementia experience differential levels of physically aggressive behaviors over time with exposure to hand massage or, calming music or a combination of hand massage and calming music, or no intervention.
5. Agitated nursing home residents with dementia experience differential levels of physically non-aggressive behaviors over time with exposure to hand massage or, calming music or, a combination of hand massage and calming music, or no intervention.
6. Agitated nursing home residents with dementia experience differential levels of verbally agitated behaviors over time with exposure to hand massage, or calming music, or a combination of hand massage and calming music, or no intervention.

## METHODS

### Design

A four group, repeated measures experimental design was used to test the effect of hand massage and calming music in reducing agitation in nursing home residents with dementia. Agitated nursing home residents were randomly assigned to one of four intervention groups and received a ten minute exposure to either hand massage (HM), calming music (CM) or both hand massage and calming music simultaneously (HMCM), or no intervention. The number of occurrences and types of agitated behaviors were recorded for ten minute periods, immediately before the intervention, during the intervention, immediately after the intervention, and at one hour.

## Sample

To obtain an estimate of the effect size likely to be realized in this study, a pilot study of 24 agitated nursing home residents was conducted and the data used for power analysis. A power calculation was performed for each pair of groups in the sample for which comparisons were to be performed in order to determine the minimum number of subjects needed to detect significant group difference in reduction in agitation. Effect size in the pilot study was 0.55. With the level of significance of 0.05 and power of 0.80, a total sample of 68 subjects with 17 subjects in each of the four treatment groups was predicted to be adequate to detect significant results.

Criteria for inclusion in this study include age of 60 or more years; diagnosis of dementia, exhibition of any agitated behavior occurring an average of one or more times a day during the preceding two weeks as identified by scores on the Cohen-Mansfield Agitation Inventory completed by the charge nurse on the unit; ability to hear; and ability to feel touch on the hands. Subjects who received medication on an as needed basis for agitated behavior within the four hours preceding the intervention were excluded. Informed consent was obtained from the family or legal guardian in writing and verbal assent was obtained from all subjects immediately prior to the intervention.

## Instrument

The Cohen-Mansfield Agitation Inventory (CMAI) is a 29 item caregiver rating scale, developed for use in the nursing home, to systematically record the presence and frequency of agitated behaviors in nursing home residents. Each of the 29 items, or agitated behaviors, is rated on a 7-point response format of frequency scaled from 1 (never) to 7 (several times an hour). Ratings refer to behaviors exhibited during the two weeks preceding the test administration. The CMAI may be administered by a caregiver or by interviewing a staff or family caregiver (Cohen-Mansfield, 1991).

Internal consistency of the CMAI has been evaluated in nursing home residents using Cronbach's coefficient alpha and reported to be between 0.74 and 0.91 (Finkel et al., 1993; Miller et al., 1995). Interrater reliability of the CMAI (Pearson's correlation coefficient) has been reported between 0.82 to 0.92 (Cohen-Mansfield et al., 1989; Miller et al., 1995).

Content validity of the CMAI was determined by extensive literature search, concept analysis and nurses' observations and attributions (Cohen-Mansfield, 1986). Convergent validity of the CMAI was examined by correlating responses on the CMAI and the Behavioral and Emotional Activities Manifested in Dementia scale (0.79 to 0.92), the Nursing Home Problem Behavior Scale (0.64 to 0.95) (Miller et al., 1995; Ray et al., 1992),

and the Brief Agitation Rating Scale (0.95) (Finkel et al., 1993). Correlations between the CMAI and the Rapid Disability Rating Scale ranged from 0.68 to 0.98 (Chrisman et al., 1991).

Factor analysis revealed three factors, or syndromes of agitated behavior, which were stable across shifts. These were called aggressive behavior, physically non-aggressive behavior, and verbally agitated behavior (Cohen-Mansfield et al., 1989). Subsequent factor analysis revealed a similar factor structure indicating that the factors represent distinct dimensions of agitation (Miller et al., 1995).

The CMAI has been modified from a retrospective data collection instrument to an observer format which is scored for frequency of occurrence of agitated behaviors (Chrisman et al., 1991). A score of '0' indicates that the behavior is not present, '1' indicates that the behavior occurred only once during the observation period, a score of '2' indicates that the behavior occurred two times, etc. The total agitation score is calculated by summing the scores for the individual behaviors. A total score of '0' indicates that the subject is not agitated and the higher the score, the greater the agitation.

Interrater reliability of the modified CMAI has been reported between 0.72 and 0.81 (Chrisman et al., 1991) and 93% agreement (Gerdner, 2000). Interrater reliability for the present ranged between 0.93 and 1 (Pearson correlation). A *t*-test verified that there was no significant difference ($t = 1.65$, $df = 28$, $p = 0.11$) in ratings of agitated behaviors between the raters.

Convergent validity of the modified CMAI was supported when examined by correlating the responses with the Ward Behavior Inventory and the Confusion Inventory (Chrisman et al., 1991).

## Procedure

This study was approved by the Committee for the Protection of Human Subjects in Research. Potential subjects with a medical diagnosis of Alzheimer's disease, multi-infarct dementia or senile dementia were identified by chart review by the principal investigator (PI). The charge nurse was then asked to select from the identified residents, those who exhibit agitation on a regular basis and document this by completion of the CMAI. Informed consent was then obtained in writing from the responsible person listed on the medical record. Prior to data collection, cards were prepared containing a subject number and group assignment and these cards were placed in sealed envelopes. As each subject agreed to participate, an envelope was drawn, providing that subject's number and group assignment. Subjects were thus randomly assigned to one of four groups: HM, CM, HMCM, or control. Each subject was observed for 10 minutes, the modified CMAI completed by a trained research assistant to identify the number of agitated behaviors exhibited immediately before the intervention. If a

subject's score was less than 1, which indicates the absence of agitation at the time of the study session, he or she was not assigned to an intervention group for that session.

Subjects assigned to the HM group received ten minutes of hand massage, five minutes on each hand, utilizing the protocol developed by Snyder et al. (1995b) as follows:

1. To the back of the hand
   - using moderate pressure, apply short to medium length straight strokes from the wrist to fingertips followed by large circular strokes from the center to the side of the hand
   - using light pressure, make small circular strokes over the back of the hand.
   - featherlike long strokes from the wrist to fingertips.
2. To the palm of the hand, using moderate pressure, apply
   - short to medium length strokes from the wrist to fingertips
   - gentle milking of tissue of entire palm
   - small circular strokes over entire palm
   - large circular strokes from center to sides.
3. To the fingers, apply gentle squeezing along the length of each finger, followed by gentle range of motion of each finger, ending with gentle pressure on the nailbed.
4. Complete massage by gently drawing your hand over the entire length of the resident's hand and fingers several times on the back then the palm.

Subjects assigned to the CM group were exposed to 10 minutes of Daniel Kobialka's recording of Pachelbel's Canon in D played on a portable compact disc player at a volume between piano and mezzo-forte, a level slightly higher than the environmental noise level but low enough to allow conversation to be heard. This piece was chosen for its slow tempo (52 beats per minute), soft dynamic levels and repetitive themes. Calming music is neutral and does not contain recognizable melodies that may evoke intense emotional responses. Technically, this music is characterized by slow tempo, soft dynamic levels, and irregular, repetitive themes, and absence of sound impulses (Goddaer & Abraham, 1994).

Ten minute duration was selected for the HM intervention based on the work of Snyder et al. (1995a,b) in which a more significant reduction of agitation was achieved with ten minutes of hand massage than with five minutes. Subjects in the HMCM group received both of the above interventions simultaneously and subjects in the control group received no experimental intervention during the ten-minute intervention period. Although it was not possible to blind the data collectors to the intervention, a different data collector conducted the intra-treatment measurement.

All subjects were assessed for level of agitation and the modified CMAI scored during four observation periods of ten minutes each; before the intervention (time 1), during the intervention (time 2), immediately after the intervention (time 3), and at one hour (time 4). Research assistants did not initiate conversation with the subject however, they responded to the subject if requested. Subjects were free to discontinue the intervention at any time; none chose to do so.

In order to minimize the potential influence of other environmental stimuli, the intervention was conducted in the patient's room or familiar lounge area. Times of scheduled activities, meals and routine care administration were avoided to avert stress associated with change in usual routine. Interventions were scheduled for the time of day in which peak agitation occurs, as reported by nursing staff for each resident.

## RESULTS

### Subjects

Subjects were 68 agitated nursing home residents from four long-term care facilities. They were mostly women (87%), Caucasian (94%), and ranged in age from 62 to 99 years. The mean age was 82.43 (SD 8.09). Level of dementia for these subjects was indicated as moderate to severe. Length of stay in the nursing home ranged from two months to nine years, four months, with 95% residing more than six months. Subjects were dependent or required assistance with activities of daily living (ADL). Level of education in this sample ranged between no formal education for one subject to a PhD for one subject, with a majority having completed less than a high school education (56%).

### Baseline levels of agitation

A one-way analysis of variance (ANOVA), comparing baseline levels of agitation in the four treatment groups, indicated the adequacy of randomization. The Levene test for homogeneity of variances indicated equal variance among the four groups ($F = 0.63$, $p = 0.60$). Mean agitation scores for the four intervention groups ranged from 16.47 in the HM group to 22 in the HMCM group, and are summarized in Table 8.1. The overall $F$ test of group differences verified that there were no significant differences among the four group means ($F = 1.09$, $p = 0.36$).

### Hypothesis 1, hand massage

A $t$-test for independent samples was conducted to test Hypothesis 1 that agitated nursing home residents with dementia who are exposed to ten

**Table 8.1** Mean agitation scores at baseline

| Group | Hand massage | Calming music | Hand massage calming music | Control |
|---|---|---|---|---|
| Mean | 16.47 | 18.41 | 22.00 | 21.76 |
| Standard deviation | 9.94 | 11.18 | 11.94 | 9.09 |
| *n* | 17 | 17 | 17 | 17 |

*p*-value from one-way ANOVA test of zero group differences = 0.36 ($F = 1.09$. $df = 3, 64$).

minutes of hand massage exhibit fewer manifestations of agitation immediately following intervention than those who receive no intervention. Scores at Time 3 (after the intervention) were compared for the HM group and the control group. Results indicated that agitation scores in the HM group were significantly different than in the control group ($t = 4.20$, $df = 32$, $p = 0.00$). The mean score at Time 3 was 7.77 (SD 9.55) for the HM group and 20.88 (SD 8.66) for the control group, with a mean difference of 13.12. The control group exhibited on average nearly three times the agitation in the control group after the intervention. Hypothesis 1 was not rejected.

## Hypothesis 2, calming music

A *t*-test for independent samples was conducted to test Hypothesis 2, that agitated nursing home residents with dementia who are exposed to ten minutes of calming music exhibit fewer manifestations of agitation immediately following intervention than those who receive no intervention. Scores at Time 3 (after the intervention) from the calming music group and the control group were compared. Results indicated that agitation scores in the CM group were significantly different than in the control group ($t = 4.18$, $df = 32$, $p = 0.00$) at Time 3. The mean score at Time 3 for the CM group was 7.65 (SD 9.79), and for the control group was 20.88 (SD 8.66) with a mean difference of 13.24. On average, subjects who were not exposed to calming music exhibited 13 more agitated behaviors during the ten-minute observation period (nearly three times the agitation) than those who were exposed to calming music. Hypothesis 2 was not rejected.

## Hypothesis 3, hand massage and calming music

A one-way ANOVA was conducted to test Hypothesis 3 that agitated nursing home residents with dementia who are exposed to ten minutes of both hand massage and calming music simultaneously exhibit fewer manifestations of agitation immediately following intervention than those who are exposed to hand massage alone, or calming music alone, or no

**Table 8.2** Mean agitation scores after intervention

| Group | Hand massage | Calming music | Hand massage calming music | Control |
|---|---|---|---|---|
| Mean | 7.76 | 7.66 | 7.06 | 20.88 |
| Standard deviation | 9.55 | 9.78 | 7.08 | 8.66 |
| *n* | 17 | 17 | 17 | 17 |

*p*-value from one-way ANOVA test of zero group differences = < 0.01 ($F = 9.79$. $df = 3, 64$).

intervention. Scores from Time 3 (after the intervention) were compared for the four intervention groups. The Levene test for homogeneity of variances was not significant ($p = 0.52$) indicating that the assumption of homogeneity of variance was reasonable. The overall $F$ test was significant ($F = 9.79$, $p = 0.00$) indicating that there was a significant difference in agitation scores among the intervention groups (Table 8.2).

*Post hoc* analysis using Tukey's HSD test with a level of significance of 0.05 indicated that the control group (mean 20.88; SD 8.66) differed significantly from HM group (mean 7.76; SD 9.55), the CM group (mean 7.65; SD 9.78), and the HMCM group (mean 7.06; SD 7.08). Subjects in the treatment groups exhibited on average between 13.12 and 13.82 fewer agitated behaviors during the ten minute observation period than the control group. These data provide partial support for Hypothesis 3.

## Hypothesis 4, change in physically aggressive behaviors over time

Repeated measures analysis of variance was used to test Hypothesis 4 that there is a differential level of reduction of physically aggressive behaviors with hand massage, calming music, and a combination of hand massage and calming music over time. The Mauchly sphericity test was significant, indicating that the sphericity assumption was not met, therefore the Greenhouse-Geisser procedure was used to adjust the degrees of freedom for the $F$ tests. Results showed no significant differences ($F = 1.93$, $p = 0.09$) in physically aggressive behaviors among the four groups. Mean scores are presented in Table 8.3. Hypothesis 4 was rejected.

## Hypothesis 5, change in physically non-aggressive behaviors over time

Repeated measures ANOVA was performed on the physically nonaggressive subset of behaviors in all four intervention groups. The Mauchly sphericity test was significant, indicating that the sphericity assumption was not met, therefore the Greenhouse-Geisser procedure was used to

**Table 8.3** Mean scores of physically aggressive behaviors over time

| | Hand massage | Calming music | Hand massage calming music | Control |
|---|---|---|---|---|
| Time 1 Mean (SD) | 3.71 (4.70) | 2.65 (4.12) | 3.35 (4.83) | 1.18 (1.70) |
| Time 2 Mean (SD) | 2.24 (4.22) | 0.94 (2.30) | 1.47 (2.62) | 1.35 (2.09) |
| Time 3 Mean (SD) | 1.47 (2.50) | 0.71 (2.02) | 0.82 (1.28) | 1.24 (1.75) |
| Time 4 Mean (SD) | 0.71 (1.76) | 0.29 (0.99) | 0.59 (0.94) | 1.06 (1.75) |
| *n* | 17 | 17 | 17 | 17 |

$p = 0.09$ from $F$ test from repeated measures ANOVA with Greenhouse-Geisser procedure applied ($df = 5.53, 118$).

**Table 8.4** Mean scores of physically non-aggressive behaviors over time

| | Hand massage | Calming music | Hand massage calming music | Control |
|---|---|---|---|---|
| Time 1 Mean (SD) | 8.41 (7.13) | 9.76 (6.13) | 10.88 (6.13) | 13.29 (7.64) |
| Time 2 Mean (SD) | 5.35 (6.25) | 5.41 (7.21) | 4.06 (4.38) | 13.94 (8.68) |
| Time 3 Mean (SD) | 4.65 (5.92) | 4.41 (5.93) | 4.06 (4.34) | 13.24 (7.35) |
| Time 4 Mean (SD) | 2.00 (3.81) | 3.59 (6.61) | 1.76 (3.11) | 12.94 (9.20) |
| *n* | 17 | 17 | 17 | 17 |

$p < 0.01$ from $F$ test from repeated measures ANOVA with Greenhouse-Geisser procedure applied ($df = 7.36, 157.08$).

adjust the degrees of freedom used to test the $F$ value for significance. Results indicated that there was a significant difference ($F = 3.78$, $p = 0.00$) among the four groups over time.

*Post hoc* analysis using Tukey's HSD test with a level of significance of 0.05 showed no difference in physically non-aggressive behavior between groups at the baseline measure (Time 1). During subsequent measurements (Times 2, 3, and 4) agitation scores in the control group were significantly greater than in the three experimental treatment groups. On average, subjects in the control group exhibited nine or more physically non-aggressive behaviors than subjects in any of the experimental intervention groups. Mean scores are shown in Table 8.4. The data provide partial support for Hypothesis 5.

## Hypothesis 6, change in verbally agitated behaviors over time

Repeated measures ANOVA conducted on the subset of verbally agitated behaviors in all four groups. The Mauchly sphericity test was significant, indicating that the sphericity assumption was violated, therefore the Greenhouse-Geisser procedure was used to adjust the degrees of freedom

**Table 8.5** Mean scores of verbally agitated behaviors over time

| | Hand massage | Calming music | Hand massage calming music | Control |
|---|---|---|---|---|
| Time 1 Mean (SD) | 2.41 (5.20) | 5.29 (6.08) | 5.53 (7.26) | 5.65 (5.56) |
| Time 2 Mean (SD) | 0.71 (1.49) | 2.41 (4.24) | 2.24 (4.31) | 5.00 (5.40) |
| Time 3 Mean (SD) | 0.41 (0.94) | 2.06 (3.80) | 1.71 (3.79) | 4.94 (5.18) |
| Time 4 Mean (SD) | 0.12 (0.33) | 0.65 (2.42) | 1.18 (2.51) | 4.88 (5.33) |
| *n* | 17 | 17 | 17 | 17 |

$p = 0.10$ from $F$ test from repeated measures ANOVA with Greenhouse-Geisser procedure applied ($df = 4.53, 96.73$).

used to test the $F$ value for significance. The overall $F$ test indicated that there was no significant difference in agitation scores ($F = 1.92$, $p = 0.10$) among the four groups over time.

*Post hoc* analysis using Tukey's HSD test with a significance level of 0.05 however, revealed a difference between the control group and the HM group at Time 2 and Time 3, and between the control group and the three experimental treatment groups at Time 4. Mean scores are shown in Table 8.5. The hand massage group was less verbally agitated at baseline, however that difference was not statistically significant. Hand massage resulted in a consistently greater reduction in verbally agitated behaviors than that found in the other groups. At Time 4, any intervention resulted in a greater reduction in verbally agitated behavior than no intervention. Hypothesis 6 was not rejected.

## ADDITIONAL ANALYSIS

The repeated measures design used in this study allowed for an additional comparison of the effects of the experimental interventions on the frequency of agitated behaviors over time.

### Change over time in all four groups

One-way analysis of variance for repeated measures was performed to compare the profiles of agitated behaviors over time among the four treatment groups. Scores from each of the treatment groups (HM, CM, HMCM, control) prior to the intervention, during the intervention, immediately after the intervention and at one hour were compared. Geisser and Greenhouse's procedure was used to adjust the degrees of freedom for all $F$ tests because the Mauchley sphericity test was significant, indicating that the sphericity assumption was violated. The mean levels of agitation over time are shown in Figure 8.1.

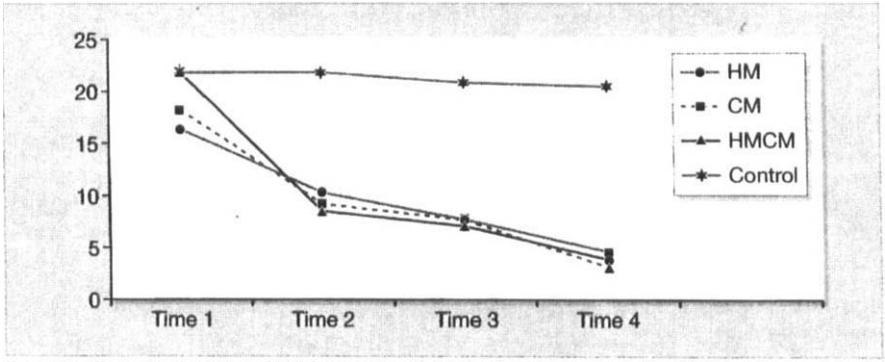


**Figure 8.1** Mean agitation scores by treatment group over time.

**Table 8.6** Mean agitation scores by treatment group over time

| | Hand massage | Calming music | Hand massage calming music | Control |
|---|---|---|---|---|
| Time 1 Mean (SD) | 16.47 (9.94) | 18.41 (11.19) | 22.00 (11.94) | 21.76 (9.09) |
| Time 2 Mean (SD) | 10.35 (11.20) | 9.18 (11.11) | 8.59 (7.87) | 21.88 (10.38) |
| Time 3 Mean (SD) | 7.76 (9.55) | 7.65 (9.78) | 7.06 (7.08) | 20.88 (8.66) |
| Time 4 Mean (SD) | 3.06 (5.44) | 4.65 (7.87) | 3.76 (4.40) | 20.47 (10.90) |
| *n* | 17 | 17 | 17 | 17 |

$p < 0.01$ from $F$ test from repeated measures ANOVA ($df = 3, 9$).

A significant difference ($F = 6.47$, $p = 0.00$) in level of agitation over time was found among the four groups. Mean agitation scores are summarized in Table 8.6. Follow-up comparisons using Tukey's HSD procedure with a level of significance of 0.05, showed that the four groups were similar at baseline and that the control group was significantly more agitated than the experimental groups during the intervention, immediately after the intervention and at one hour.

## DISCUSSION

Results of this study indicate that hand massage and calming music are easily administered, effective interventions to reduce the level of agitation in agitated nursing home residents with dementia. Subjects who received either of these interventions, alone or in combination, exhibited significantly less agitation than the control group after the intervention. The trend in this investigation was for the level of agitation to decrease considerably during the intervention, with further decrease ten minutes after, and again at one hour. After an initial reduction in agitation several subjects experienced slight increases in agitation upon removal of the

intervention. Among the subjects who experienced any increase in agitated behaviors, none returned to baseline levels of agitation during the entire study period.

The receipt of both hand massage and calming music did not appear to result in an additional reduction agitation as originally predicted. Each of the three interventions resulted in significantly greater reduction in agitation than no intervention. However, the reduction in agitation was similar in each of the three experimental intervention groups.

When examined over time, the reduction in agitation among subjects receiving any experimental intervention began during the intervention. Further reduction in agitation was observed during the immediate post-intervention period, with even further reduction observed at one hour. This pattern over the intervention periods differs from that found in previous studies which showed positive effects with the use of music or massage with agitated nursing home residents. In the preliminary study (Tabloski et al., 1995) in which a 15-minute calming music intervention was used, the greatest reduction in agitation occurred during the intervention, followed by a small increase in agitation in the immediate post-intervention period. This suggests that the shorter music intervention used in this study may produce a more sustained effect. Alternately, decreasing a hand massage intervention from ten minutes (Snyder et al., 1995a) to five minutes (Snyder et al., 1995b) resulted in less consistently observed reductions in agitation, suggesting that a five-minute intervention may not be sufficient. Data from this study indicate that a ten-minute intervention of either hand massage or calming music resulted in both a reduction of agitation, as well as a sustained effect.

The music used for the intervention in this study was chosen for its slow tempo, soft dynamic levels, and repetitive themes. A recognizable melody that may evoke intense emotional responses was purposely avoided. Using a piece of music that had personal significance to the subject in earlier years, Gerdner & Swanson (1993) found that there was a lag time in producing an effect of the music intervention. This may be due to the additional cognitive effort required to process memory of a familiar piece of music before a response can occur. Calming music used in this study produced an initial, as well as a progressive response over time.

In summary, either of the interventions investigated in this study produced a reduction in agitation in nursing home residents in this group, and each produced similar results. Moreover, the benefit was sustained and increased over time at levels that were similar with each of the interventions.

None of the experimental interventions produced a significant reduction in physically aggressive behaviors over the four observation periods. This may be due to the fact that the initial level of these behaviors was low and did not allow for variation over time. These results are similar to those found by Goddaer & Abraham (1994) using music during mealtime.

Cohen-Mansfield & Werner (1995) also note a lower prevalence rate of physically aggressive behaviors and propose that these behaviors in a person with dementia may be a response to a perceived noxious stimulus. It may be that calming music or gentle hand massage may have controlled or eliminated the perception of a noxious stimulus, however, initial levels of these behaviors was so low that a significant difference was not detected.

Physically non-aggressive behaviors decreased significantly in the presence of each of the three experimental interventions. Similar results were reported with music (Goddaer & Abraham, 1994) and touch (Cohen-Mansfield & Werner, 1995). These behaviors are the most commonly observed agitated behaviors in the sample nursing home (Cohen-Mansfield & Werner, 1995), as well as in this sample.

Change in verbally agitated behaviors over time was significant in the presence of the experimental interventions. The use of hand massage resulted in less agitation than no intervention at each of the measurement periods, and any intervention resulted in less agitation than no intervention at Time 4 only. Because of the small differences, these results must be interpreted with caution, especially in light of the Cohen-Mansfield & Werner (1995) finding in which verbally agitated behavior increased in the presence of touch.

The findings of this study support the use of either hand massage or calming music for the reduction of agitation in nursing home residents with dementia. Both interventions require little training and are easily administered by both professional and lay caregivers. The cost of providing these interventions is small, especially in comparison with special environmental designs and the administration of medications to control agitation. Time expenditure required by caregivers to provide the interventions is also small. Hand massage as used in this study is a simple intervention that can be used effectively by caregivers. It differs in scope and intensity from that which would be provided by a trained massage therapist.

A limitation of this study pertains to the sample, which was comprised of nursing home residents from middle class communities. A majority of the subjects were white, female, and widowed. This sample may not be representative of all nursing home residents with dementia. Persons with cognitive impairment related to conditions other than dementia of the Alzheimer's type and multi-infarct dementia were not included in the sample. This limits generalizability of the results to the management of agitation in persons with agitation resulting from delirium, depression, brain injury, and other dementias, such as AIDS dementia, Pick's disease and Creutzfeldt-Jakob disease.

No single intervention — pharmacological, environmental or behavioral — is universally effective in reducing agitation. This study demonstrates

the effectiveness of two easily administered interventions that may be used as a part of a comprehensive plan to address the specific needs of agitated nursing home residents. Hand massage and calming music represent practical treatment options that can be used alone or augment an individualized therapeutic regimen.

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## INTRODUCTION TO SECTION 4

The final chapter in this book examines work-site massage. The possibility of using massage in the workplace is exciting and health psychologists have frequently used work sites for community intervention programs in the past (Kaplan et al., 1993). Health psychologists consider such settings important in part because 'most adults are employed, people spend a great amount of time at work, there are existing communication channels that can be used for health education, and companies are motivated to keep employees healthy and productive' (Kaplan et al., 1993, p. 452).

Much research has examined workplace stress and numerous studies describe such effects as psychological distress and physical illness (Taylor, 1999). Evidence suggests that workplace stress may be largely preventable, an important consideration since disability payments to workers for stress-related ailments are numerous and expensive (Taylor, 1999). Previous studies indicate that work-site stress can be alleviated in part by rewarding workers for jobs well done and by making the workplace interesting (Taylor, 1999). Studies also indicate that job stress may lead to increased illness and tardiness (Taylor, 1999), outcomes that employers would certainly prefer to avoid. Perhaps massage therapy could provide part of the answer to this widespread and costly social issue.

In the following chapter, Margaret Hodge and her colleagues suggest that massage can indeed benefit workers. Hodge and colleagues examine 100 male and female health care workers between the ages of 25 and 60. The group receiving massage received massage twice each week for 20 minutes. Certified massage therapists followed a standard protocol and continued treatment for eight weeks. Hodge and colleagues demonstrate decreased anxiety and depression, and a decrease in perceived sleep disturbance among workers who received worksite massage. Such results have important and exciting implications for work-site stress reduction programs.

Hodge and colleagues' results mirror the results of other studies of massage that use the State-Trait Anxiety Inventory, such as numerous studies reviewed by Field (2000). Specifically, Field (2000) reviews a study she conducted with her colleagues on job stress and performance among a sample of somewhat different health care professionals, fifty medical faculty and staff members. The group receiving massage received chair massage 15 minutes a day, twice weekly for five weeks (Field, 2000, p. 107). Massaged subjects reported decreased anxiety and depression, and decreased job stress. As in Hodge and colleagues' study, Field's group also found improved cognition scores. Given the potential cost savings of massage in the workplace, future studies should specifically examine potential cost savings of including work-site chair massage in stress reduction programs.

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# 9

# Employee outcomes following work-site acupressure and massage*

*Margaret Hodge, Carol Robinson, Judie Boehmer, Sally Klein*



## INTRODUCTION

Fast-paced work environments with high demands, little chance of relief and limited control, characterize high stress occupations. Recent studies have reported work related stress rates as high as 30–46% (Lusk, 1997; Murphy, 1996). In a study of 28,000 workers in 215 different organizations, Kohler & Kamp (1992) reported that stress at work was associated with employee burnout, acute and chronic health problems, and poor work performance. In addition, a study of 130 occupations conducted by the National Institute for Occupational Safety and Health, found that 40 occupations had a higher than expected incidence of stress-related disorders or stress responses (Seago & Faucett, 1997). Seven of these high stress occupations were in the health care field.

Health care workers have identified occupational issues such as poor staffing, shift work, increased work load, death and dying, and conflicts with other health care providers as leading to increased work stress (Field et al., 1997; Jenkins & Rogers, 1997). Stress can result in low morale, increased anxiety and depression, as well as other health related concerns (Jenkins & Rogers). Studies have shown that job stress can lead to increases in blood pressure and heart rate as well as decreasing cognitive functioning (Field et al., 1996; Murphy, 1996). As a result, health care workers are at risk for significant untoward physiological effects including hypertension and cardiovascular disease. For the organization, there are significant financial costs associated with job stress, including increased errors, absenteeism, and work related injuries in addition to decreased

*This chapter was first published as a paper in *Massage Therapy Journal* 2000, 39(3), 48–64; 39(4), 40–47.

productivity as the result of poor job satisfaction. Therefore, the development and investigation of work site strategies to decrease stress are relevant and critical in the current health care environment.

The purpose of this study was to systematically investigate the physiological, psychological/cognitive, and organizational effects of a stress reduction strategy, work-site acupressure/massage (WSAM), for employees in high stress health care occupations. This study is important because it represents a potentially cost effective strategy for decreasing perceptions of stress in employees in high stress occupations.

## BACKGROUND

While a growing number of institutions, including the US Department of Justice, offer massage in the workplace, there are limited data reported on the benefits of massage in high stress work environments. Health care environments have traditionally been associated with high occupational stress and recent changes in the health care environment have resulted in increased job stress, placing health care workers at risk for significant untoward physiological and psychological effects.

Health care organizations, in the face of frequent changes, widespread uncertainty, and increased competitiveness, need to consider the impact of these changes on employee work stress and foster the development of strategies to promote employee wellness (Erbin-Roesemann & Simms, 1997; Jenkins & Rogers, 1997; Kennedy & Grey, 1997). This study is of importance to both health care employees and health care organizations because it represents a potentially low risk strategy for coping with the effects of job stress.

### Literature review

#### *Mind–body connection*

The use of alternative therapies, such as acupressure and massage, has re-emerged in recent years as a strategy leading to multiple favorable health outcomes. In the late 1970s, George Engel (Engel, 1974), introduced a bio-psycho-social model of health and illness. This model states that health is an outcome with multiple integrated components such as genetics, lifestyle, attitude, environment, and social relationships. The stress response is one example of how the integration of biological, psychological and social factors affect health. When faced with an acute challenge or threatening situation, the body responds by initiating the fight or flight reaction which prepares the body to function at a higher level of efficiency. As a result, the body initiates a complex physiological response which includes an increase in blood pressure and heart rate, increased oxygen

consumption, and increased muscle tension (Jenkins & Rogers, 1997; Murphy, 1996). While each of these responses is intended to protect the body, prolonged exposure to stress can result in physiological and psychological problems.

Conversely, in 1976, Benson demonstrated a pattern of changes known as the relaxation response. Physiologic changes included in the relaxation response show reversal of the acute stress response with corresponding reductions in blood pressure and heart rate, decreased oxygen consumption and reduced muscle tension. This response provides a framework for examining the effect of various relaxation therapies such as, massage, acupressure and reflexology, on work related stress.

A variety of psychologically related measures such as anxiety, depression, and coping skills have been associated with job stress (Cady & Jones, 1997; Jenkins & Rogers, 1997). Fatigue has also been linked to job stress as the result of high demands or workload (Labyak & Metzger, 1997). In a study of over 11,000 health care workers Hardy et al. (1997) found significantly higher levels of fatigue than expected and found that work demands predicted additional general fatigue.

### *Responses to massage*

Although there are a wide variety of massage therapy techniques, each with their own cultural and theoretical perspectives, proponents suggest that beneficial outcomes in response to most, if not all types of massage include: improved blood flow, release of muscle tension, improved musculoskeletal structure and function, and a reduction in the perception of stress (Benson, 1976; Jacobs, 1996). While there are anecdotal reports of the aforementioned benefits, there are few systematic investigations to determine the effects of massage on physiological, psychological and organizational outcomes. A meta-analysis of previous studies of the physiological benefits of massage showed reductions in blood pressure and heart rate (Cady & Jones, 1997). One study of 50 healthy adults demonstrated that massage therapy leads to improved concentration and mood, lower anxiety and depression, increased alertness as measured by electroencephalogram, and decreased salivary cortisol levels (Field et al., 1997).

Musculoskeletal injuries, one of the most frequent work related injuries reported by nurses, may be caused by fatigue, lifting or work overload (Seago & Faucett, 1997). Massage reduces muscle tension and tonic contraction, decreasing both postural and muscle imbalances that can lead to muscle fatigue and injury. Massage therapy is purported to affect both the structure and function of the musculoskeletal system by promoting the relaxation response and reducing muscle tension and fatigue while improving posture (Benson, 1976). The integration of these improvements

in the musculoskeletal system, in turn, may lead to greater ease of body movement, wider range of motion, and greater flexibility, resulting in decreased musculoskeletal injuries.

Given this theoretical framework, the research hypotheses of this study were:

1. Employees who receive WSAM (work-site acupressure massage) will exhibit decreased absenteeism, work related injuries, sleep disturbances, perceptions of fatigue and anxiety when compared with a control group.
2. Employees who receive WSAM will exhibit decreased blood pressure, heart rate and somatic complaints when compared with a control group.
3. Employees who receive WSAM will have improved cognition, mood, well-being, and job satisfaction when compared with a control group.

## METHODS

While there are limited data on the effect of massage on selected physiological and psychological outcomes, the effect of massage on organizational factors, such as job satisfaction and work-related injuries, has not been reported. For purposes of this study, the psychological variables of interest included measures of the perceptions of mood, anxiety, fatigue, sleep disturbances as well as measures of cognitive function. The physiologic variables of interest included blood pressure, both systolic and diastolic, as well as heart rate and measures of somatic complaints such as fatigue and muscle tension. Organizational outcomes were addressed in measures of employee job satisfaction, work-related injuries and absenteeism.

### Design/sample

The study design was a randomized, controlled experimental investigation. Male and female health care workers ($n = 100$) between the ages of 25 and 60 years were recruited to participate in this study. Anticipating a moderate effect size, power analysis (power = 0.8, $p = 0.05$) confirms this was an adequate sample for a clinically relevant effect (Cohen, 1988). In order to control for the effect differences in management style might have, subjects were recruited from purposively chosen units within the organization. Health care personnel in units supervised by the same manager, were randomized by unit to participate in either the treatment or control group. The massage therapy group ($n = 50$) received WSAM, twice weekly for 20 minutes, while the control group ($n = 50$) did not receive any specific intervention during break times of equal duration.

## Procedures

Approval for the study was obtained from the hospital's institutional review board. All participants gave written, informed consent prior to entering the study. Staff were recruited after meeting with members of this research team. The gender and ethnic composition of the sample reflected a diverse population.

Subject inclusion criteria were: (1) agreement to no change in life style during the eight-week period of the protocol. This included no changes in normal patterns of exercise, diet, rest, or alternative therapies. Subject exclusion criteria were: (1) presence of an infection during the previous two weeks and (2) employees who receive regularly scheduled massage therapy. In order to control for hormonal effects associated with menstruation, all pre-menopausal women in the control and treatment group began the study between menstrual cycle days 5 and 11.

## Treatment

The WSAM procedure was provided by certified massage therapists, who were trained in the specific protocol. Each subject in the experimental group received a 20-minute massage, twice weekly for a period of eight weeks. The massage was scheduled in the later half of the employee's shift. Subjects were fully clothed and the massage consisted of a blend of traditional massage, acupressure, and reflexology.

The massage protocol included bodywork on the upper to middle back, back of the neck, the face, upper chest, shoulders and feet. Deep tissue massage was not used during any part of this protocol. The first area to be worked was the back of the neck, the shoulders, and the region below the shoulder blades. Treatment consisted of applying light to medium pressure in each area for one minute in a circular motion. The face and upper chest area were worked using acupressure, which consisted of light finger and thumb pressure. Each point was worked for a slow count of 10. Foot reflexology was used to reduce stress by applying medium pressure in an alternating pattern starting just below the toes and working down to the heel and back to the base of the toes. In addition, each toe was worked, again using medium pressure.

Subjects in the control group were expected to take a 20-minute break twice weekly without WSAM treatments. A quiet room was provided where subjects in the control group could remove themselves from the work environment. Investigators met with the control group at least every other week to monitor subjects for compliance with study procedures.

## Outcome measures

Baseline demographic and health history data for each subject was obtained prior to initiating the treatment. In addition, at the beginning of the study, and on completion of the study, subjects completed the General Well-Being Scale, Profile of Mood States, State-Trait Anxiety Inventory, Multidimensional Fatigue Inventory, General Sleep Disturbance Scale and Index of Work Satisfaction questionnaires. Data were also collected on work related injuries and absenteeism.

### *Psychological measures*

The General Well-Being Scale (GWBS) was used as a measure of subject mood before and after the eight week study intervention. The GWBS contains subscale measures of depression, emotional control, emotional ties, affect, and anxiety. Adequate concurrent validity and internal consistency has been reported ($r = 0.90$).

The State-Trait Anxiety Inventory (STAI) was used to measure the subject's perception of anxiety, pre and post eight week treatment intervention (Spielberger, 1983). The STAI is one of the most frequently used instruments for measuring anxiety. Both components of the STAI have demonstrated good reliability. Concurrent validity has been demonstrated through correlation with another anxiety index ($r = 0.85$) and the adjective checklist ($r = -0.54$).

The Multidimensional Fatigue Inventory (MFI-20) was used to evaluate the perception of fatigue pre and post eight-week treatment intervention. This 20-item questionnaire provides scores for general fatigue, physical fatigue, reduced activity, reduced motivation and mental fatigue. The MFI-20 has demonstrated both construct and convergent validity and shows good internal consistency (Smets et al., 1995).

The General Sleep Disturbance Scale (GSDS) was used to evaluate sleep patterns pre and post eight week treatment intervention. The GSDS is a 21-item questionnaire which measures the use of substances to aid sleep, sleep quality, sleep quantity, frequency of awakening, and sleepiness. The GSDS shows good internal consistency (Chronbach's alpha = 0.88) (Lee, 1992).

The Symbol Digit Modalities Test (SMDT) was used to measure cognition in both the control and treatment group. The SMDT is a 90-second timed instrument which provides useful indices of normal capacities in testings of adults as well as improvement resulting from specific therapeutic interventions. The treatment group completed the SMDT prior to and immediately following massage in weeks one, four, and eight. Construct validity has been demonstrated with selected factors of the Weschler Performance and Verbal IQ tests.

### *Physiological measures*

Physiological outcomes of interest included blood pressure, heart rate, and somatic complaints such as headache, backache, etc. Before and after each massage therapy session for the treatment group, and every other week for the control group, systolic and diastolic blood pressure as well as heart rate were measured using a Dyna-Map. The Dyna-Map is a non-invasive instrument which can be used to obtain each of these readings with minimum operator error. Prior to the start of the study each Dyna-Map was calibrated per manufacturer's recommendations. The massage therapists were trained in the use of the Dyna-Map, thus controlling for measurement errors as the result of discrepancies in the skill level of those obtaining these measures. In addition to the objective measures of blood pressure and heart rate described above, subjects were asked to rate symptoms or feelings he/she had, such as fatigue and anxiety as well as somatic complaints such as headache and backache immediately prior to and following each WSAM treatment, as well as weekly in the control group.

*Somatic complaints* were assessed before and after treatment using a 10-point Likert scale. Subjects were asked to rank their level of fatigue, muscle tightness, and overall health on a scale of 0 to 10, with 0 indicating absence of the attribute and 10 indicating the maximum level of the attribute.

### *Organizational measures*

The Index of Work Satisfaction (IWS) is a two-part questionnaire developed to evaluate job satisfaction in nurses pre and post eight-week treatment intervention. Alpha reliability for the Index of Work Satisfaction is reported as 0.85 (Stamps, 1997).

## RESULTS

Data analysis was carried out using SPSS, version 9.0 (for computerized statistical analysis). Descriptive statistics, including frequencies, means, and standard deviations were analyzed. Inferential statistics included one-tailed *t*-tests to determine pre and post study differences. For purposes of this study, a $p$ value less than 0.05 was considered significant.

## Demographic data

Table 9.1 shows the demographic and health data for the study participants in the experimental and control groups. A total of 100 subjects initially participated in the study, but not all post-study instruments were completed. There were 89 subjects who completed all of the pre and post study instruments. Reasons given for non-compliance included being too

**Table 9.1** Demographic data

| Demographics | Control group | Treatment |
|---|---|---|
| Age | Mean = 41.5 ± 8.7 | Mean = 41.6 ± 7.7 |
| Gender | Males = 8 | Males = 7 |
| | Females = 24 | Females = 48 |
| Ethnicity | White = 24 | White = 43 |
| | African American = 1 | African American = 1 |
| | Hispanic = 3 | Hispanic = 4 |
| | Asian = 4 | Asian = 4 |
| | Other = 1 | Other = 3 |
| Overall health rating (1–3) | Mean = 1.8 ± 0.70 | Mean = 1.7 ± 0.52 |
| Smoking history | Yes = 3 | Yes = 7 |
| | No = 30 | No = 49 |
| Personal use of alternative therapies | Yes = 19 | Yes = 27 |
| | No = 14 | No = 29 |

busy, forgetting, or misplacing some of the instruments. Compliance was poorest among those subjects in the control group, even though, as an incentive, a one-hour massage was offered to the control group upon completion of the study.

The mean age for the sample was 41.6 ± 8.1 years. Ten of the 89 subjects were smokers. Sixty-five subjects reported that they regularly exercised. Chi-square analysis showed no significant differences between the control group and treatment group for gender ($p = 0.15$), marital status ($p = 0.80$), ethnicity ($p = 0.27$), overall health ($p = 0.26$), smoking ($p = 0.45$) or personal use of alternative therapies ($p = 0.26$). No significant differences in demographic data were noted in subjects who did not complete the study.

Health care workers at this institution generally work a 12-hour shift. Forty-four of the participants worked a 12-hour day shift, while 31 participants worked a 12-hour night shift. Fourteen of the subjects worked an 8-hour day shift. For subjects working a 12-hour shift, the treatment occurred between the $7^{th}$ and $9^{th}$ hours of their shift. For subjects working an 8-hour shift, the treatment occurred during the later half of their shift. All participants in the experimental group completed a minimum of 14 of the 16 scheduled massage therapy sessions.

In relation to the first hypothesis (Table 9.2), which looked at perceptions of mood, the treatment group demonstrated significant decreases in both state anxiety ($t = 2.4$, $p = 0.009$) and trait anxiety ($t = 1.7$, $p = 0.04$). The General Well-Being Scale was used to measure subject's perception of overall health. Subjects in the treatment group reported significantly decreased levels of anxiety ($t = 2.8$, $p = 0.003$) and depression ($t = 2.0$, $p = 0.024$), as well as significantly increased feelings of emotional control ($t = 1.9$, $p = 0.029$) and positive affect ($t = 1.9$, $p = 0.029$) when compared

**Table 9.2** Comparison of differences in pre- and post-treatment scores between the control group and the treatment group (pre-test score minus post-test score)

| Variable | Control group Mean ± SD | Treatment group Mean ± SD | Significance (1-tailed) |
|---|---|---|---|
| State anxiety (high score = high anxiety) | 0.93 ± 12.1 | 7.7 ± 11.9 | $t = 2.4$ $df = 78$ $p = 0.009$ |
| Trait anxiety (high score = high anxiety) | 3.2 ± 13.7 | 8.4 ± 11.3 | $t = 1.8$ $df = 74$ $p = 0.04$ |
| GWB anxiety (high score = high anxiety) | −0.15 ± 5.1 | 2.7 ± 4.4 | $t = 2.8$ $df = 85$ $p = 0.003$ |
| GWB depression (high score = low depression) | 0.33 ± 2.5 | 1.3 ± 2.6 | $t = 1.7$ $df = 85$ $p = 0.05$ |
| GWB emotional control (high score = high emotional control) | 0.84 ± 4.2 | −2.3 ± 4.2 | $t = 1.61$ $df = 85$ $p = 0.05$ |
| General sleep disturbance? (high score = high sleep disturbances) | −1.9 ± 11.7 | 7.3 ± 11.9 | $t = 2.9$ $df = 60$ $p = 0.02$ |

with the control group. No significant differences were observed for the subscales of anger, confusion, or fatigue.

A significant decrease in perceived sleep disturbances was noted for subjects in the treatment group, working 12-hour shifts ($t = 2.9$, $p = 0.005$); while no differences in perceptions of sleep disturbances were noted in subjects working 8-hour shifts.

The Multidimensional Fatigue Inventory was used as a measure of the dimensions of general fatigue, physical fatigue, mental fatigue, reduced motivation, and reduced activity. For each of these subscales, no significant differences were noted between the control and treatment groups.

The massage treatment group exhibited a significant decrease between pre- and post-treatment systolic blood pressure ($t = 2.7$, $p = 0.014$) and pre- and post-treatment diastolic blood pressure ($t = 4.0$, $p = 0.000$) when compared with the control group. No pre- and post-treatment differences were noted in subject's heart rate. In addition significant differences were noted between the pre-treatment and post-treatment systolic blood pressure ($t = 68.4$, $p = 0.002$) and between the pre-treatment and post-treatment heart rate ($t = 142.3$, $p = 0.000$) of subjects in the massage treatment group. No significant differences were noted between the pre-treatment and post-treatment diastolic blood pressure for this group ($t = 24.7$, $p = 0.39$). In other words, subjects in the treatment group had a greater decrease in blood pressure readings between the blood pressure taken before massage

and that taken after massage, than did the subjects in the control group who had their blood pressure taken before and after a rest break. The subjects in the treatment group also had a greater change when comparing each subject's blood pressure and heart rate from before massage or break with after massage or break.

The massage treatment group exhibited significantly improved differences in cognition scores, as measured by the SDMT, when compared with the control group ($t = 3.8$, $p = 0.000$). In addition, significant improvement in cognition occurred between pre-treatment and post-treatment ($t = 144.8$, $p = 0.000$) for subjects in the massage treatment group.

Significant improvements in overall health rating ($t = 326.4$, $p = 0.000$) were noted for subjects in the treatment group. In addition, for this group, significant decreases in subject's perception of muscle tightness ($t = 914.3$, $p = 0.000$) and overall fatigue ($t = 227.8$, $p = 0.000$) were noted between the pre-treatment and post-treatment measures. No differences were noted for other somatic complaints.

In relation to job satisfaction, subjects completed the Index of Work Satisfaction (IWS) prior to and at the end of the study. Results demonstrate that prior to beginning the study, IWS scores were lower for the treatment group (IWS = 13.1) than for the control group (IWS = 14.4). Upon completion of the study, IWS scores remained consistent for the treatment group (IWS = 13.4), while the control group demonstrated a decrease in scores (IWS = 12.7). Chi-square analysis of absenteeism showed no differences between the treatment group and control group ($p = 0.7$).

During the three months in which the study was conducted, there was only one work related injury reported among the subjects enrolled. Therefore, it is not possible to draw inferences on the effect of WSAM on work-related injuries.

## Limitations

Limitations in the study design are related to (a) generalizability, and (b) sampling. A convenience sample of subjects from a large university teaching hospital located on the west coast was used. Results from a Robert Woods Johnson Foundation survey found that subjects in the west were more likely to utilize alternative therapies (Paramore, 1997). Therefore, these results may not be generalizable to employees in areas less accepting of alternative therapies. In addition, increased managed care leading to changes in the health care environment may have contributed to a degree of stress that is greater than elsewhere. This, too, may affect the generalizability of the study findings to other health care environments.

In order to control for the effect differences in management style might have, subjects were recruited from units managed by the same supervisor.

As a result, there may be differences between the general population and the sample population, which may affect the findings.

## DISCUSSION

The purpose of this study was to investigate the effect of work-site acupressure massage (WSAM) on selected physiological, psychological/cognitive, and organizational outcomes. Previous research has shown that employees in high stress occupations are at risk for untoward psychological problems related to anxiety and depression, physiological problems such as hypertension and heart disease, and musculoskeletal problems, which may result in work related injuries. Downsizing, shorter patient stays, restructuring and layoffs add to the stress in health care environments. Employees responsible for providing health care are, therefore, at a greater risk for illness while health care organizations face problems of reduced productivity, absenteeism, accidents and injuries.

Results of this study demonstrate the benefits of work-site acupressure massage. Subjects in the experimental group exhibited decreased systolic and diastolic blood pressure. In addition, subjects in the experimental group exhibited decreased post-treatment systolic blood pressure and heart rate when compared with their pre-treatment systolic blood pressure and heart rate.

Subjects in the experimental group exhibited improved cognitive function, general well-being, as evidenced by decreased anxiety and depression, as well as increased emotional control and overall well being. In addition, participants reported a decrease in general sleep disturbances.

Although no improvement in employee job satisfaction was noted, subjects in the treatment group maintained their pre-study level of job satisfaction, while subjects in the control group demonstrated a decrease in their level of job satisfaction. This may be explained in part by increases in patient acuity and hospital census, as well as decreases in staffing which occurred during the course of this study. An increase in job stress, as well as a decrease in job satisfaction is consistent with these changes. Subjects in the treatment group may have perceived less job stress as a result of WSAM and, therefore, did not exhibit a decrease in job satisfaction.

The effects of WSAM, as defined in this present study, are multiple, providing benefits to both the employee and the organization. Implications for future research include the need to look at the effect of WSAM on absenteeism and work-related injuries over a longer period of time and with a larger sample size. Additional research is also necessary to examine the association between health care workers, WSAM, and patient care delivery. Given the beneficial responses found, it is possible that these favorable outcomes might lead to improved patient care and patient care outcomes.

## ACKNOWLEDGEMENTS

*Partial funding for this study was received from the American Massage Therapy Association and Sigma Theta Tau, Zeta Eta Chapter.*

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# Index

*Numbers in bold refer to illustrations.*

## A



## B

## C



## D

## E



## F



## G



## H

## I



## J



## K



## L



## M

## N



## O



## P

## Q



## R



## S

## T



## U



## V



## W

## X



## Z