Title of Dissertation: THE EFFECT OF YOGA AND RELAXATION TECHNIQUES ON OUTCOME VARIABLES ASSOCIATED WITH OSTEOARTHRITIS OF THE HANDS AND FINGER JOINTS

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A Dissertation
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by
Marian S. Garfinkel
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ABSTRACT

THE EFFECT OF YOGA AND RELAXATION TECHNIQUES
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OSTEOARTHRITIS OF THE HANDS AND
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by Marian Garfinkel
Doctor of Education
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Osteoarthritis (OA), one of the rheumatic diseases that affects joints, muscles, and connective tissues of the body, is a chronic degenerative joint disease. It is practically universal in people over 65 years of age, and is not responsive to medical treatment.

OA leads to permanent loss of normally smooth articular cartilage. Systemic drug therapy can relieve pain, but has not been shown to alter the disease process. Movement therapy may be useful in relieving the OA symptoms, protecting the diseased joint(s), and strengthening the muscles around the joint(s), yet current therapy management is primarily directed toward pain control with use of pharmaceutical agents.
The purpose of this study was to examine the effect of a health education intervention based on yoga and relaxation techniques on patients with OA of the hands and finger joints. Six dependent variables were considered: (a) range of motion of the finger joints, (b) hand grip strength, (c) tenderness of the finger joints, (d) circumference of the finger joints, (e) hand pain, and (f) hand function.

Subjects were OA patients from the Philadelphia Veterans Affairs Medical Center, the Hospital of the University of Pennsylvania, private patients of Dr. H. Ralph Schumacher, Chief of Rheumatology at both hospitals, and respondents to newspaper ads. The treatment group received a yoga and relaxation program consisting of eight 60-minute weekly sessions. The control group received no program during the eight weeks. Both groups were measured on the dependent variables before and after the intervention.

Statistically significant differences (p < .05) were found between the two groups in pre-test minus post-test measurements for the variables of range of motion of the finger joints for the right hand, tenderness of the finger joints for both hands, and hand pain during activity. On each of these variables, the treatment group improved more than the control group. Findings suggest that a health education intervention based on yoga and relaxation may be an effective way to increase range of motion of the finger joints, decrease tenderness of the finger joints, and decrease hand pain during activity.
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To my many friends and colleagues who practice the art of yoga, and to Geeta and Prashant Iyengar.

To my beloved teacher and friend, Mr. B. K. S. Iyengar, who inspires me by his teaching and practice of yoga.

For nearly 20 years, I have been a student and practitioner of yoga. Because I am such a firm believer in the efficacy of the methods of Mr. B. K. S. Iyengar, I have undertaken this study to teach people how to achieve better health through yoga.

Since I have always been interested in hands, as I believe loss of hand function is accompanied by a loss of dignity and self-esteem, I have focused on OA of the hands and finger joints. My program has shown that those people who have received the intervention have benefitted significantly.

I hope the medical community will recognize my program as an alternative health care modality to treat OA without drugs or surgery.
DEDICATION

To my teacher

B. K. S. Iyengar
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CHAPTER 1
THE PROBLEM

Introduction

Osteoarthritis (OA), a degenerative joint disease, is a chronic disease and, so far, has no cure (Schumacher, 1988). Practically a universal problem, OA increases with age in frequency and symptomatology, and is not as responsive to medical treatment as one might wish (Lorig & Fries, 1986).

OA is the oldest joint disease recorded (Moskowitz, Howell, Goldberg, & Mankin, 1984). In the United States, 75 million people experience mild symptoms of OA in their joints and muscles from time to time, while about 3 million suffer with severe symptoms. Many people over 40 years of age have OA to some degree, but few have it badly enough to be disturbed by restricting symptoms (Peyron, 1984). OA is more common and severe, however, in people over the age of 65 years. Proper treatment can help relieve the symptoms and may prevent or correct serious joint problems, but is not adequate for patients with the more severe disease (Moskowitz et al.).

Thus, OA can be talked about either as a national problem that is usually relatively mild, or as an extremely severe problem that affects a smaller number of people. Nevertheless, the effects of OA and rheumatism (an imprecise
term that includes not only problems with the joints but any problems affecting the body's musculoskeletal system) cause more work loss, more pain, and more poor functioning in daily life than does any other kind of human illness (Fries, 1986).

OA is the most common type of arthritis. It begins as a biomechanical abnormality in cartilage that leads to irregularity of the joint surface with loss of normally smooth articular cartilage. Pain occurs predominantly upon use of the diseased joints and often is relieved by rest. A minor component is inflammation. Since no systemic drug therapy has yet been proven to alter this disease process, physical measures to protect the diseased joints, maintain motion, and strengthen adjacent muscles are important (Riggs & Gall, 1984).

Although it is true that the majority of patients with OA will have mild and relatively asymptomatic disease, there are significant disabilities associated with the disorder in patients in older age groups, in which the disease is eventually almost universal (Moskowitz et al., 1984). Much can already be done to help relieve symptoms related to OA, although present therapy remains symptomatic rather than specific (Moskowitz et al.). Current management is directed mostly at pain control with the use of pharmaceutical agents (Moskowitz et al.). Alternative treatment modalities are needed. Non-pharmacologic treatments would be especially
attractive as they would avoid the potential risks of drug therapy (i.e., dyspepsia, gastric ulcers, impaired renal function, and central nervous system disturbances seen with non-steroidal anti-inflammatory agents) (Moskowitz et al.).

Racial differences in prevalence and distribution of affected joints may be related to differences in occupation, lifestyle, and predisposing genetic factors. For example, epidemiologic studies have reported that southern Chinese, South African Blacks, and East Indians have a lower evidence of OA of the hip than European or American Whites. Genetic factors play a role in the development of OA of the distal interphalangeal joints of the hands (Heberden's nodes). The genetic mechanism appears to involve a single gene that is sex influenced and dominant in females, resulting in an incidence in women 10 times greater than in men (Moskowitz et al., 1984).

The pathogenic role of obesity contributing to OA remains controversial; however, a recent study based on data from the National Health and Nutrition Examination Survey (HANES) found that obesity was associated with OA of the knee, the strongest association being seen in women. The study also suggested that the principal reason for the association was the additional mechanical stress resulting from overweight (Hartz, Fischer, & Bril, 1986).
Several studies have described a relationship between bone density and OA. Patients with diminished bone mass are predisposed to development of femoral neck fractures; in contrast, increased bone mass is positively correlated with OA (Solomon, Schnitzler, & Browett, 1982).

Findings that relate OA to prolonged occupational or sports stress have been inconsistent. For example, in support of a relationship are findings that show increased severity of OA of the right hand in right-handed people (Acheson, Chan, & Clemett, 1970). Marathon runners, however, have no increase in OA as compared with controls (Puranen, Alaketola, Reltokallio, & Saarela, 1975).

Participation of millions of Americans in aerobic exercise has intensified interest in the question of OA and joint overuse. When compared with matched community controls, knee roentgenogram of long distance runners aged 50 years to 72 years showed a statistically significant increase in knee sclerosis suggestive of OA in females but not in male runners (Lane, Bloch, & Jones, 1986). In a similar study limited to male runners, long duration high-mileage running was not associated with premature degenerative joint disease in the lower extremities (Panush, Schmidt, & Caldwell, 1986). Both of these studies represent retrospective evaluations of the prevalence of OA in persons able to maintain active running. Additional long-term
prospective studies are needed and may provide more definitive information as to the safety of running as it relates to the development of OA.

The effect of strenuous aerobic exercise on joint symptoms was evaluated and compared with functional capacity and muscle strength among OA patients and very sedentary matched controls. Strenuous ergometer exercise did not exacerbate joint symptoms; isotonic leg extension and flexion as well as grip strength were diminished; subjects displayed low maximum oxygen consumption indicating reduced functional capacity. Acute bouts of strenuous exercise performed on a bicycle ergometer do not appear harmful to the non-acute OA patient (Beals et al., 1985).

Treatment and Coping

OA can occur at any age after joint abuse or trauma (Schumacher, 1988). Before planning treatment, it is important to consider current symptoms, get a proper diagnosis, and determine functional limitations or concerns that affect the patient. It is here, perhaps, that the health educator can work with the physician or therapist in helping the patient identify goals and needs and determine whether these are realistic. Some physical measures may be good for one purpose but have potential risk for others. Walking, for example, is good for general conditioning and should be continued in most elderly OA patients, even though potentially accelerating hip or knee disease (Schumacher).
OA causes more total work loss, pain, and poor functioning than does any other kind of human illness (Abraham, 1989). Because of the nature and extent of OA, there is an abundance of literature on the subject; new methods of treatment and coping are constantly being suggested. Medical professionals as well as health care professionals play an active role in recognizing the presence of OA. Ways of substituting healthy behavior patterns for old habits that may make the condition worse are needed. The increasing specialization and depersonalization of health care services, and the development and growth of The Arthritis Foundation have helped to shift the focus of treatment and self-management programs for coping with arthritis to the patient as well as the physician and health care professional (Abraham).

Presently there appears to be more cooperation between patients, physicians, and health care teams. The Arthritis Foundation is available to all of those who suffer and provides information, programs, and new management techniques. The literature on OA continues to grow as does the availability of courses on how to cope with the disease. Content of educational material varies widely; there is some emphasis on exercise in this material but nothing like a yoga-based intervention (H. R. Schumacher, personal interview, October 15, 1990).
It is important that any form of intervention or educational program be designed to help the patient recognize where there is a need for change, to develop the skills necessary to execute that change, and to recognize when change has occurred (Gerber & Hicks, 1984). Such a program could consist of a list of objectives and practice assignments designed to present the content of the program. This process will take time as changes in routine behaviors and lifestyles are gradually replaced by newly learned coping mechanisms (Gerber & Hicks).

Coping with the physical symptoms of OA and managing pain behavior is an area that needs to be addressed in a health education intervention. If the victim has allowed pain and pain behavior to change the way he/she looks at life, then making the turnaround is difficult. There are, however, alternative models to develop new habits of pain perception and reactions associated with it. (Abraham, 1989).

Need for the Study

The literature on OA research and education has increased vastly in the past 10 years. Common to most of the published works is the stated need for more research in the field. Interventions have been developed to improve the education of physicians, health care professionals, and sufferers of OA, as well as lay people. Some adjunct therapies have shown some impact and seem to relate to
general improvement of the condition of OA of the hands. For example, improvement of OA of the hand was evident when an occupational therapist participated in the management of this disease (Moratz, Muncie, & Miranda-Walsh, 1986).

The health education intervention of this study is based on yoga and relaxation techniques to affect physiological variables including the following: (a) range of motion of the finger joints, (b) hand grip strength, (c) tenderness of the finger joints, (d) circumference of the finger joints, (e) hand pain, and (f) hand function in patients with OA of the hands and finger joints. The program encourages a positive frame of mind regarding OA for those who are afflicted with the disease. In addition, the program is designed to prepare these individuals to deal with the disease in their own lives. It is also intended to reduce perceived pain and help the patient feel better. Since this particular program has not been presented before, no empirical data on the effects of the program have been published.

Pilot observations indicated that the subjective reactions of participants to the health education intervention were favorable. Thus, it was important to measure the impact of this intervention quantitatively and to look at the appropriateness and safety of treatment. The
focus of the health education intervention was to provide a learning environment to positively affect key variables associated with OA of the hands.

Although this study was developed primarily to study a health intervention on the physiological functioning of OA of the hands and finger joints, it may also contribute to the larger body of knowledge about OA. The study was conducted to explore self-health care education and the effects of a positive attitude and purpose in life.

**Statement of the Problem**

The purpose of this study was to examine the effectiveness of a health education intervention based on yoga and relaxation techniques on physiological variables including: (a) range of motion of the finger joints, (b) hand grip strength, (c) tenderness of the finger joints, (d) circumference of the finger joints, (e) hand pain, and (f) hand function in patients with OA of the hands and finger joints. It was the premise of this study that a health education intervention program based on yoga and relaxation techniques would have a physiological effect on patients who have been diagnosed with OA of the hands. Since health education has been shown to exert a beneficial influence on other conditions such as medication use and outpatient visits (Lorig, Kraines, & Holman, 1981), it is expected that an intervention designed to affect the condition of OA will increase range of motion of the finger joints, hand grip
strength, and hand function, and decrease tenderness of the finger joints, circumference of the finger joints, and general hand pain. It may reduce the amount of stress and enhance coping abilities of those who receive it.

It is assumed, then, that a health education intervention program (independent variable) would affect: (a) range of motion of the finger joints, (b) hand grip strength, (c) tenderness of the finger joints, (d) circumference of the finger joints, (e) hand pain, and (f) hand function (dependent variables) in a sample of patients with OA of the hands and finger joints. Other factors (control variables) which might be confounding are the following: (a) age, (b) sex, (c) employment, (d) duration of disease which may influence physical or psychological abilities for health education intervention, and (e) motivation to continue the program. These factors, however, may be controlled by random assignment.

Hypotheses

The null hypotheses are:

$H_{01}$. There will be no statistically significant differences between the health education intervention group and control group on changes (post-test minus pre-test) in measurement of range of motion of the finger joints in patients with OA of the hands and finger joints.
$H_{02}$. There will be no statistically significant differences between the health education intervention group and control group on changes (post-test minus pre-test) in measurement of hand grip strength in patients with OA of the hands and finger joints.

$H_{03}$. There will be no statistically significant differences between the health education intervention group and control group on changes (post-test minus pre-test) in measurement of tenderness of the finger joints in patients with OA of the hands and finger joints.

$H_{04}$. There will be no statistically significant differences between the health education intervention group and control group on changes (post-test minus pre-test) in measurement of circumference of the finger joints in patients with OA of the hands and finger joints.

$H_{05}$. There will be no statistically significant differences between the health education intervention group and control group on changes (post-test minus pre-test) in measurement of hand pain in patients with OA of the hands and finger joints.

$H_{06}$. There will be no statistically significant differences between the health education intervention group and control group on changes (post-test minus pre-test) in measurement of hand function in patients with OA of the hands and finger joints.
Operational Definitions

1. Range of motion at the distal interphalangeal and proximal interphalangeal finger joints was evaluated with a goniometer (a calibrated instrument that allows recording of maximum extension and flexion) giving the total range of joint motion on a scale of 0 to 120 in degrees.

2. Hand grip strength reflecting both hand and finger strength was evaluated with a hand grip meter giving the total range of strength in Kg. One value was obtained for each hand. (Higher numbers indicate greater strength.)

3. Tenderness of the finger joints was measured by the amount of pressure recorded on a pressure gauge (dolorimeter) that produces pain at each study joint. A single value was obtained for each joint at examination where the possible range of values is 1 to 10 recorded in Kg. (Higher numbers indicate decreased tenderness.)

4. Circumference of the finger joints was evaluated with a ring sizer. Each joint was recorded and evaluated separately before and after the intervention. (Smaller numbers indicate decreased circumference.)

5. A visual analogue scale graded from 0 (no pain) to 10 (maximum imaginable pain) was used for subjective hand pain.
6. Hand function was assessed by the validated Stanford Hand Assessment Questionnaire (HAQ) which reliably detects changes in daily activities related to the hand. A score ranging from 3 to 0 was recorded. (The lower the score, the better the function.)

**Conceptual Definitions**

1. Health education intervention—an educational program composed of exercises for hands, arms, shoulders, and relaxation techniques based on yoga techniques designed to focus specifically on the effect of (a) range of motion of the finger joints, (b) hand grip strength, (c) tenderness of the finger joints, (d) circumference of the finger joints, (e) hand pain, and (f) hand function in patients with OA of the hands and finger joints who participated in the study.

2. Yoga—a system of Hatha Yoga in which special focus is placed on developing strength, endurance, and correct body alignment. It is based on the teachings of a yoga master, Mr. B. K. S. Iyengar, who lives in Pune, India.

3. Criteria for diagnosis of OA—bony enlargement with either limitation of motion or tenderness at the distal interphalangeal and proximal interphalangeal joints of the hands evaluated by (a) range of motion of the finger joints measured with a goniometer, (b) hand grip strength measured with a hand grip meter, (c) tenderness of the finger joints measured with a dolorimeter, (d) circumference of the finger
joints measured with a ring sizer, (e) hand pain in patients with OA of the hands and finger joints measured by the visual analogue scale, and (f) hand function measured by the Stanford HAQ. All patients entered in this study also had to have pain quantifiable on the visual analogue scale (H. R. Schumacher, personal communication, December 11, 1990). Patients with other diseases of joints were excluded.

Delimitations

1. This study was delimited to a health education program based on yoga and relaxation techniques, which is a specific intervention for OA of the hands and fingers designed by this researcher. Therefore, findings of this study may not be generalizable to other OA health education interventions or practitioners.

2. Because the research subjects were self-selected, the findings of this study were only applicable to individuals who volunteered to participate in a health education intervention based on yoga and relaxation techniques.

3. Because OA of the hands and fingers occurs predominantly in persons over 40 years of age, this study was delimited to persons over age 40.
CHAPTER 2
REVIEW OF LITERATURE

This chapter presents a review of the representative literature used in the formulation of the research questions and hypotheses previously discussed. It has been conducted to develop a theoretical basis for a health education intervention based on yoga and relaxation techniques for patients with osteoarthritis (OA) of the hands and finger joints. The intervention was designed to increase (a) the range of motion of the finger joints, (b) hand grip strength, and (c) hand function, as well as to decrease (a) the tenderness of the finger joints, (b) the circumference of the finger joints, and (c) hand pain. This intervention has also been designed as an alternative mode of therapy to drug treatment and surgery. The variables involved pertain to OA of the hands and finger joints. This study seeks to establish the basis for the health education intervention.

Introduction and Organizational Structure

Literature in the field of arthritis research has rapidly expanded in the past 10 years. Major research published by the Arthritis Foundation (Schumacher, 1988) has defined the scope and process of the disease in addition to developing arthritis-related classifications and
rehabilitative programs. Today, OA is the most common rheumatic disease, affecting an estimated 40.5 million adults in the United States alone (Meisel & Bullough, 1984).

Given the plethora of information available in the field of OA, this review covers only the literature and research most pertinent to this study. The review of literature relates only to the hypotheses under investigation and in no way encompasses all variables that may be associated with the disease.

This chapter is organized in the following manner:

1. The first section of the review deals with (a) past and present OA research; (b) the disease process, assessment, current therapy, and intervention; (c) rehabilitation; and (d) measuring devices used.

2. The second section covers (a) the subject of yoga, its history and philosophy; (b) research that has examined the use of yoga in relation to pain management and healing; and (c) yoga and arthritis.

OA: Past and Present Research

OA is one of the major health problems today because of its relatively persistent progressive nature which contrasts with many other diseases in persons in the first 50 years of life. The recognition at the end of the 19th Century of OA as a separate type of chronic arthritis was a step forward, and the history of its development as a concept has been often recounted (Bollet, 1969). Bywaters (1984) emphasized
that increased longevity due to better social conditions, antibiotics, and so forth have placed much more importance on diseases of the aged such as OA. Moskowitz et al. (1984) found it surprising that not one textbook had been published until his book in 1984 as a comprehensive resource bringing together clinical aspects of this common and important disorder.

The first epidemiologic studies of OA appeared in the 1920s and endeavored to evaluate patients with this disorder who appeared for medical care. Although these early studies had obvious limitations in design, studies in the 1950s utilized more thorough population sample surveys and included people not limited to those seeking medical advice, and permitted the evaluation of the overall prevalence of this and other rheumatic conditions (Kellgren & Moore, 1952).

OA, the most common form of arthritis, influences a person's mental well-being, ability to work or perform activities of daily living, and personal and family relationships. Ideally, management of this disease is multidisciplinary, involving not only the uses of medication, but also exercise instruction, dietary counseling, and psychosocial intervention (Berger, 1981). The effects of such a comprehensive program have not been well-studied; however, in a 12-week trial of multidisciplinary assessment and management of OA conducted
by Muncie (1986), 80% of patients had improvement in their OA and 71% improved in their ability to conduct activities of daily living at the end of the trial. A comprehensive approach to OA could significantly reduce disability and pain (Muncie). Moratz et al. (1986) indicate that OA of the hand is associated with considerable disability, more so in women than in men, and that improvement is evident when an occupational therapist participated in the management of this disease.

Patients may also, however, respond very well to adjunct treatments such as drug therapy, which have shown some marked results. Vavra, Laronche, Chainz, and Hedrick (1988) studied ketoprofen, a drug widely used in the treatment of arthritic diseases to treat OA. Patients who had taken this medication have shown an overall improvement in morning stiffness, and even some improvement in joint tenderness and swelling. However, there are still some common adverse effects such as gastrointestinal disorders and dyspepsia.

Drugs may moderate or control the symptoms of arthritis, but they probably do not alter its course. Acetylsalicylic Acid (aspirin) is generally satisfactory and effective. Chrisman (1969) studied the effects of aspirin on cartilage metabolism, and suggests that salicylates may inhibit the catabolic enzymes in cartilage and protect it to some degree from degeneration. Swanson and Swanson (1985)
noted that aspirin should be considered as medication and is most effective when a dose of 0.6 to 0.9 grain is taken regularly with milk after meals to minimize possible irritation to the gastric mucosa. Buffered or enteric-coated tablets may be used if plain aspirin is not suitable.

Safety and convenience are the two main criteria in choosing a non-steroidal anti-inflammatory drug from the many drugs available. It is sensible to use the safest and best-tolerated drug first, and to use drugs that have convenient once- or twice-daily dosage requirements (Swanson & Swanson, 1985). Non-steroidal anti-inflammatory drugs have become important items in the drug armamentarium. OA may be regarded now as a low-grade inflammatory polyarthritis that may often benefit from drug therapy, and not as a wearing-out process of the joints.

Recently, to promote uniformity in the reporting of OA, the Diagnostic and Therapeutic Criteria Committee of the American College of Rheumatology established subcommittees to develop classification criteria. Patients with OA were compared with a group of patients who had hand symptoms from other causes. Variables from the medical history, physical examination, laboratory tests, and radiographs were analyzed. All patients had pain, aching, or stiffness in the hands. Patients were classified as having clinical OA if, on examination, there was hard tissue enlargement involving at least 2 of 10 selected joints, swelling of
fewer than three metacarpophalangeal joints, and hard tissue enlargement of at least two distal interphalangeal joints. If the patient had fewer than two enlarged distal interphalangeal joints, then deformity of at least one of the 10 selected joints was necessary in order to classify the symptoms as being due to OA. The 10 selected joints were the second and third distal interphalangeal, the second and third proximal interphalangeal, and the trapeziometacarpal (base of the thumb) joints of both hands. Radiography was of less value than clinical examination in the classification of symptomatic OA of the hands (Altman et al., 1990).

OA: The Disease Process and Assessment

While many scientists search for better treatments for OA, others are looking for clues to the causes of the disease. Ehrlich (1975) observed that OA could begin with inflammation, while Joseph (1989), in a study of joint cartilage, reported that there are many possible initiating events for OA and that diseases can have different causes but one final path. He continued by discussing the destruction of joint cartilage, which appears to be the focus of much current OA research. Joint cartilage contains cells called chondrocytes, which create and are surrounded by a matrix of proteins. The most abundant protein in the matrix is collagen, which provides strength for the cartilage. Collagen fibers are linked together to create a
network that even destructive enzymes have a hard time destroying. In OA, however, the cohesion of this collagen network is diminished (Meisel & Bullough, 1984).

The other major component in the matrix is proteoglycan, which inflates the collagen network with water, providing the cartilage with resiliency. With OA, there is a loss of proteoglycans from the matrix, resulting in a loss in the cartilage's resiliency. This increases the stress on the joint, which further wears down the cartilage. Nimni (1974) reports that many researchers are studying collagen and proteoglycans, as well as the chondrocytes which create and replenish them. One particular area of interest is chondrocyte metabolism, which is the process by which chondrocytes are able to replenish the proteins in the cartilage matrix (Keiser & Sandsen, 1974).

Joseph (1989), while studying the repair effort in the bone adjacent to the cartilage, noted that cartilage repairs itself from the side nearest the bone. Other researchers looked at the enzymes that break down cartilage (Harris, Parker, Radin, & Krane, 1972). These enzymes, like the proteins in the cartilage matrix, are produced by chondrocytes. Some enzyme production is normal, but with OA, there may be an over-production of enzymes. It appears that researchers hope to find an agent that will inhibit these enzymes, and prevent damage from occurring (Harris et al.).
Not all OA research is being done at the cellular level. Radin (1976) observed that researchers also studied mechanical joint problems, such as trauma, motion, and the alignment of limbs, to learn more about how they relate to OA. Other researchers searched for serum markers (markers in the blood) that are specific to OA; the discovery of such markers could revolutionize the process of diagnosing OA (Lambert & Casoli, 1978). However, one of the problems with OA is that by the time the patient first comes to the doctor the disease is already quite advanced. Therefore, it may be very helpful to have a method of detecting joint damage early, even before the person has symptoms (Howell, Sapolsky, Pita, & Woessner, 1976).

In earlier epidemiologic studies, the relationship of OA to aging was a rather striking feature (Roberts & Burch, 1966). Lowman (1955) found that symptoms due to primary OA were relatively uncommon before 40 years of age. The frequency and severity of symptoms due to the primary form of the disease was found to increase progressively with age, so that OA was considered to be a major cause of symptomatic arthritis present in persons in the middle to older age groups (Lawrence, Bremner, & Bier, 1966). In studies of an English population comprising more than 2,000 individuals of mixed urban and rural origin, Lawrence et al. found a marked increase in frequency of severe OA. Heberden's nodes, for instance, have a prevalence of 29% in individuals between
the ages of 59 and 69, but the prevalence increases to 69% in the 75-year-old and over age group. Lawrence (1977) reported that several studies have shown that the age-related increment in the prevalence of OA applies particularly to multiarticular involvement in women over age 55.

OA disrupts and prevents the normal remodeling processes that constantly repair joint cartilage and underlying bone. Inactivity has been recognized as an important cause of OA joint deterioration (Bullough, 1970).

The specific joints affected by OA appear to vary somewhat depending on the age group studied. According to Peyron (1984), the site where OA is seen earliest is the first metatarsophalangeal joint, with significant numbers of cases present in individuals over 25 years of age. From age 35 on, OA begins to appear in the wrist and the spine. In subjects 45 years of age, the distal interphalangeal joints are likely to be involved, usually the index finger first, followed by other small joints of the hand (first carpometacarpal, metacarpophalangeal, and proximal interphalangeal joints).

In a study of males and females between the ages of 45 and 55 years, Mikkelsen, Duff, and Dodge (1970) observed that OA was found with equal frequency in both sexes, but over the age of 55, the disease occurred significantly more frequently in women. OA in females occurs not only more
frequently but is also more severe, as shown by the steeper increase in the severity index of OA of the fingers in women between 45 and 55 years of age when compared with that for men in the same age group. In another study by Lawrence et al. (1966), multiple involvement was also a feature more prevalent in OA in women, with 1.8% of women over 15 years of age displaying five or more joints involved, compared with 0.5% of men. In the 55 to 64-year-old age group, four or more involved joints were noted in 47% of women but in only 29% of men.

Peyron (1984) observed that the mechanisms by which the process of aging relates to the onset of OA appeared to be poorly understood. Factors that were possibly operative include minute anatomic changes of the joints, or biochemical or biomechanical alterations in the articular cartilage, which in turn compromise its mechanical properties.

OA in the hands typically affects the distal interphalangeal joints and the trapeziometacarpal joint of the thumb. The proximal interphalangeal joints may also be prominently involved, while the metacarpal phalangeal joints of the wrists, elbows, and shoulders are rarely affected in primary OA (Meisel & Bullough, 1984).

In most patients, joint involvement is limited to one or only a few joints. In some forms of the disease, however, such as primary generalized OA, symptomatic
involvement of a number of joints, including the hands, knees, hips, metatarsophalangeal joints, and spine, may be noted. Signs of joint involvement by OA are once again variable and depend on disease severity and stage and specific joint involvement (Lawrence et al., 1966).

The disease manifestations will often vary in presentation, depending on the specific joint involved. In patients with OA of the distal interphalangeal joints (Heberden's nodes) and proximal interphalangeal joints (Bouchard's nodes) of the hands, osteophyte formation at the dorsolateral and medial aspects of the joints is prominent. Flexion and lateral deviations of the distal phalanx are common. In some patients, Heberden's nodes (first noted as a painless asymmetric enlargement of the dorsomedial or dorsolateral aspect of the distal joint of one finger) develop with little or no pain over a period of many years. In other patients, OA involvement of these joints is associated with a marked inflammatory response. Small gelatinous cysts that appear on the dorsal aspects of the distal interphalangeal joints may be relatively asymptomatic and may be of concern to the patient mainly because of cosmetic effects. In other patients, these cysts become painful and inflamed and lead to significant disability. Progressive lateral deviation of the interphalangeal joints generally leads to a snake-like configuration of the hands (H. R. Schumacher, personal communication, December 11, 1990).
Often, a small non-tender cystic swelling just proximal to the fingernail may herald an underlying, asymptomatic osteoarthritic osteophyte. The cyst may reach a diameter of 2 cm and extend proximal to the distal interphalangeal extension crease. The overlying skin is thin, virtually translucent, and may rupture. A viscous, clear fluid with the consistency of currant jelly will escape. This fluid is identical to the contents of a typical ganglion cyst. Smith (1984) observes that osteoarthritic mucous cysts often are not painful, and the patient's chief complaint is likely to be displeasure with the cyst's appearance or with the appearance of the fingernail just distal to it. The bony swelling about the distal joint slowly enlarges, and soon the distal joints of the thumb or other fingers are involved, there may be occasional aching pain in addition to the disfigurement. Smith further points out that with advancing OA, joint cartilage is lost, osteophyte increase in size, and the supporting terminal tendon of the extensor aponeurosis and the joint ligaments stretch.

OA of the distal interphalangeal joint may follow a fracture of the base of the distal phalanx. This is most common after a "mallet finger" fracture of the dorsal lip of the base of the distal phalanx that follows an acute flexion injury. In contrast to Heberden's nodes, secondary distal interphalangeal joint OA is more likely to occur in younger patients, and the deformity is symmetric. There is uniform
bony swelling transversely at the level of the distal interphalangeal joint extension crease. Rarely is more than one finger involved (Schumacher, 1988).

Many patients request removal of a Heberden's node for aesthetic reasons. If there is no joint space narrowing, subluxation, or instability at the distal interphalangeal joint and if the patient has no complaints of pain, such surgery may be justified. Smith (1984) advises that the patient be warned, however, that the operation will not significantly alter the progress of the disease, and that there may be the possibility of further joint changes.

For most patients with primary OA of the distal interphalangeal joints, treatment is conservative. Small plastic or aluminum foam splints may be applied to a swollen, tender joint as protection when the patient is engaged in manual activities. Nonsteroidal anti-inflammatory medications are often helpful. Although there is no reason to use systemic steroids, local steroid injections intra-articularly or into inflamed para-articular tissues may be beneficial (Smith, 1984).

In OA of the interphalangeal joints, the major difficulties arise from pain with activity and decreased hand function. Heat by immersion in warm water, paraffin wax treatments, or a recently introduced modality named fluidotherapy (increased heat application of liquid), followed by range of motion exercises can be employed to
relieve pain and increase joint mobility. Borrell, Parker, Henley, Masley, and Repinecz (1980) demonstrated that, when compared with paraffin and hydrotherapy, fluidotherapy generated higher intermuscular and intercapsular temperatures. Riggs and Gall (1984), however, found that the effectiveness of such external heating of joints on pain relief had not been established, although patients often report some short-term relief of pain.

With more advanced changes and functional disability, the joint may be treated by arthroplasty (plastic repair of a joint) or arthrodesis (fusion of the joint). Swanson (1972) emphasized that few surgeons favor arthroplasty, because the joint may remain unstable considering the stresses to which it is subject and the poor quality of the lateral supporting ligaments. Those surgeons who do favor arthroplasty may use a silicone implant, with stems inserted into both the middle and distal phalanges, or hemiarthroplasty using a silicone toe implant. It would appear that arthroplasty is least indicated in the index finger, where normal pinch exerts greater stress on the distal joint (Eaton & Malerich, 1980).

Smith (1984) observed that arthrodesis was the best way to correct the deformity and instability and to "cure" the pain of primary or secondary OA of the distal interphalangeal joint. There is little penalty in arthrodesing the distal joint, as postoperative function is
usually excellent. The hand can then be used for manual labor, for fine prehension, and even for typing and playing most musical instruments, provided the more proximal joints are normal.

Smith (1984) concluded that arthrodesis provides a painless and strong but immobile joint. For a manual worker, the strength of grip afforded by arthrodesis of the proximal interphalangeal joint may justify the lack of mobility. Most patients, however, are at an age at which strength of grip is not as important as dexterity. They would like to be able to handle a pen or a paintbrush, play cards, and use a golf club or tennis racket with comfort. For this reason, in most patients with OA, arthroplasty of the proximal interphalangeal joint is favored over arthrodesis.

In a study of tendon arthroplasty of the trapezio metacarpal joint, Froimson (1970) noted that replacement arthroplasty of the proximal interphalangeal joint had been used with varying success for more than 25 years. Lately, silicone implants have been most popular. Silicone was thought to be relatively non-reactive, and improvements in design and elastomer chemistry have increased the durability and flexibility of the implant. In all cases of replacement arthroplasty, the patient is cautioned that there is a chance that the implants may break and that the finger may have to be reoperated on in the years to come (Smith, 1984).
Deterioration begins in the joints but its functional impact can spread to affect the rest of the body. The results can be devastating: (a) joint pain, (b) immobility, (c) deformity, (d) weakness, (e) fatigue, (f) depression, (g) fear, (h) grief, and (i) dependency.

A cycle can begin with joint pain and swelling. Decreased use results in muscles that shorten from lack of stretching, creating deforming contractures. Unused muscles become weak, and this weakness, coupled with the stretched joint support structures caused by swelling, produce instability of the joints. Unstable joints are vulnerable to dislocation, further injury, and more pain (Schatz, 1985).

**OA: Rehabilitation**

Swezey (1978) advised that any diagnostic treatment or therapeutic procedure that was used in patient evaluation and management be considered a specific part of a rehabilitative process. Other general rehabilitation goals in treating patients with OA are: (a) to increase function (restorative goal); (b) to maintain current function (maintenance goal); and (c) to prevent dysfunction or preserve normal function (preventive goal) (Gerber & Hicks, 1984). Schatz (1985) suggested that modalities, such as adaptive devices, orthoses, exercises, environmental changes, and educational plans may be therapeutically employed to accomplish both general goals and more specific
goals. Specific goals include: (a) relief of pain; (b) maintenance of strength and range of motion; (c) preservation of energy; (d) provision of supportive measures; and (e) facilitation of coping with a change in functional status. Schatz suggested that effective use of any one treatment method or any combination of methods depends on thorough analysis of the patient's OA problem and the formulation of an individualized comprehensive rehabilitation treatment plan for that particular patient. This plan could be designed and agreed upon by the patient and the rehabilitation treatment team and could be reasonable and attainable.

Goodwill (1976), in a symposium on measurement in rehabilitation, discussed evaluation tools used in rehabilitation and how they were designed to answer questions about how much pain and how much change in strength and range of motion the patient has endured, how much financial and emotional impact the arthritic condition has had on the patient, and how the patient was managing daily activities. The measurements used attempt to be comprehensive, easy to perform, reproducible, informative, and useful in assessing the outcome of treatment. Although effort is focused on the musculoskeletal system, it is the juxtaposition of musculoskeletal performance with the patient's overall function in all aspects of life that is of greater concern to the rehabilitation team.
Rehabilitation intervention addresses the issues of prevention, restoration, and maintenance (Moskowitz et al., 1984). Treatment begins before the development of a disability, and the goal is to lessen the severity of the disability or to shorten its duration. When prevention is not possible, treatments may be designed to restore function, and the goal is to help the patient achieve a significantly better functional level. A treatment plan designed to maintain a particular level of function assumes that the patient will be left with a handicap, perhaps a progressive one, and has as its goal an increase in comfort and a decrease in complications. Not all patients, however, are able to accept treatment. Granger and Greer (1976), in a study of rehabilitative out-patients, found that accommodation to the patient on the part of the health care provider is essential; a compromise plan may be better than total rejection of an ideal plan.

The first goal is to control acute and chronic pain. Pain can have adverse effects on motor function by fostering decreased muscle activity, muscle atrophy, and osteopenia, which is often due to decreased muscle tension on bone. Additional complications of pain in terms of limiting musculoskeletal function include decreased joint range of motion, interruption of sleep and its effect on increasing fibromyalgia, and psychologic stress.
M. P. Schatz (personal communication, October 22, 1991) highlights the importance of maintaining the strength of the patient, and preserving functional level and to prevent further pain, weakness, and disability. It is also important that the patient be taught to conserve energy and avoid muscle fatigue so as to maximize function. When a muscle becomes fatigued, the joint is improperly supported, and as a result, increasing joint destruction may occur.

Another goal is to provide supportive measures, either adaptive equipment or some substitutive function, to compensate for a lost function on the part of the patient. Frequently, local measures are used for local problems, incorporating the use of heat and cold, orthoses or splints, and adaptive devices. It is important to provide the patient with enough information as well as certain behavioral adaptive strategies for coping with his/her functional level or disability.

Gerber and Hicks (1984) recommend an educational program which may help the patient adapt or cope with this illness. Behavioral changes are encouraged to effect a higher level of independence and satisfaction. Although there appears to be no convincing data to support the hypothesis that good comprehensive rehabilitation prevents disease progression or deformity, it is hoped that a comprehensive patient management program will promote maximal function and pain control.
Swezey (1978) advised that a therapy program should work within a comfortable range. Patients can accept stretching, range of motion exercises, strengthening exercises, and gait training to a varied degree depending on the severity of pain, their tolerance for it, and their general medical condition. This can be determined by trial and error and by asking the patient to assign a number to quantify the level of pain.

Toohey and Larson (1968) suggested that the use of a comfortable position for the patient during treatment was essential. This should be determined, and the range of motion and exercise program should be performed in this position, if possible. It may be more effective to use a few short sessions rather than one prolonged session to remain within the patient's pain tolerance level and to avoid undue fatigue.

Traditional management of flexion exercises for range of motion, for example, has been acknowledged to be clinically useful (Schumacher, 1988), but nothing is included with regard to a health intervention program using yoga exercises and relaxation techniques. Since interventions between chronic pain and medications, and between functional loss and deformity have not proved effective, additional intervention is suggested to help treat some aspects of the disease for the arthritic patient (Gerber, Furst, & Shulman, 1987).
Schatz (1985) urged that informal education should be incorporated with each treatment session. This makes the patient aware of the problems caused by the disease, the outcome of the disease, and the goals of and reasons for treatment. The education process could help to reassure the patient, build confidence, and maximize compliance.

The rehabilitation effort is a composite of input from several disciplines, including rehabilitation medicine, occupational therapy, physical therapy, vocational counseling, social work, and the medical subspecialties of orthopedics and neurology. The rehabilitation team member must initially perform an evaluation that is comprehensive and that can be individually tailored to the needs of the patient with arthritis. Gerber and Hicks (1984) emphasize the importance of an assessment of the relationship of the biomechanical deficits as they relate to joint function, as well as the impact of the disease and the psychosocial adjustment of the patient.

It is well to keep in mind that the health care team, as well as the patient, must believe that the patient is able and willing to learn preventative and/or rehabilitative treatments. Rothberg (1981) reminds us that teamwork depends on mutual respect, clarity of individual roles, shared goals, and skill in communication and decision-making. In the management of a disease that is not curable and that lasts a long time, education of the patient for
independence should be emphasized, as well as sensitivity, concern, and outlook of the physician and health care professional.

**Literature Review of Measures Used**

**Range of Motion of the Finger Joints: Goniometry**

Joint range of motion, recorded in degrees by noting maximum flexion and extension on a translucent plastic arch (goniometer), is the standard assessment used to evaluate joint mobility (Moskowitz, 1979).

A manual muscle test (MMT) is frequently performed in addition to a joint range of motion assessment in the patient with OA. This test, which is standardized and normally reliable when done by a trained health professional, identifies and tests weak muscles. In the face of a contracted muscle, or a painful one, strength grades are less reliable. In most instances, the MMT is performed with the patient trying to overcome the therapist's resistance to the muscle pull. It does not provide a good picture of the patient's "stamina" or ability to perform repetitive or sustained contractions; hence it is not a very good indicator of why a patient "fatigues." (Melvin, 1982)
**Hand Grip Strength**

A calibrated grip dynamometer was used to measure hand grip strength of each hand. This is a compact mechanical device held entirely in the palm and fingers. The dial reads grip strength in Kg force from 0 to 200 Kg.

Gillespie, Fisher, and Shaw (1983) reviewed two dynamometers and found some variation in measurements when repeated measures of individuals were taken, and some inaccuracy of instruments at lower ends of the scale. They recommend carefulness when collecting measurements, encouraging the focused concentration of the individual being measured, and averaging four measurements of each individual to account for slight variations.

A digital pinch/grip analyzer is also available for measurement of hand grip strength and provides measurement of grip performance over a period of 10 seconds. While this instrument is superior to a dynamometer in that it provides more accurate and informative results, its cost is much greater and, thus, was not used in this study.

**Tenderness of the Finger Joints**

Tenderness of the finger joints was measured with a dolorimeter. A study by Langley, Fowles, Sheppeard, and Wigley (1983) suggests that the dolorimeter is a reliable and sensitive instrument for measuring joint tenderness in inflammatory joint disease.
Circumference of the Finger Joints

Swelling of joints is associated with OA, and measurement of the circumference of the finger joints is desirable. As recommended by H. R. Schumacher (personal communication, December 10, 1990), a ring sizer was used to measure the circumference of the finger joints.

Hand Pain

General hand pain is a commonly reported symptom of patients with arthritis. The demonstration of pain relief is an important measure of the outcome of treatment (Huskisson, 1982). Measurements of pain intensity are easily and reliably recorded on a visual analogue scale and can be added to the patient's record (Gerber & Hicks, 1984). The visual analogue scale appears to be the most sensitive measure of pain (Huskisson) and was used in this study.

Hand Function

The psychosocial impact of a chronic and often painful illness that can restrict mobility and function is measurable (Gerber & Hicks, 1984). This is often a critical measurement because it helps identify individual needs of patients and may suggest certain interventions to help improve rehabilitation or adjustment to disease. The patient's medical problems and how they may affect the rehabilitation process are also relevant (Schumacher, 1984).
Gerber and Hicks (1984) cite a number of tests currently in use that measure activities of daily living. Some were developed specifically for patients with OA, while some have been adapted from general assessments. They do include questions about use of adaptive equipment. The purpose of these tests is to determine how independent the person is in several categories: (a) toileting, (b) grooming, (c) dressing, (d) mobility, and (e) feeding. The Stanford HAQ (Fries, 1986) was developed in response to the need for a reliable and consistent instrument for the measurement of health outcomes in arthritis patients. This instrument was used in this study and includes questions regarding the person's function in the categories noted above.

**Yoga: History and Philosophy**

Yoga's multifaceted approach to life and health could offer persons with arthritis powerful tools for restoring not only joint health, but psychospiritual health as well. Menuhin (cited in Iyengar, 1966) finds yoga a technique ideally suited to prevent physical and mental illness and protect the body generally. Schatz (1985) suggests that yoga could provide the means for helping internal healing processes and creating an environment in which other therapies (such as medication and diet) have a chance to work.
Yoga in the Iyengar tradition teaches movement with proper joint alignment, helping to move deformed joints back to normal position as muscles can be lengthened and strengthened (B. K. S. Iyengar, personal communication, July 12, 1988). Yoga psychology stresses the healing powers of positive states of mind: (a) friendship, (b) fellowship, (c) love, (d) compassion, and (e) joy. Focusing on positive emotions while working with yoga, one could begin to regain hope (Schatz, 1985).

Background of Yoga

Yoga is a very ancient practice that originated in India over 2,000 years ago. It consists of physical and mental techniques which can be practiced in a spiritual or non-religious context. Yoga is a timeless pragmatic science evolved over thousands of years dealing with the physical, moral, mental, and spiritual well-being of the person as a whole. Yoga is also a technique of personal development which existed long before any system of philosophy (M. Mehta, personal communication, December 19, 1990).

The Sanskrit term yoga is most frequently interpreted as the "union" of the individual self (jiva-atman) with the transcendental self (parania-atman). This definition is at home in the nondualist tradition of Vedanta, the dominant branch of Hindu philosophy. Vedanta originated with the ancient esoteric scriptures known as the Upanisliads
Thus, it seems appropriate to inquire into the meaning of the word yoga (derived from the Sanskrit root "yuj" which means to bind, join, attach, and yoke).

In the technical sense, yoga refers to that enormous body of spiritual values, attitudes, precepts, and techniques that have been developed in India over three millennia. It may also be regarded as the very foundation of the ancient Indian civilization. Yoga is thus the generic name for the various paths of ecstatic self-transcendence specific to the great civilization of India (Feuerstein, 1989).

Within the Hindu realm, six major forms of yoga have gained prominence. They are Raja Yoga, Hatha Yoga, Jnana Yoga, Bhakti Yoga, Karma Yoga, and Mantra Yoga. (These will be discussed shortly.) To these could be added Laya Yoga and Kundalini Yoga, which are closely associated with Hatha Yoga. If one likens yoga to a many-spoked wheel, then the spokes can represent the diverse schools and movements of yoga, the tire can symbolize the ethical requirements shared by all types of yoga, while the hub can stand for the ecstatic experience (samadhi) by virtue of which the practitioner (yogin) transcends not only his own limited consciousness but cosmic existence itself. All authentic forms of yoga are ways to a single center, the transcendal
reality, which may be defined differently by different schools. The genuine yogin is thus always motivated by self-transcendence or self-realization (Feuerstein, 1989).

Historically speaking, the most significant of all schools of yoga is the classical system of Patanjali (Iyengar, 1976). Around 500 B.C., Patanjali, who, according to Iyengar was the most notable authority on yoga philosophy, assembled the Yoga Sutras. His classic work contains 185 aphorisms based on the holistic idea that everything is permeated by a supreme universal spirit of which the individual spirit is part (Iyengar). Although there is little known about Patanjali himself, his works are widely read by students of yoga and Sanskrit literature (Feuerstein, 1989).

Yoga demands no dogmatic beliefs. It is based on ancient Hindu traditions; yoga classics use obscure symbolic languages, and often require an initiated teacher to interpret them. Its practical and experimental nature means that yoga is best learned from a teacher or guru. A book could be used as a supplementary guide (B. K. S. Iyengar, personal communication, July 12, 1988).

A principal premise of yoga is that one must take responsibility for one's own health and growth. Yoga, therefore, requires the involvement of the total person. Iyengar (1966) describes the eight Ashtanga (limbs) of yoga as follows:
1. Yama—non-violence, non-stealing, and right action.
3. Asana—exercises.
4. Pranayama—breath control.
5. Pratyahara—sensory withdrawal (as the prelude to meditation).
6. Dharana—concentration.
7. Dhyana—meditation.
8. Samadhi—an uninterrupted state of meditation, peace, or joy.

The first four limbs comprise Hatha (sun and the moon) Yoga. Aspects of it may have practical application as an intervention in the management of OA (B. K. S. Iyengar, personal communication, July 12, 1988).

1. Deep breathing to enhance energy and to calm down the nervous system. Proper breathing is the basis for a sound yoga practice. Without full expansion of the lungs, exercising muscles are not adequately supplied with oxygen (Schatz, 1985).

2. Stretching exercises to stimulate the circulation and thereby optimize the delivery of oxygen to tissues throughout the body. Yoga Asanas provide a system of movement that may strengthen all muscles and improve range of motion. Iyengar's modifications of the classical poses take into account joint strength and limitations in assuming
positions of properly aligned movement. They may help increase strength, joint stability, and range of motion while protecting joints through right movement (Schatz, 1985).

3. Complete relaxation to allow the tissue rejuvenation and management of pain and fatigue. The relaxation response of Savasana (Corpse Pose) and meditation helps counteract the energy-draining effects of prolonged stress and chronic pain. Deep relaxation helps restore more normal functioning of the immune system, which deteriorates with chronic stress, chronic pain, grief, and depression (Schatz, 1985).

4. Imaging, the idea of focusing on a central idea or visualizing to help the person concentrate on the exercise or relaxation.

There are several types of yoga including the following:

1. Jnana Yoga is the yoga of knowledge and wisdom; it is practiced through reflection, meditation, and renunciation. The Jnana yogi is a scholar and an ascetic.

2. Karma Yoga is the yoga of action. Actions are performed as offerings, for the good of mankind or love of God.
3. Bhakti Yoga is the yoga of love and devotion and is the third of the great paths outlined in the Bhagavadgita, a sacred text of Hindu mythology. If a man cannot reach enlightenment through wisdom or disinterested action, then he can do so through devotion to God.

4. Tantric Yoga is the worship of the female principle, represented by the goddess Shakti. Tantric has affinities with alchemy in its experiments towards transmitting the physical into the divine. It brings into Hinduism many foreign and exotic elements for reviving some ancient and primitive symbols and rituals.

5. Raja Yoga involves control of mind and will and develops meditation techniques. It is simply the stilling of the waves of the mind. Most westerners, when thinking about a non-active kind of meditation, will consider Raja Yoga.

6. Mantra Yoga is the repetition of meaningful sounds as an aid to meditation. Mantras are basic syllables based on sounds of different vibrations.

7. Hatha Yoga, the "forceful" yoga of bodily transformation, is the most widely taught form of yoga to which most modern practitioners of yoga, especially in the West, adhere (Berry, 1971). Like Tantric Yoga, Hatha Yoga affects the mind through the body. It consists of cleansing practices and physical exercises. The Hatha Yoga generally taught in western civilization is a system of postures
(asanas) and breathing exercises. The postures are designed to make the body physically and mentally strong, alert, supple, and to develop self control. Usually, it is taught in a group situation. Although it has a direct tie to Indian philosophy and Indian religion, Hatha Yoga can be taught effectively by itself as a separate health promoting technique. Jnana Yoga, Karma Yoga, Bhakti Yoga, Tantric Yoga, Raja Yoga, and Mantra Yoga are usually taught within the religious context of Hinduism. Perhaps the best-known modern representative of this type of yoga is B. K. S. Iyengar, who has trained many Western practitioners (Feuerstein, 1989). Hatha Yoga, particularly the Iyengar method, because of its precision, is favored by some health practitioners who use yoga for everything from assisting spiritual development to purely physical movement (Smoley, 1991).

Udupa (1978) observed that yoga relaxation techniques have been used to control hypertension, disorders of stress, and other physical disabilities. Considering the several thousand year history of yoga, the scientific study of yoga is only very recent. One of the many unsupported abilities that had long been reported of yogis in India was the stopping of the heart. Theresa Brosse, a French cardiologist, was the first investigator to examine this claimed ability in an objective way. Brosse went to India in 1935 and took a portable electrocardiograph so that she
could monitor the activity of the heart. Brosse (1946) concluded from her research that one of her subjects actually was able to stop his heart. Two American physiologists, Wenger, from the University of California, Los Angeles, and Bagchi, from the University of Michigan Medical School, conducted a larger scale research project in collaboration with the All-India Institute of Medical Sciences in New Delhi, in 1957. Wenger and Bagchi (1961) corroborated Brosse's research and found that yogis could slow the heartbeat.

In the 1970s, two research studies examined the effects of yoga upon hypertension. These studies were conducted by Benson, Rosner, Marzetta, and Klemchuk (1974), and Patel and North (1975). Benson et al. worked with the International Meditation Society to obtain subjects that were just beginning to learn a yoga practice called transcendental meditation (TM). Subjects that had high blood pressure were included in the research project. Eighty-six subjects volunteered and agreed to put off learning TM for six weeks while their blood pressure was monitored to establish their pre-TM blood pressures. They were told to stay under their doctor's care and to follow their doctor's direction regarding medication for high blood pressure. At the end of this six week blood pressure baseline period, subjects were taught TM. Blood pressures were monitored every two weeks, but not when subjects were meditating. Out of the original
group of subjects, only 36 either had not altered their medications or had never been on medication. The results from these 36 subjects were used for data analysis. During the pre-TM baseline the subjects had a mean systolic blood pressure of 146 millimeters of mercury. After two weeks of TM practice the mean systolic blood pressure decreased to 137 millimeters of mercury. After two weeks of TM practice the mean diastolic blood pressure decreased. Both results were statistically significant. Benson (1974) reported that the subjects' lower blood pressure readings lasted only as long as they practiced TM. A major criticism of this study was the lack of a control group.

Brena (1972) gives Hatha Yoga a definite place among holistic techniques and combines logic concepts with traditional procedures in the practice of medicine. Behanan (1964) studied the effects of Hatha Yoga at Yale and in India and concluded that yoga is unsurpassed as a system of practices for inducing high levels of relaxation.

Patel and North (1975) studied 34 hypertensive patients that were assigned randomly to either a six week yoga treatment group with physiological monitoring of galvanic skin response and muscle tension or to a placebo therapy group. Both groups showed a reduction in blood pressure readings. The yoga group's mean pre-training systolic blood pressure was 168 millimeters of mercury and their post-training systolic blood pressure was 141 millimeters of
mercury. The yoga group's mean pre-training diastolic blood pressure was 100 millimeters of mercury and their post-training diastolic blood pressure was 84 millimeters of mercury. The placebo therapy group's mean pre-training diastolic blood pressure was 101 millimeters of mercury and their post-training diastolic blood pressure was 96 millimeters of mercury. Patel and North reported that these differences in pre and post-training systolic and diastolic blood pressure between the yoga and placebo therapy groups were highly significant. Patel and North's placebo control group had the same number of sessions as the yoga treatment group but were given only the instructions to relax throughout the session.

Brown (1978) supported the use of Hatha Yoga in conjunction with biofeedback training. She claimed that yogic exercises and relaxation techniques appear to be useful in reducing moderate levels of blood pressure in essential hypertensives to normal range.

There is limited published research on the use of yoga and biofeedback, partly because the subject is the only "control," according to Budzinski (cited in Collins, 1982). Individuals may come to depend upon the biofeedback machines in order to reduce stress, rather than integrate the relaxation techniques into their lives. There is some question as to whether equipment operators are all fully qualified (Gans & Griffith, 1980).
Collins (1982) in a study of 45 adult males and females, noted physiological changes and biofeedback levels in stress reduction after a 10-week session of Hatha Yoga training.

**Yoga: The Iyengar Method**

The method of Hatha Yoga to be used in this study follows the system developed by Iyengar (1966), the author of *Light on Yoga*, which has become a classic text. This method has been widely disseminated, particularly in Britain where Iyengar-trained teachers are numerous and their quality monitored and examined by a national committee (M. Mehta, personal communication, July 12, 1988).

In the Iyengar System of Hatha Yoga, M. Mehta (personal communication, July 12, 1988) illustrates that special focus is placed on developing strength, endurance, and correct body alignment. Standing poses unique to this system of yoga build strong legs, increase general vitality, and improve balance and coordination. Poses are individualized to each body type and special physical needs by trained teachers. To help people who are new to yoga understand the movements that must take place, various props are sometimes used to help increase the students' strength and flexibility and to prevent injury. Everyday household items such as chairs, blankets, belts, doors, and walls are used to allow students to approach the postures within their limits of flexibility and endurance.
The Iyengar method is consistently applicable and practicable and reproducible involving a minimum of abstruse philosophy. Essentially, it consists of a series of different physical postures (or asanas) which increase mobility and strength and produce increased relaxation (reducing "automatic hyperactivity") and interoceptor sensitivity (enabling reduction of "motor tension"). Apprehensive expectation is combatted by teaching continual awareness of one's physical state from moment to moment, the teacher taking a very active role in focussing the subject's attention to any lack of symmetrical alignment in the postures. Vigilance and scanning are reduced by encouraging the subject to work with intense conscious mental effort as well as with physical effort (M. Mehta, personal communication, July 12, 1988).

Exercise can often reinforce misalignment. If one does not know how to exercise properly, he/she may tend to stretch from more flexible areas and rely on better-developed muscles for strength. Iyengar Yoga encourages weak parts to strengthen and stiff areas to stretch, thus awakening and re-aligning the whole body. As the body moves into better alignment, less muscular work is required and relaxation increases naturally (M. P. Schatz, personal communication, October 15, 1991).
Western-style exercise tends to focus on achieving a goal. Iyengar Yoga places much less emphasis on goals. Rather, it encourages students to finely tune the manner in which they move. The extreme concentration which such close observation requires draws the attention inward, quieting and integrating mind and body.

Done properly, Iyengar Yoga may help many physical conditions. Although yoga teachers are not therapists, many students find that their physical difficulties decrease as a by-product of improved alignment. Some yoga teachers specialize in "therapeutic" yoga. These people are doctors, physical therapists, or individuals with physical problems who have found relief from their condition through the practice of Iyengar style yoga (B. Carrothers, personal communication, September 10, 1991). Carrothers is also a yoga teacher who, since 1980, has been treating his patients with chronic muscoskeletal problems and various forms of pain disorders with yoga programs.

Some recent studies (Anonymous, 1989; Anonymous, 1991; Doyle, 1988; Fraser, 1988; Nespor, 1989; Rai, 1987; Sharma, Singh, Shettiwar, & Udupa, 1987; Simon, 1989) have examined the effectiveness of yoga exercises in reducing pain and stress in patients suffering from rheumatoid arthritis, backache, or other forms of chronic pain.
In an article entitled, "Holistic GPs Cut Prescribing Costs to 40% of Average," in the November 25, 1989 issue of Pulse (Anonymous, 1989), a west London practice based at the Marylebone Health Centre has cut its prescribing costs to 40% of the natural average. Much of this reduction is due to the use of acupuncture, massage, yoga, meditation, and relaxation education, for pain relief. A pilot pain relief project using complementary methods is planned, involving patients with specific joint pains.

A pilot study of patients with chronic diseases described in the May 25, 1991 issue of Pulse, entitled "Yoga Relieves RA" (Anonymous, 1991), has found that yoga exercises reduce pain, as measured by a visual analogue scale, especially in rheumatoid arthritis. The team, led by Dr. Ian Haslock at the South Cleveland Hospital, is now undertaking a controlled trial.

Many Western doctors have become less skeptical about what certain alternatives or Eastern therapies might have to offer, according to Doyle (1988). Understandably, they are reluctant to use them until research has proved them to be safe and efficacious. The subject of this article is yoga and stress reduction, and two research projects in particular are illustrated. Dr. Bruce Low, in Glasgow, is recruiting patients suffering from general anxiety, from Edinburgh and Glasgow, for a pioneering trial. Patients will be either given the tranquilizing drug, Imipramine, a
harmless placebo, or yoga instructions. Those members who might be involved in a second alternative therapies report would do well to recharge their batteries using Dr. Low's method of standing on their heads (Doyle). Dr. Robin Monro is conducting a trial at Cambridge to show how effective yoga can be for five specific ailments, including asthma, pre-menstrual tension, and diabetes. His work is being funded through the Research Council for Complementary Medicine, which has recently been awarded a modest grant from the Department of Health to help with administrative costs over the next two years. Dr. Ian Haslock, at Middlesborough Hospital, Cleveland, is cited as using yoga for his rheumatoid arthritis patients, and Dr. Chandra Patel, at University College, London, for her pioneering work using relaxation methods, including yoga, for her hypertensive patients.

Fraser (1988) explained how Rene Descartes, some 400 years ago, was responsible for the split between medics and the religious mystics, when his philosophy separated the mind from the body. Before this, meditation and prayer played a large part in the healing process, but it appears that doctors today prefer to put their faith in medicine and pills. Systematic research in America is now questioning whether the mind can heal the body, and considerable United States money is being poured into the National Institutes of
Mental Health to develop this potential, known as psychoneuroimmunology. In the United Kingdom, the findings are met with the response--no money, no interest--despite the fact that research is showing the state of mind can directly affect the body's immune system. The brain chemicals, endorphins, which influence emotion and ability to feel pain, may directly interact with cells in the immune system. Despite official apathy, some doctors in the United Kingdom are convinced this research is on the right track. Dr. Peter Nixon, at Charing Cross Hospital in London, uses sleep as one of the main weapons against threatened heart attacks in his patients, and the Marylebone Healing and Counselling Centre runs yoga relaxation classes within its general practice. The National Institutes of Mental Health scientists are about to embark on systematic and scientifically watertight trials to prove the power of mind over body in a way acceptable to Western skeptics (Fraser, 1988).

Several extensive computer searches, however, give no evidence of any health intervention for treatment of OA of the hands and finger joints using yoga as therapy. It appears that this study is the first of its kind.
CHAPTER 3
METHODOLOGY

This chapter will discuss the methodology of the study. It will include the selection of the subjects, description of instrumentation, procedures, statistical treatment of data, and limitations of the method.

The purpose of this study was to examine the impact of a health education intervention based on yoga and relaxation techniques upon: (a) range of motion of the finger joints, (b) hand grip strength, (c) tenderness of the finger joints, (d) circumference of the finger joints, (e) hand pain, and (f) hand function in patients with osteoarthritis (OA) of the hands and finger joints.

Design

To address the issues of cause and effect, a fixed-effect pre- and post-test experimental design was employed using two randomly assigned groups:

1. Yoga and Relaxation Experimental Group (YR)—a group of subjects receiving the yoga and relaxation program.

2. Control Group (CG)—a group of subjects receiving no intervention, but who were given the choice to receive the yoga and relaxation program at a later date.
Design Schematic

Randomized Control Group Pre-Test and Post-Test Design

R  YR Pre-Test (O_1)  Treatment (X)  Post-Test (O_2)
R  CG Pre-Test (O_1)  Post-Test (O_2)

Selection of Subjects

An initial pool of potential subjects (N = 98) diagnosed as having OA was obtained. It included patients from four sources: (a) rheumatology clinic patients' records on file at The Philadelphia Veterans Affairs Medical Center and computer-generated listings of all patients on record from 1988 to 1990 with diagnosis of OA of the finger joints; (b) rheumatology records from patients at The Hospital of the University of Pennsylvania; (c) rheumatology records of private patients from Dr. H. Ralph Schumacher, Chief of Rheumatology at both hospitals; and (d) responses from volunteers acquired through ads in local newspapers.

From this pool, 40 potential subjects voluntarily participated in a screening for OA of the hand and fingers conducted at the hospitals and clinics. Diagnoses were made by Ralph Schumacher, M.D., based on observed bony enlargement with either limitation of motion, or tenderness of the distal and proximal interphalangeal joints.

These potential subjects were told that to participate they must be currently under a physician's care for their OA and be willing to continue to follow their physician's
advice regarding their treatment. They had to be willing to inform their physicians of their intentions to take part in this research project and to get their physician's permission to do so. They were also told that all information obtained during the study would be confidential as stated in the Human Subjects' Consent forms (see Appendix A).

Subjects who voluntarily participated in the initial screening, were diagnosed as having OA, and who consented to conditions of participation in the research study were selected. From the initial pool of 40 volunteer subjects, 26 subjects met the criteria, and participated in the study. Thus, the total sample size was a function of the number of volunteers who met the criteria.

**Procedures**

Subjects \((N = 26)\) were randomly assigned to either the YR Group or the CG Group. Since there were only 26 subjects who met the criteria, the study was divided into three phases. Of the 26 subjects, 17 subjects were tested and would participate in Phase 1. Because of the allocation of time and resources, the nine other subjects were told they would be tested later to participate in the next phase of the study.
In the first phase, nine subjects were randomly assigned to the YR Group and eight subjects were randomly assigned to the CG Group. One of the CG Group subjects dropped out before post-testing, leaving seven subjects in the Phase 1 CG Group.

In the second phase, the seven subjects who were in the CG Group for Phase 1 were offered the treatment; five of these subjects received the treatment and two of the subjects dropped out. The post-test scores of the CG Group from Phase 1 served as the pre-test scores for the YR Group in Phase 2.

The remaining nine subjects from the initial pool were then tested to participate in the third phase of the study. Five of these subjects were assigned to the YR Group and four of these subjects were assigned to the CG Group for Phase 3. The raw data for all subjects is given in Appendix B. This was accomplished by the researcher, while blindfolded and in the presence of the testing physician, drawing names out of a box and placing the names in two separate piles.

Subjects currently taking medication for OA and those not taking medication were included in the study. Medication use was recorded throughout the study and was controlled during statistical analyses of the data. Subjects were asked not to change their medication use, and were not to add new medications or rehabilitation treatments
during the course of the study. The names of all subjects and their assignment numbers were kept on a master list by the researcher in a locked file at the Veterans Administration Hospital.

The researcher worked with subjects in the treatment group in small groups to ensure individual attention and to facilitate scheduling. The specific intervention and treatment procedures can be found in Appendix C.

For each of the three phases, subjects in the YR Group (n = 19) met for a 60-minute period once a week for eight weeks to receive the Health Education Yoga and Relaxation Intervention. This was considered to be a minimum effective length of time for the program (B. K. S. Iyengar, personal communication, July 15, 1989).

The intervention was based on yoga exercises of traditional poses (or asanas) specially designed by the researcher to address OA of the hands and finger joints. Particular emphasis was to call the subject's attention to respiration, circulation, and upper-body alignment. This program was conceived by the researcher based on her knowledge and experience of 20 years of study and practice of the subject of yoga. The program was approved and encouraged by Mr. B. K. S. Iyengar.
Subjects in the CG Group (n = 7) were told that their program intervention would begin in 10 weeks. They were put on a waiting list while the YR Group was receiving the intervention.

Subjects in both groups were evaluated (pre-tests) on the dependent variables prior to the initiation of the intervention (see Appendix D). Ten weeks after the YR Group began the intervention program, all subjects (both the YR Group and the CG Group), were again evaluated (post-tests) using the identical procedures as those used to obtain pre-test baseline levels of measurements.

Written subjective evaluations were also obtained from subjects in the YR Group at the close of the study. A copy of the evaluation form is given in Appendix E.

Instrumentation

The effect of the intervention was measured by changes observed in six dependent variables: (a) range of motion of the finger joints, (b) hand grip strength, (c) tenderness of the finger joints, (d) circumference of the finger joints, (e) hand pain, and (f) hand function in patients with OA of the hands and finger joints. The intervention was designed to increase measurement of the first three variables. On the scales used to measure range of motion of the finger joints and hand grip strength, a numerical increase corresponds to an increase in range of motion or hand grip strength. On the scale used to measure tenderness
of the finger joints, a decrease in joint tenderness is designated by a higher number which indicates improvement. The intervention was designed to decrease measurement of circumference of the finger joints, hand pain, and hand function. On the scales used to measure circumference of the finger joints and hand pain, a numerical decrease corresponds to a decrease in circumference of the finger joints and hand pain. On the scale used to measure hand function, a numerical decrease indicates increased function. Measurement of variables (a) range of motion of the finger joints, (b) hand grip strength, (c) tenderness of the finger joints, and (d) circumference of the finger joints was done separately for both the left and right hands. Both hands were combined for measures of hand pain and hand function, upon the recommendation of Dr. Ralph Schumacher, in that pain level on each hand was too close to be differentiated individually. Generally, it was the same for both hands.

Changes in each variable were measured with the following instruments:

1. Range of motion at the distal interphalangeal and proximal interphalangeal finger joints was evaluated with a goniometer, a calibrated instrument that allows recording of maximum extension and flexion. Range of motion was measured on a scale of 0 to 120 degrees, with a higher number representing greater joint mobility.
2. Hand grip strength was evaluated with a hand grip meter (dynamometer) that measured combined hand and finger strength in Kg. A single value was obtained for each hand, with a higher number representing greater hand grip strength. Possible values ranged from 0 Kg to 200 Kg.

3. Tenderness of the finger joints was measured using a pressure gauge (dolorimeter) to record the amount of pressure that produced pain at each joint. A single value was obtained for each joint. The possible range of values was 0 to 10 Kg, with a higher number representing decreased tenderness.

4. Circumference of the finger joints was evaluated using a ring sizer. Each joint on both hands was evaluated and the measurement recorded separately before and after the intervention. A smaller number represents a smaller circumference. Possible values ranged from 40 cm to 160 cm.

5. Hand pain in patients with OA of the hands and finger joints was measured using a visual analogue scale. Subjective assessment of pain was recorded on a scale of no pain (0) to maximum pain (10). Two measures of hand pain were taken—one at rest and one during activity.

6. Hand function was assessed using the validated Stanford Hand Assessment Questionnaire (HAQ) which detects changes in daily activities related to the hand. Obtainable values ranged from 3 to 0, with a lower number representing greater function.
Each finger joint was measured for each subject. An average measurement was calculated for each subject. For the variables where the unit of measure was finger joints rather than the whole hand (i.e., range of motion of the finger joints, tenderness of the finger joints, and circumference of the finger joints), an average across joints was taken for each person.

A summary of the six dependent variables (range of motion of the finger joints, hand grip strength, tenderness of the finger joints, circumference of the finger joints, hand pain, and hand function) with their possible ranges is outlined in Table 1. The possible and actual observed ranges of the dependent variables can be found in Appendix F.

Table 1. Summary of Dependent Variables: Possible Ranges

<table>
<thead>
<tr>
<th>Variable</th>
<th>Most Positive</th>
<th>Least Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range of motion</td>
<td>120 degrees</td>
<td>0 degrees</td>
</tr>
<tr>
<td>Hand grip strength</td>
<td>200 Kg</td>
<td>0 Kg</td>
</tr>
<tr>
<td>Tenderness</td>
<td>10 Kg</td>
<td>0 Kg</td>
</tr>
<tr>
<td>Circumference</td>
<td>40 cm</td>
<td>160 cm</td>
</tr>
<tr>
<td>Hand pain (at rest/during activity)</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Hand function</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Note. For the first three variables, higher values indicate improvement. For the last three variables, lower values indicate improvement.
Abid Husain, M.D., Assistant Chief of Rehabilitation Medicine Service of the Veterans Administration Hospital administered the pre- and post-tests to all of the subjects. He was trained to administer and read the tests accurately. Subjects sat in chairs during the measurement procedures. He was blinded regarding which subjects were in which group.

**Statistical Treatment of the Data**

The main analyses conducted to address the research questions were comparisons of difference scores (post-pre) of the YR Group versus the CG Group. A total of 14 subjects received the yoga and relaxation intervention (YR Group) \( n = 14 \), and a total of 11 subjects formed the CG Group \( n = 11 \). The null hypothesis \( H_0 \) states that there will be no statistically significant differences between the YR Group and CG Group on difference scores on any of the six dependent variables.

To control for subjects' use of medication, each subject was coded into one of five categories. They were: (a) never took drugs (0), (b) started and continued using analgesic drugs (1), (c) started but stopped using analgesic drugs (2), (d) started and continued using anti-inflammatory drugs (3), and (e) started but stopped using anti-inflammatory drugs (4) (see Appendix G).

A chi-square test of the association between medication use and subject group (YR Group vs. CG Group) showed no statistically significant relationship. Thus, medication
practices were shown to be similar across the two groups, and hence ignored in the main analyses. See Appendix H for results of the chi-square analysis.

The primary analyses conducted were:

1. Two multivariate analyses of variance (MANOVAs), one for each hand, for the set of variables for which data were collected for each hand (range of motion of the finger joints, hand grip strength, tenderness of the finger joints, and circumference of the finger joints), followed by univariate F tests.

2. Three one-way analyses of variance (ANOVAs) for each of the variables for which data were collected for hands in general (hand pain at rest, hand pain during activity, and hand function).

Appropriate preliminary analyses were undertaken to test assumptions prior to conducting MANOVA or ANOVA tests. These included tests of homogeneity of dispersion matrices (for MANOVAS) and tests of homogeneity of variance (for ANOVAs).

The tests of homogeneity of dispersion matrices for the MANOVAs showed assumptions were met for the MANOVA of the left hand and MANOVA of the right hand, but not met for the MANOVA for variables for which data were collected for hands in general. Thus, this third MANOVA was omitted, and ANOVAs were conducted for each of the variables for which data were
collected for hands in general. The tests of homogeneity of variance showed assumptions were met for hand pain during activity and hand function, but not for hand pain at rest.

**Limitations**

1. The study's sample size was limited because of time and availability constraints on the part of potential subjects and the testing physician. Attracting additional subjects would have delayed the study and precluded the researcher's ability to complete the study. With a larger sample size, greater power for detecting significant differences would have been available.

2. External factors created a less than optimal environment for conducting the yoga and relaxation intervention and may have reduced the effectiveness of the intervention. Erratic room availability and scheduling conflicts at the Veterans Administration Hospital resulted in occasional shortening of the planned sessions. Physical limitations of the meeting site (poor ventilation, small room size, external interruptions and distractions, and lack of parking availability) diminished the subjects' physical and emotional comfort and affected their concentration.

3. Attendance by the YR Group subjects was excellent (see Appendix I). In general, attendance was regular and the morale and outlook of the subjects was positive. Only one subject missed four sessions, two subjects missed three
sessions, five subjects missed two sessions, seven subjects missed one session, and four subjects attended all sessions (see Table 2).

Table 2. Missed Sessions by Subjects in YR Group

<table>
<thead>
<tr>
<th>Number of Missed Sessions</th>
<th>Number of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>19</td>
</tr>
</tbody>
</table>
CHAPTER 4

RESULTS

This chapter presents analysis of the data collected during an investigation to determine if a health education intervention program based on yoga and relaxation techniques would help patients with osteoarthritis (OA) improve regarding six outcome variables: (a) range of motion of the finger joints, (b) hand grip strength, (c) tenderness of the finger joints, (d) circumference of the finger joints, (e) hand pain, and (f) hand function.

The null hypothesis ($H_0$) stated that there will be no statistically significant differences between the Yoga and Relaxation Experimental Group (YR) and the Control Group (CG) in (post-pre) difference scores on any of the six dependent variables.

Subject improvement regarding the variables is defined as observed positive differences in measurements (post-pre) for: (a) range of motion of the finger joints, (b) hand grip strength, and (c) tenderness of the finger joints because for these variables the higher the score the better; and observed negative differences in measurement (post-pre) for: (a) circumference of the finger joints, (b) hand pain, and (c) hand function because for these variables the lower the score the better.
Subjects

A pool of 40 volunteer subjects was developed that included patients with OA from the Veterans Administration Hospital Clinic, the Hospital of the University of Pennsylvania Clinic, and the private practice of Ralph Schumacher, M.D., plus OA patients who responded to a newspaper advertisement for subjects. From this group, 25 subjects who met the study criteria participated in the study.

The subjects represented both genders (11 males and 14 females), with ages ranging from 52 to 79. Three subjects (12%) were black and the remainder were white. The subjects were enthusiastic and eager to begin the study. Subjects were also instructed not to change any medications nor add any new ones. They were also guaranteed medical help should any complications develop.

Results

Table 3 presents results of two MANOVAs, one for each hand, for the set of variables for which data were collected for each hand (range of motion of the finger joints, hand grip strength, tenderness of the finger joints, and circumference of the finger joints). Results of the multivariate statistical test are also shown.

Table 4 presents the groups' means, standard deviations, and results of the univariate F tests on the difference scores, by hand, for the same set of variables
Table 3. MANOVA, Results by Hand

<table>
<thead>
<tr>
<th>Variable</th>
<th>Right Hand</th>
<th></th>
<th>Left Hand</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Prob.</td>
<td>F</td>
</tr>
<tr>
<td>Range of Motion</td>
<td>11.55</td>
<td>.002**</td>
<td>3.19</td>
</tr>
<tr>
<td>Hand Grip Strength</td>
<td>.16</td>
<td>.691</td>
<td>2.76</td>
</tr>
<tr>
<td>Circumference</td>
<td>2.51</td>
<td>.127</td>
<td>.44</td>
</tr>
<tr>
<td>Tenderness</td>
<td>14.57</td>
<td>.001**</td>
<td>8.13</td>
</tr>
<tr>
<td>Multivariate Test</td>
<td>4.98</td>
<td>.006*</td>
<td>2.79</td>
</tr>
</tbody>
</table>

* Statistically significant p < .05
** Statistically significant p < .01

(range of motion of the finger joints, hand grip strength, tenderness of the finger joints, and circumference of the finger joints). A negative difference (post-pre) signifies improvement for the variable of circumference. A positive difference (post-pre) signifies improvement for the variables of range of motion of the finger joints, hand grip strength, and tenderness of the finger joints.

Table 5 presents the means, standard deviations, and results of univariate F tests on difference scores for the set of variables for which data were collected for both hands combined (hand pain at rest, hand pain during activity, and hand function). For all three variables, a negative difference (post-pre) signifies improvement. As
Table 4. Means, Standard Deviations, and Univariate F Test Results on Difference Scores, by Hand

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>F</th>
<th>Prob.</th>
<th>M</th>
<th>SD</th>
<th>F</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable where a negative difference (post-pre) signifies improvement:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circumference</td>
<td>YR</td>
<td>-1.71</td>
<td>1.14</td>
<td>2.51</td>
<td>.127</td>
<td>-1.57</td>
<td>1.60</td>
<td>.44</td>
<td>.515</td>
</tr>
<tr>
<td></td>
<td>CG</td>
<td>- .73</td>
<td>1.95</td>
<td></td>
<td></td>
<td>-1.18</td>
<td>1.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variables where a positive difference (post-pre) signifies improvement:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range of Motion</td>
<td>YR</td>
<td>16.93</td>
<td>7.78</td>
<td>11.55</td>
<td>.002**</td>
<td>14.86</td>
<td>7.88</td>
<td>3.19</td>
<td>.087</td>
</tr>
<tr>
<td></td>
<td>CG</td>
<td>6.91</td>
<td>6.67</td>
<td></td>
<td></td>
<td>8.09</td>
<td>11.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand Grip Strength</td>
<td>YR</td>
<td>4.21</td>
<td>4.69</td>
<td>.16</td>
<td>.69</td>
<td>6.14</td>
<td>5.60</td>
<td>2.76</td>
<td>.110</td>
</tr>
<tr>
<td></td>
<td>CG</td>
<td>3.36</td>
<td>5.89</td>
<td></td>
<td></td>
<td>2.45</td>
<td>5.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tenderness</td>
<td>YR</td>
<td>2.20</td>
<td>1.32</td>
<td>14.57</td>
<td>.001***</td>
<td>2.14</td>
<td>1.55</td>
<td>8.13</td>
<td>.009**</td>
</tr>
<tr>
<td></td>
<td>CG</td>
<td>.40</td>
<td>.94</td>
<td></td>
<td></td>
<td>.41</td>
<td>1.43</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** p < .01

*** p < .001
Table 5. Means, Standard Deviations, and Results of Univariate F Tests on Difference Scores, for Combined Hands

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>F</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand pain at rest</td>
<td>YR</td>
<td>-1.86</td>
<td>5.63</td>
<td>.89</td>
<td>.355</td>
</tr>
<tr>
<td></td>
<td>CG</td>
<td>- .09</td>
<td>2.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand pain during activity</td>
<td>YR</td>
<td>-4.29</td>
<td>2.09</td>
<td>10.42</td>
<td>.004**</td>
</tr>
<tr>
<td></td>
<td>CG</td>
<td>-1.00</td>
<td>3.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand function</td>
<td>YR</td>
<td>- .13</td>
<td>.21</td>
<td>2.33</td>
<td>.141</td>
</tr>
<tr>
<td></td>
<td>CG</td>
<td>.21</td>
<td>.79</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** p < .01

Note. For all three variables, a negative difference (post-pre) signifies improvement.

previously mentioned, an increase in hand function is measured by a decrease on the hand function measurement. See Table 1.

Findings

It was expected that a health education intervention program based on yoga and relaxation techniques would help patients with OA improve on six dependent variables: (a) range of motion of the finger joints, (b) hand grip strength, (c) tenderness of the finger joints, (d) circumference of the finger joints, (e) hand pain, and (f) hand function.
Analysis of the data revealed the following:

1. The most dramatic difference between the YR Group and CG Group was observed for the variable of tenderness of the finger joints for both hands. It is argued that this improvement was not only clearly statistically significant, but clinically significant as well. On average, patients improved more than 2 points on a 10-point scale. Improvement in measurements of tenderness of the finger joints following intervention was statistically significant beyond the .01 level of significance in both the right and left hands (right—F = 14.57, p = .001; Left—F = 8.13, p = .009). For both hands, the YR Group improved significantly more than the CG Group.

2. Improvement in measurements of range of motion of the finger joints in the right hand following intervention was statistically significant beyond the .01 level of significance (F = 11.55, p = .002). Improvement in measurements of range of motion of the finger joints in the left hand following intervention approached statistical significance (F = 3.19, p = .087). Again, for both hands, the YR Group improved significantly more than the CG Group.

3. There was no significant difference between the YR Group and CG Group on the variables (a) hand grip strength (though it approached significance for the left hand—p = .110); (b) circumference of the finger joints (though it approached significance for the right hand—p = .127); or
(c) hand function (though it approached significance—p = .141). Thus, it can be concluded that a health education intervention based on yoga and relaxation is generally effective in improving the "hand health" of OA patients.

4. For the combined hands variables, the YR Group improved significantly more than the CG Group on the variable of hand pain during activity (F = 10.42; p = .004). The differences were not statistically significant for hand pain at rest or hand function.

5. The observed differences in measurements between the YR Group and CG Group were greater for the right hand than for the left hand, with the exception of hand grip strength.

6. For both the YR Group and the CG Group, the difference scores were in the improved direction for all variables for both hands, with the exception of hand function in the CG Group. Thus, the CG Group also improved from pre- to post-test measurements without benefit of the intervention. In all cases, however, by inspection, the YR Group improved more.

**Supplemental Analysis of Relationships Between Dependent Variables**

Table 6 presents the results of a supplemental analysis of the intercorrelations of the dependent variables for both the right and left hands. As expected, the relationships
### Table 6. Intercorrelations Between Pairs of Measured Variables (Pre-Test Data)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Right Hand</th>
<th>Left Hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circumference, ROM</td>
<td>-.35</td>
<td>-.36</td>
</tr>
<tr>
<td>Circumference, Tenderness</td>
<td>.15</td>
<td>.03</td>
</tr>
<tr>
<td>Circumference, Grip Strength</td>
<td>.80***</td>
<td>.75***</td>
</tr>
<tr>
<td>Circumference, Pain</td>
<td>-.47**</td>
<td>-.13</td>
</tr>
<tr>
<td>Circumference, Function</td>
<td>-.56**</td>
<td>-.45*</td>
</tr>
<tr>
<td>ROM, Tenderness</td>
<td>.16</td>
<td>.25</td>
</tr>
<tr>
<td>ROM, Grip Strength</td>
<td>-.08</td>
<td>.09</td>
</tr>
<tr>
<td>ROM, Pain</td>
<td>.22</td>
<td>-.21</td>
</tr>
<tr>
<td>ROM, Function</td>
<td>.24</td>
<td>.16</td>
</tr>
<tr>
<td>Tenderness, Grip Strength</td>
<td>.28</td>
<td>.26</td>
</tr>
<tr>
<td>Tenderness, Pain</td>
<td>-.17</td>
<td>-.44*</td>
</tr>
<tr>
<td>Tenderness, Function</td>
<td>-.30</td>
<td>-.22</td>
</tr>
<tr>
<td>Grip Strength, Pain</td>
<td>-.37</td>
<td>-.39*</td>
</tr>
<tr>
<td>Grip Strength, Function</td>
<td>-.35</td>
<td>-.41*</td>
</tr>
<tr>
<td>Pain, Function</td>
<td>.47**</td>
<td>.46**</td>
</tr>
</tbody>
</table>

ROM = Range of Motion

N = 25

* p < .05

** p < .01

*** p < .001
were generally consistent for the two hands. One-tailed tests reveal a statistically significant intercorrelation between circumference of the finger joints and hand grip strength for both the right and left hands (positive correlation, \( p < .001 \)); circumference of the finger joints and hand pain for the right hand (negative correlation, \( p < .01 \)); circumference of the finger joints and hand function for both the right hand (negative correlation, \( p < .01 \)) and the left hand (negative correlation, \( p < .05 \)); tenderness of the finger joints and hand pain for the left hand (negative correlation, \( p < .05 \)); hand grip strength and hand pain for the left hand (negative correlation, \( p < .05 \)); hand grip strength and hand function for the left hand (negative correlation, \( p < .05 \)); and hand pain and hand function for both the right and left hands (positive correlation, \( p < .01 \)). The strongest relationships were between circumference of the finger joints and hand grip strength (\( r = .80 \) and .75), where a larger circumference is associated with greater grip strength. (Inverse relationships were observed between some of the variables due to the way the variables were scaled.) Other strong relationships are between circumference of the finger joints and hand function (\( r = -.56 \) and -.45), where a smaller circumference is associated with higher function represented by lower values on the function scale; and hand pain and
hand function \((r = .47 \text{ and } .46)\) where lower pain is associated with greater function represented by lower numbers on the function scale.

To summarize, for all variables, with one exception (hand function in the CG Group), both the YR Group and the CG Group improved. In all cases, however, the YR Group showed greater improvement than the CG Group. There were statistically significant differences in the expected direction for range of motion of the finger joints, tenderness of the finger joints, and hand pain during activity.
CHAPTER 5
SUMMARY, CONCLUSIONS, DISCUSSION, AND
RECOMMENDATIONS FOR FUTURE STUDY

Osteoarthritis (OA) is the most common rheumatic disease, affecting an estimated 40.5 million adults in the United States alone. It is generally a relatively benign disease with less than 15% of those affected displaying serious symptoms or disability. Nevertheless, numerous studies have shown that OA accounts for the greatest loss of time from work in the United States and Great Britain. Thus, the disease has a considerable economic impact as well. Because of the nature of the disease, there is also much discomfort and pain. There may be a reduction in "can do" tasks causing a need to simplify life and patterns of living. There may also be pain-stress depression which could necessitate the family doctor and other support professionals to work together and make positive changes to build one's life around wellness.

Given the consequences of the impairment which may be caused by OA, the challenge to the rheumatologist and to all others who treat the arthritis patient is to minimize impairment and lessen the burden of the handicap so as to prevent disability. For those patients who suffer from perhaps more complex impairments, with various handicaps and
disabilities, the efforts of highly qualified physicians and allied health professionals in various disciplines are essential to a successful rehabilitative outcome.

The goals of comprehensive care for arthritis patients are to restore them to the highest possible level of function and independence they are capable of achieving, and to enable them to obtain optimum satisfaction and usefulness in terms of themselves, their families, and even their communities. For the arthritis patient, this may mean maximizing pain relief, restoring mobility and strength, and, above all, inculcating a sense of value as a human being in his/her social setting. In terms of human values, the relief of pain and enhancement of an individual's independence and self-image in achieving even partial restoration of participation in the opportunities and activities of society are of incalculable value to the individual.

The primary purpose of this experimental study was to examine the effect of a health education intervention incorporating yoga and relaxation techniques on (a) range of motion of the finger joints, (b) hand grip strength, (c) tenderness of the finger joints, (d) circumference of the finger joints, (e) hand pain, and (f) hand function in patients with OA of the hands and finger joints. These
dependent variables were measured with appropriate mechanical devices by a physician trained in test measurement and rehabilitation.

Procedures

The subjects of this study were 25 medically diagnosed patients with OA of the distal interphalangeal and proximal interphalangeal joints of the fingers. The subjects were volunteers who were randomly assigned to a Yoga and Relaxation Experimental Group (YR) and a Control Group (CG) on an alternate basis.

A fixed effect, two group, pre-test/post-test experimental design was used to assess the health education intervention. Twenty-five persons with diagnosed OA of the finger joints were randomly assigned to one of two groups:

Group 1 (YR)—a yoga and relaxation group which participated in a program of uniquely designed yoga and relaxation techniques.

Group 2 (CG)—a control group which received no treatment but was offered the program at a later date.

The yoga and relaxation program consisted of eight 60-minute sessions (once a week for eight weeks). Both groups were measured on six dependent variables prior to the intervention and at the end of the study by the same physician.
Subjects were selected from four sources: (a) rheumatology clinic patients' records on file at The Philadelphia Veterans Affairs Medical Center and computer-generated listings of all patients on record from 1988 to 1990 with diagnosis of OA of the finger joints; (b) rheumatology records from patients at The Hospital of the University of Pennsylvania; (c) rheumatology records of private patients from Dr. H. Ralph Schumacher, Chief of Rheumatology at both hospitals; and (d) responses from volunteers acquired through ads in local newspapers. These patients were evaluated by a rehabilitation physician, Dr. Abid Husain, to confirm presence of the inclusion criteria. Those who met the inclusion criteria for the study were invited to participate.

The potential subjects were initially seen by the rehabilitation physician at the Veterans Hospital for purposes of confirming the diagnosis of OA of the distal interphalangeal joint and proximal interphalangeal joint. It may be well to mention here that in cases where multiple joints are involved, the pattern of joint involvement may be helpful in differentiating OA from other forms of arthritis. The most common physical finding in OA is tenderness localized in the specifically involved joint. However, pain may occur on passive movement of the joint even in the absence of local tenderness. Bony proliferation and osteophyte formation at the distal interphalangeal joints
may produce the characteristic Heberden's nodes (named after the British doctor who first described them), or at the proximal interphalangeal joints. Subjects were also given the consent forms and pre-tested for the study after which they were randomly assigned into two groups, the YR Group and the CG Group. This marked the beginning of the study.

Each subject in the YR Group was asked to return to the hospital the following week at the time and place assigned for the study, and to commit to participating for the next nine consecutive weeks (eight sessions followed by a post-test a week later). The same instruments were administered as a pre-test to the subjects in the CG Group. The subjects in the CG Group were asked to return in nine weeks for a post-test, after which they would receive the intervention, if they so desired. The post-test scores served as the pre-test scores on the second phase of the study.

The consent forms, both from the Veterans Hospital and the University of Pennsylvania, were reviewed by Dr. Ralph Schumacher to protect subjects' confidentiality and provide requested health care if needed. Both forms were approved by research review committees in both institutions.

The YR Group subjects received the yoga health intervention classes for eight consecutive weeks and were then post-tested. The CG Group subjects received only a pre- and post-test and were later offered the intervention. During the class sessions, the YR Group subjects were
supportive toward one another and complied with the prerequisites of being on time, not missing any classes, bringing their belts and handouts, and participating actively in the classes. They asked questions and were concerned. Everyone expressed disappointment when the classes ended and expressed the need for the classes to continue and for the importance of the intervention. The same instrument was later administered to members of the CG Group, which became the second YR Group.

A second screening was held to gather additional subjects. These people were tested for the second phase of the study and randomly assigned to increase the number in the new YR Group, and to have an additional CG Group. Hence, the post-test for the CG Group, the now new YR Group, served as the pre-test. In addition, consent forms were explained and signed, upon entry to the study, and each subject was also asked to list current medications taken and not to change medications during the study. Attendance was kept, as well as medication compliance. Each subject was later asked to evaluate the intervention.

Conclusions

Based upon the results and findings of this study, and within its limitations, the following conclusions as they apply to the specific population studied and the intervention (or instrument) used are offered:
1. Participation in a health education intervention program based on yoga and relaxation techniques can contribute to an increase in the range of motion of the finger joints in patients diagnosed as having OA of the hands.

2. Participation in a health education intervention program based on yoga and relaxation techniques can contribute to a decrease in tenderness of the finger joints in patients diagnosed as having OA of the hands.

3. Participation in a health education intervention program based on yoga and relaxation techniques can contribute to a decrease in hand pain during activity in patients diagnosed as having OA of the hands.

4. Participation in a health education intervention program based on yoga and relaxation techniques did not appear to result in any statistically significant improvement in hand grip strength, circumference of the finger joints, and hand function.

In the majority of cases, by visual inspection, the CG Group also improved from pre- to post-test measurements without benefit of intervention. This could be explained in that post-test measurements were taken in the Spring when weather was warmer, and symptoms of OA would be less apparent, while pre-test measurements were taken in the Winter when symptoms may be more apparent. Measurements were also taken for the YR Group at these times and this may
account for some of the changes of YR Group members. The Hawthorne effect could also account for improvement in the CG Group. Recall that the CG Group wanted the treatment and was, therefore, promised the treatment at the conclusion of the study.

It was observed that when the CG Group received the intervention, still greater improvement occurred. It was already noted, that in all cases, the YR Group improved more than the CG Group.

Improvement in measurements of tenderness of the finger joints following intervention was statistically significant in both the right and left hands. This is meaningful in that tenderness of the finger joints is the most important variable in affecting overall patient improvement and clearly affects all other variables studied (R. Schumacher, personal communication, November 12, 1991).

Written subjective evaluations obtained from participants after the study showed enthusiasm, and more positive attitudes toward their disease, increased self-esteem, and both a willingness and eagerness to participate in further classes. Participants thought that the hospital should include this program for clinic patients.

Based on written evaluations, those who regularly attended the weekly sessions felt more encouraged to practice on their own and felt better about their physical and mental health. The patients assumed responsibility for
their own attendance. They also were encouraged by the fact that no financial investment was required, nor was expensive equipment needed.

**Recommendations for Patient Education and Health Care Practice**

In light of the findings of this study, several recommendations are proposed. Since there were no drugs involved in this intervention, nor was there costly equipment, the program could be accessible to patients with OA. It is relatively simple to understand and to teach, and if done regularly, may improve some OA conditions. Patients can perform these procedures without a professional as the risks involved are minimal.

This study also suggests that physicians may have a significant impact on maximizing the positive effects of such a program. The doctor could encourage participation in this type of program and promote self-care techniques and preventative hand health care measures. Further research may reveal the exact factors which contribute to the degree of success of the participants.

It could also be important to look at characteristics of health care providers as well as consumers. It is expected that providers with a positive attitude would encourage patients to participate and comply with this alternative health care intervention. Since the
relationship between health care providers and patients is
of a long-term nature, the support and encouragement of the
provider may be especially important.

Recommendations for Further Research

This study did not investigate the relationship of
various demographic variables such as gender, race,
ethnicity, occupation, socioeconomic status, and age with
the intervention and its effect on study variables. This
study examined OA over a relatively short period of eight
weeks. The long-term effects of the program at 6 to 12
months may yield important information when examining OA. A
longitudinal study that follows participants for one year or
more may also be useful in quantifying improvement.

Another area which might yield important information is
that of associated arthritic diseases of the hands such as
rheumatoid arthritis, carpel tunnel syndrome, and Rheynaud's
syndrome. The effects and interactions of these other
diseases may have a bearing on the individuals' health
status.

This study did not control for the pre-treatment level
of the illness due to the lack of long-term longitudinal
information. People who get the disease are not aware that
they have it and may not seek diagnosis or treatment. There
was no accurate way to determine the exact duration of the
disease. The pre-treatment level of illness may also play a role in determining the success of the program and is important to address.

The present study should be replicated. Since the time of the study, refinements have been made and further improvements added. It is recommended that 1-1/2 hour sessions rather than one-hour sessions be conducted twice a week for 10 weeks rather than once a week, and that each session end with an extended relaxation period. If the class is held twice a week, the additional class reinforces the intervention; also, if patients missed a class, they will still have one class during that week.

It is also recommended that a treatment facility easily accessible by public transportation and with adequate parking be utilized. A future study should include these changes and refinements.

The most advantageous aspect of this intervention is that patients can do it themselves and monitor the efficacy of their own regimen. It is noninvasive and has no side-effects. No expensive equipment is required. The program is easy to teach the health care provider and could be instrumental in bringing about positive results.

The study is an initial step in learning more about the effects of an alternative method of health care. In a time when health services are so costly, and demands for services far outnumber the supply, this program provides the impetus
to motivate people to be responsible for their own health care and recovery. OA, with all its personal challenges, may be managed. This health education program may assist patients with destructive joint disease in the digits in living life to its fullest and best by following these practical applications and positive approaches in their attitudes and philosophy of life.
REFERENCES


APPENDIXES
APPENDIX A

HUMAN SUBJECTS' CONSENT FORMS
Marian Garfinkel, Researcher  
H. R. Schumacher, M.D.  
Abid Husain, M.D.

VOLUNTARY CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Veteran's Administration Medical Center

INVESTIGATIONAL USE OF A HEALTH EDUCATION INTERVENTION  
BASED ON YOGA* AND RELAXATION TECHNIQUES FOR PATIENTS  
WITH OSTEOARTHRITIS OF THE HANDS AND FINGER JOINTS

Patient Name: ____________________________ Date: ________

This form is called an "Informed Consent." Its purpose is  
to inform you about a medical research project and to invite  
you to consent to participate in the project. In this  
research project we will learn more about the effectiveness  
of a health education intervention based on Yoga* and  
Relaxation techniques for patients diagnosed with  
osteoarthritis of the hands and fingers joints. Your  
participation in this project is completely voluntary and  
you should read this carefully and ask questions before you  
decide whether or not to participate. You have been  
selected for this study because you have osteoarthritis of  
the hands and fingers.

Participants in the project will be divided into two groups  
at random. One group will receive treatment with the health  
education intervention based on Yoga and Relaxation  
Techniques. The health education intervention is a new  
therapeutic program designed for its potential benefits over  
conventional therapy and treatment of osteoarthritis of the  
hands and finger joints. These potential benefits include  
an increase in range of motion (ROM), increase of hand grip  
strength, increase in flexibility, decrease in size (or  
swelling), increase in finger function, and greater ability  
to manage pain and minimize it. There may also be a  
reduction in morning stiffness and in pain. The program  
consists of gentle stretching; developing body awareness;  
posturing in standing, sitting, and lying positions; and  
ending with periods of relaxation. No extreme movements are  
required. The group will meet once a week for a period of  
60 minutes over the course of 10 weeks. The first and last  
meeting will be devoted to pre and post testing of the  
group. Testing will evaluate pain, motion, strength,  
flexibility, function, and swelling of joints. Pre and post  
testing will be administered by recognized and  
scientifically accurate instruments of measurements.

* Based on the methods developed by B. K. S. Iyengar.
The second group will act as a control group. No intervention will be administered. The group will meet for two sessions, the first being the pre "test" session, the last meeting being a post "test" session, 10 weeks later. Each session should last approximately 60 minutes. Patients selected for this group will be offered a course of the Health Education Intervention after completion of the formal study.

There are no known complications from the health education intervention. There may be some temporary slight pain or temporary joint soreness during or following the health education intervention.

Alternative treatments for the condition of osteoarthritis of the hands and fingers are available and include physical and occupational therapy outside of the study. Drugs can also be used alone without other interventions. You may continue your current medications during this study.

It is important that you agree to attend the first and last follow up evaluation visits at which no treatment will be given. You will be expected to maintain a diary in which you will record information regarding any drugs which you take during the period of the trial and any home physical therapy program which you are carrying out and you will be expected not to alter any drug or physical therapy program therapy you are on.

Any information obtained in connection with this project that can be identified with you will remain confidential. Results of this study will be published but your name will not be identified. You will not be charged and will not receive compensation for your participation in this project.

You should understand that in the event of injury resulting from the research procedures, medical care will be provided without cost to you. Eligible veterans will be entitled to medical care and treatment for any sustained injury. Compensation may also be payable under 38USC3351 or in some circumstances, under the Federal Torts Claims Act. Financial compensation is not available. You should understand that you will not give up any of your legal rights by signing this form.
Your decision whether or not to participate in the research project will not prejudice or harm your future relations with the Veteran's Administration Hospital, Philadelphia or with Dr. Schumacher. If you decide to participate you will be free to withdraw your consent and to discontinue participation at any time without prejudice to yourself. Mrs. Garfinkel and Dr. Schumacher will give you any new information which is developed during the course of the project and which relates to your willingness to continue your participation.

If I have any questions during the study, I should contact: H. Ralph Schumacher, Jr., M.D. Telephone Number: (215) 382-2400, Ext. 6460. I also understand that if I wish further information regarding my rights as a patient and a veteran, I may contact patient's representative, Mr. Eugene Montgomery at (215) 382-2400, Ext. 6622.

Marian Garfinkel is a doctoral candidate in health education at Temple University in Philadelphia. She has practiced Yoga for 20 years and has been teaching in the Philadelphia area for over 15 years. She has studied with Mr. B.K.S. Iyengar, author of Light on Yoga since 1974, and continues her studies annually with him at his institute in Pune, India.

A. Husain, M.D. is the Assistant Chief of the Rehabilitation Medicine Service and is in charge of the Outpatient section at The Veterans Administration Medical Center, Philadelphia, PA. He is a certified practitioner of Acupuncture. He has completed his post-graduate residency in Physical Medicine Rehabilitation at The Hospital of The University of Pennsylvania. In 1982 he had obtained his M.D. degree from the University of Sind, Pakistan.

You are making a decision whether or not to participate in an experimental study. Your signature on this form means that you have read and understood the information contained on this form; that you have been verbally informed about the experiment; that you have had an opportunity to ask questions; that you understand that you have a 1 in 2 chance of being randomly assigned to the Yoga Based Health Intervention Education treatment; that you have decided to participate; and that you consent to the procedures or treatment prescribed above.

I have been given the opportunity to ask questions and they have been answered satisfactorily.
I have read the above information, received a copy of the consent form and understand what my doctors have told me, and consent to participate in this project. I can withdraw from the study at any time without prejudicing continuing care.

I agree to participate in this study.

Date: ___________________________ Time: ___________

Patient's Signature: ________________________________

Witness: _______________________________________

I have explained the procedures for the treatment together with the potential benefits, complications, and risks, and alternative methods of treatment, to the above named patient. The patient appears to understand and has consented to participate in the project.

Date: ___________________________

Researcher's Signature: ______________________________

Advising Doctor's Signature: ___________________________

Testing Doctor's Signature: ___________________________
Marian Garfinkel, Researcher
H. R. Schumacher, M.D.
Abid Husain, M.D.

VOLUNTARY CONSENT TO PARTICIPATE IN A RESEARCH STUDY

The Hospital of The University of Pennsylvania

INVESTIGATIONAL USE OF A HEALTH EDUCATION INTERVENTION
BASED ON YOGA* AND RELAXATION TECHNIQUES FOR PATIENTS
WITH OSTEOARTHRITIS OF THE HANDS AND FINGER JOINTS

Patient Name: ______________________ Date: __________

This form is called an "Informed Consent." Its purpose is
to inform you about a medical research project and to invite
you to consent to participate in the project. In this
research project we will learn more about the effectiveness
of a health education intervention based on Yoga* and
Relaxation techniques for patients diagnosed with
osteoarthritis of the hands and finger joints. Your
participation in this project is completely voluntary and
you should read this carefully and ask questions before you
decide whether or not to participate. You have been
selected for this study because you have osteoarthritis of
the hands and fingers.

Participants in the project will be divided into two groups
at random. One group will receive treatment with the health
education intervention based on Yoga and Relaxation
Techniques. The health education intervention is a new
therapeutic program designed for its potential benefits over
conventional therapy and treatment of osteoarthritis of the
hands and finger joints. These potential benefits include
an increase in range of motion (ROM), increase of hand grip
strength, increase in flexibility, decrease in size (or
swelling), increase in finger function, and greater ability
to manage pain and minimize it. There may also be a
reduction in morning stiffness and in pain. The program
consists of gentle stretching; developing body awareness;
posturing in standing, sitting, and lying positions; and
ending with periods of relaxation. No extreme movements are
required. The group will meet once a week for a period of
60 minutes over the course of 10 weeks. The first and last
meeting will be devoted to pre and post testing of the
group. Testing will evaluate pain, motion, strength,
flexibility, function, and swelling of joints. Pre and post
testing will be administered by recognized and
scientifically accurate instruments of measurements.

* Based on the methods developed by B. K. S. Iyengar.
The second group will act as a control group. No intervention will be administered. The group will meet for two sessions, the first being the pre "test" session, the last meeting being a post "test" session, 10 weeks later. Each session should last approximately 60 minutes. Patients selected for this group will be offered a course of the Health Education Intervention after completion of the formal study.

There are no known complications from either the health education intervention. There may be some temporary slight pain or temporary joint soreness during or following the health education intervention.

Benefits to the subject may include an increase in range of motion, increase of hand grip strength, increase in flexibility, decrease in size (or swelling), increase in hand function, and greater ability to manage pain and minimize it.

Alternative treatments for the condition of osteoarthritis of the hands and fingers are available and include physical and occupational therapy outside of the study. Drugs can also be used alone without other interventions. You may continue your current medications during this study.

It is important that you agree to attend the first and last follow up evaluation visits at which no treatment will be given. You will be expected to maintain a diary in which you will record information regarding any drugs which you take during the period of the trial and any home physical therapy program which you are carrying out and you will be expected not to alter any drug or physical therapy program therapy you are on.

Any information obtained in connection with this project that can be identified with you will remain confidential. Results of this study will be published but your name will not be identified. You will not be charged and will not receive compensation for your participation in this project.

Your decision whether or not to participate in the research project will not prejudice or harm your future relations with the Hospital of The University of Pennsylvania, Philadelphia or with Dr. Schumacher. If you decide to participate you will be free to withdraw your consent and to discontinue participation at any time without prejudice to
Marian Garfinkel, Researcher
H. R. Schumacher, M.D.
Abid Husain, M.D.

yourself. Mrs. Garfinkel and Dr. Schumacher will give you new information which is developed during the course of the project and which relates to your willingness to continue your participation.

Dr. Schumacher, who is coordinating this study, is a member of the medical staff at The Hospital of the University of Pennsylvania. His office is located at 34th and Spruce Streets and his telephone number is 215-662-2454. There is a university committee that reviews the use of this procedure. You are to notify the Office of Research Administration at 898-7293 immediately if any problems or research-related injuries occur.

Marian Garfinkel is a doctoral candidate in health education at Temple University in Philadelphia. She has practiced Yoga for 20 years and has been teaching in the Philadelphia area for over 15 years. She has studied with Mr. B. K. S. Iyengar, author of *Light on Yoga* since 1974, and continues her studies annually with him at his institute in Pune, India.

A. Husain, M.D. is the Assistant Chief of the Rehabilitation Medicine Service and is in charge of the Outpatient section at The Veteran's Administration Medical Center, Philadelphia, PA. He is a certified practitioner of Acupuncture. He has completed his post-graduate residency in Physical Medicine Rehabilitation at The Hospital of The University of Pennsylvania. In 1982 he had obtained his M.D. degree from the University of Sind, Pakistan.

You are making a decision whether or not to participate in an experimental study. Your signature on this form means that you have read and understood the information contained on this form; that you have been verbally informed about the experiment; that you have had an opportunity to ask questions; that you understand that you have a 1 in 2 chance of being randomly assigned to the Yoga Based Health Intervention Education treatment; that you have decided to participate; and that you consent to the procedures or treatment prescribed above.

I have been given the opportunity to ask questions and they have been answered satisfactorily.
I have read the above information, received a copy of the consent form and understand what my doctors have told me, and consent to participate in this project. I can withdraw from the study at any time without prejudicing continuing care.

I understand that if I wish further information regarding my rights as a research subject, I may contact the Director of Research in the Office of Research Administration at The University of Pennsylvania by telephoning 215-898-7293. I understand that in the event of physical injury resulting from the research procedures, medical treatment in excess of that provided by third party payers will be provided without cost to me but financial compensation is not available.

I agree to participate in this study.

Date: ____________________________  Time: ____________

Patient's Signature: ____________________________

Witness: ____________________________

I have explained the procedures for the treatment together with the potential benefits, complications, and risks, and alternative methods of treatment, to the above named patient. The patient appears to understand and has consented to participate in the project.

Date: ____________________________

Researcher's Signature: ____________________________

Advising Doctor's Signature: ____________________________

Testing Doctor's Signature: ____________________________
APPENDIX B

RAW DATA
GROUP YR (n = 9)--FIRST PHASE OF STUDY, DECEMBER, 1990 TO APRIL, 1991

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Note. Lower numbers are better.
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**Note.** Lower numbers are better.
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Note. Lower numbers are better.
APPENDIX C

INTERVENTION AND TREATMENT PROCEDURES
PROCEDURES FOR YOGA AS AN INTERVENTION
OF OSTEOARTHRITIS OF THE HANDS
AND FINGER JOINTS

Statement of Purpose

Yoga has been used for centuries to correct structural defects of the body, body movement, and emotional disturbances. At the present time, it is being used actively in India and the United Kingdom as a therapy for a variety of ailments, including osteoarthritis (OA). This study investigated the impact of yoga on (a) range of movement of the finger joints, (b) hand grip strength, (c) tenderness of the finger joints, (d) circumference of the finger joints, (e) hand pain, and (f) hand function in patients with OA.

General Objectives for Intervention:

1. To increase range of movement of the finger joints.
2. To increase hand grip strength.
3. To decrease tenderness of the finger joints.
4. To decrease circumference of the finger joints.
5. To decrease hand pain.
6. To teach participants how to relax in order to manage hand pain.
7. To increase hand function for the intervention.
The eight sessions presented below are those used as a method of instruction for Group 1 (Intervention Subjects). Group 2 (Control Group) had no intervention. (Group 2 was promised the intervention at a later time.) Each session is 60 minutes in duration and is conducted once a week. The general format of each class is divided into two parts. In Part A the instructor presents an introduction to the program with demonstration, discussion, and participation by the subjects. Part B is the conclusion of the session which is relaxation and breathing techniques. As sessions continue weekly, materials are reviewed from the previous meeting and practice assignments are given. Questions from the subjects are encouraged.

The outline of each session follows.
First Session: Basic Sitting Posture, Clasping, Shaking and Stretching of the Arms and Hands

Introduction to Health Maintenance: Overview of Program (10 minutes)
- Gaining control over one's disease
- Developing a positive attitude
- Pain: How to look at it and work with it.

Introduction to Upper Body (5 minutes)
- Basic anatomical structure. Emphasis on upper spine, head, shoulders, arms, and emphasis on hands
- Awareness of alignment and movement
- Importance of breathing

Yoga Positions for the Hands: Asanas for Arthritis (50 minutes)

Position 1 Basic Sitting Position (Dandasana)

Sit on the chair with the trunk upright. Pressing the hands into the seat extend the sides and the back of the body up. Stretch the sacrum and lumbar. Lift the rib cage; press the shoulder blades into the back. Rotate the upper arms outward and lock the elbows. Extend the front of the body from the pubis up. Keep the lower abdomen slightly pulled back, without tensing it. Lift the sternum, the top ribs and the collarbones. Move the shoulders back and down. Open the chest and breathe evenly.

Position 2 (Urdhva Hastasana)

Stretch the arms and fingers forward, vertically up. Lock the elbows by pressing the backs of the elbows into the elbow joints and stretch the inner elbows. Open the palms, keep the fingers together. Lift the sides of the body. Do not hunch the shoulders. Keep the shoulder blades in. Stay for 20 to 30 seconds, then bring the arms back down.
Position 3 (Parvatasana)

Interlock the fingers with the right thumb base over the left, base of the fingers in contact. Turn the palms out and stretch the arms forward and up. Lock the elbows. Open the armpits. Pull up the trunk with the arms. Take the arms further back. Stay for 15 to 20 seconds. Bring the arms down. Repeat from beginning with left thumb in front.

Position 4 (Garudasana)

Bend the elbows and cross them in front of the chest with the forearms stretching up and thumbs facing the head. Cross the left elbow over the right, fitting it snugly into the notch of the elbow. Moving the right hand toward the head and the left away from it, cross the hands and place the fingers of the right hand on the left palm. Raise the elbows to shoulder level. Stretch the hands and fingers up. Stay, breathing evenly, for 20 to 30 seconds. Release the arms and stand straight.

Position 5 (Gomukhasana)

Bend the left elbow behind the back and take the back of the hand high up the spine. Stretch the right arm up. (Taking the right arm back and the left arm up gives a different balance.) Bend the right elbow back, stretch the hand down, and clasp the left hand or wrist with the palms facing. Stay, breathing evenly, for 15 to 20 seconds. Keep the head straight and look ahead. Release the arms.

Position 6 (Namaste)

the palms together, especially the parts of the palm that form the base of each finger. Pull the fingers back into hyperextension, trying to increase the distance between the fingers of the left hand and the fingers of the right. Again encourage the fingers away from ulnar deviation. Hold and encourage 1-2 breaths. Release 1-2 breaths. Hold and encourage. Release. Hold and encourage. Release.

Relaxation in a seated position (10 minutes)

- Importance to the program/disease

The relaxation response of Savasana (Corpse Pose) and meditation helps counter-act the energy-draining effects of prolonged stress and chronic pain. Deep relaxation helps restore more normal functioning of the immune system, which deteriorates with chronic stress, chronic pain, grief and depression.

- How to do it

Turning attention to your head. Let yourself imagine your entire forehead and scalp becoming smooth and at rest. Relax your eyes. Let them remain closed gently and comfortably. Relax your jaw. When the jaw is relaxed, your lips will be lightly parted. Relax your tongue.

Press your head back as far as it can comfortably go and observe the tension in your neck. Straighten your head and bring it forward. Relax your throat. Let the relaxation deepen. Now relax your shoulders. Lower head down between your shoulders. Relax your shoulders. Drop them back and feel the relaxation spreading through your neck, throat and shoulders, pure relaxation, deeper and deeper.

Give your entire body a chance to relax. Feel the comfort and the heaviness. Now breathe in and fill your lungs completely. Hold your breath. Notice the tension. Now exhale, let your chest become loose. Continue relaxing, letting your breath come freely and gently.

Class will end with actual relaxation

Assignment: Practice. Beginning of Awareness of sitting, alignment of hands, breathing, relaxing.
Second Session: Basic Sitting Posture, Clasping, Shaking, and Stretching of the Arms and Hands

Yoga Positions for the Hands: Asanas for Arthritis (50 minutes)

Position 1 Basic Sitting Position (Dandasana)

Sit on the chair with the trunk upright. Pressing the hands into the seat extend the sides and the back of the body up. Stretch the sacrum and lumbar. Lift the rib cage; press the shoulder blades into the back. Rotate the upper arms outward and lock the elbows. Extend the front of the body from the pubis up. Keep the lower abdomen slightly pulled back, without tensing it. Lift the sternum, the top ribs and the collarbones. Move the shoulders back and down. Open the chest and breathe evenly.

Position 2 (Urdhva Hastasana)

Stretch the arms and fingers forward, vertically up. Lock the elbows by pressing the backs of the elbows into the elbow joints and stretch the inner elbows. Open the palms, keep the fingers together. Lift the sides of the body. Do not hunch the shoulders. Keep the shoulder blades in. Stay for 20 to 30 seconds, then bring the arms back down.

Position 3 (Parvatasana)

Interlock the fingers with the right thumb base over the left, base of the fingers in contact. Turn the palms out and stretch the arms forward and up. Lock the elbows. Open the armpits. Pull up the trunk with the arms. Take the arms further back. Stay for 15 to 20 seconds. Bring the arms down. Repeat from beginning with left thumb in front.

Position 4 (Garudasana)

Bend the elbows and cross them in front of the chest with the forearms stretching up and thumbs facing the head. Cross the left elbow over the right, fitting it snugly into the notch of the elbow. Moving the right hand toward the head and the left away from it, cross the hands and place
the fingers of the right hand on the left palm. Raise the elbows to shoulder level. Stretch the hands and fingers up. Stay, breathing evenly, for 20 to 30 seconds. Release the arms and stand straight.

Position 5 (Gomukhasana)

Bend the left elbow behind the back and take the back of the hand high up the spine. Stretch the right arm up. (Taking the right arm back and the left arm up gives a different balance.) Bend the right elbow back, stretch the hand down, and clasp the left hand or wrist with the palms facing. Stay, breathing evenly, for 15 to 20 seconds. Keep the head straight and look ahead. Release the arms.

Position 6 (Namaste)

Relaxation in a seated position (10 minutes)

- Importance to the program/disease

The relaxation response of Savasana (Corpse Pose) and meditation helps counter-act the energy-draining effects of prolonged stress and chronic pain. Deep relaxation helps restore more normal functioning of the immune system, which deteriorates with chronic stress, chronic pain, grief and depression.

- How to do it

Turning attention to your head. Let yourself imagine your entire forehead and scalp becoming smooth and at rest. Relax your eyes. Let them remain closed gently and comfortably. Relax your jaw. When the jaw is relaxed, your lips will be lightly parted. Relax your tongue.

Press your head back as far as it can comfortably go and observe the tension in your neck. Straighten your head and bring it forward. Relax your throat. Let the relaxation deepen. Now relax your shoulders. Lower head down between your shoulders. Relax your shoulders. Drop them back and feel the relaxation spreading through your neck, throat and shoulders, pure relaxation, deeper and deeper.

Give your entire body a chance to relax. Feel the comfort and the heaviness. Now breathe in and fill your lungs completely. Hold your breath. Notice the tension. Now exhale, let your chest become loose. Continue relaxing, letting your breath come freely and gently.

Class will end with relaxation.

Assignment: Practice positions learned.
Yoga Positions for the Hands: Asanas for Arthritis (50 minutes)

Position 1 Basic Sitting Position (Dandasana)

Sit on the chair with the trunk upright. Pressing the hands into the seat extend the sides and the back of the body up. Stretch the sacrum and lumbar. Lift the rib cage; press the shoulder blades into the back. Rotate the upper arms outward and lock the elbows. Extend the front of the body from the pubis up. Keep the lower abdomen slightly pulled back, without tensing it. Lift the sternum, the top ribs and the collarbones. Move the shoulders back and down. Open the chest and breathe evenly.

Position 2 (Urdhva Hastasana)

Stretch the arms and fingers forward, vertically up. Lock the elbows by pressing the backs of the elbows into the elbow joints and stretch the inner elbows. Open the palms, keep the fingers together. Lift the sides of the body. Do not hunch the shoulders. Keep the shoulder blades in. Stay for 20 to 30 seconds, then bring the arms back down.

Position 3 Chair Twists (Bharadvajasana)

Sit sideways on a chair, with the right hip against the back of the chair. Sit on the whole seat. Stretch the trunk up and take the shoulders back. Line up the trunk with the legs. Keep the knees and feet together.

Exhale and turn toward the back of the chair, synchronizing the movements of the right and left sides. Move the back ribs in. Do not disturb the position of the legs.

Place the hands on the back of the chair. Pull with the left hand to bring the left side toward the back of the chair and push with the right hand to turn the right side away from it. Turn to the maximum, keeping the trunk upright.
Turn the head and look over the right shoulder. Stay for 20 to 30 seconds, breathing evenly. Exhale, turn to the front. Repeat on the left. Afterward, sit on the front of the chair. Spread the legs and bend down, relaxing the back and the head.

Position 4 (Parvatasana)

Interlock the fingers with the right thumb base over the left, base of the fingers in contact. Turn the palms out and stretch the arms forward and up. Lock the elbows. Open the armpits. Pull up the trunk with the arms. Take the arms further back. Stay for 15 to 20 seconds. Bring the arms down. Repeat from beginning with left thumb in front.

Position 5 (Garudasana)

Bend the elbows and cross them in front of the chest with the forearms stretching up and thumbs facing the head. Cross the left elbow over the right, fitting it snugly into the notch of the elbow. Moving the right hand toward the head and the left away from it, cross the hands and place the fingers of the right hand on the left palm. Raise the elbows to shoulder level. Stretch the hands and fingers up. Stay, breathing evenly, for 20 to 30 seconds. Release the arms and stand straight.

Position 6 (Gomukhasana)

Bend the left elbow behind the back and take the back of the hand high up the spine. Stretch the right arm up. (Taking the right arm back and the left arm up gives a different balance.) Bend the right elbow back, stretch the hand down, and clasp the left hand or wrist with the palms facing. Stay, breathing evenly, for 15 to 20 seconds. Keep the head straight and look ahead. Release the arms.

Position 7 (Namaste)

Gently press the palms and fingers of each hand against the palms and fingers of the other hand. As you breathe smoothly and evenly encourage the fingers away from their position of ulnar deviation. Hold for 1-2 breaths. Release pressure but maintain contact for 1-2 breaths.

Relaxation in a seated position (10 minutes)

- Importance to the program/disease

The relaxation response of Savasana (Corpse Pose) and meditation helps counter-act the energy-draining effects of prolonged stress and chronic pain. Deep relaxation helps restore more normal functioning of the immune system, which deteriorates with chronic stress, chronic pain, grief and depression.

- How to do it

Turning attention to your head. Let yourself imagine your entire forehead and scalp becoming smooth and at rest. Relax your eyes. Let them remain closed gently and comfortably. Relax your jaw. When the jaw is relaxed, your lips will be lightly parted. Relax your tongue.

Press your head back as far as it can comfortably go and observe the tension in your neck. Straighten your head and bring it forward. Relax your throat. Let the relaxation deepen. Now relax your shoulders. Lower head down between your shoulders. Relax your shoulders. Drop them back and feel the relaxation spreading through your neck, throat and shoulders, pure relaxation, deeper and deeper.
Give your entire body a chance to relax. Feel the comfort and the heaviness. Now breathe in and fill your lungs completely. Hold your breath. Notice the tension. Now exhale, let your chest become loose. Continue relaxing, letting your breath come freely and gently.

Class will end with relaxation

Assignment: Practice positions learned.
Fourth Session: Basic Sitting Posture, Clasping, Shaking, and Stretching of the Arms and Hands

Yoga Positions for the Hands: Asanas for Arthritis (50 minutes)

Position 1 Basic Sitting Position (Dandasana)

Sit on the chair with the trunk upright. Pressing the hands into the seat extend the sides and the back of the body up. Stretch the sacrum and lumbar. Lift the rib cage; press the shoulder blades into the back. Rotate the upper arms outward and lock the elbows. Extend the front of the body from the pubis up. Keep the lower abdomen slightly pulled back, without tensing it. Lift the sternum, the top ribs and the collarbones. Move the shoulders back and down. Open the chest and breathe evenly.

Position 2 (Urdhva Hastasana)

Stretch the arms and fingers forward, vertically up. Lock the elbows by pressing the backs of the elbows into the elbow joints and stretch the inner elbows. Open the palms, keep the fingers together. Lift the sides of the body. Do not hunch the shoulders. Keep the shoulder blades in. Stay for 20 to 30 seconds, then bring the arms back down.

Position 3 Chair Twists (Bharadvajasana)

Sit sideways on a chair, with the right hip against the back of the chair. Sit on the whole seat. Stretch the trunk up and take the shoulders back. Line up the trunk with the legs. Keep the knees and feet together.

Exhale and turn toward the back of the chair, synchronizing the movements of the right and left sides. Move the back ribs in. Do not disturb the position of the legs.

Place the hands on the back of the chair. Pull with the left hand to bring the left side toward the back of the chair and push with the right hand to turn the right side away from it. Turn to the maximum, keeping the trunk upright.
Turn the head and look over the right shoulder. Stay for 20 to 30 seconds, breathing evenly. Exhale, turn to the front. Repeat on the left. Afterward, sit on the front of the chair. Spread the legs and bend down, relaxing the back and the head.

Position 4 (Parvatasana)

Interlock the fingers with the right thumb base over the left, base of the fingers in contact. Turn the palms out and stretch the arms forward and up. Lock the elbows. Open the armpits. Pull up the trunk with the arms. Take the arms further back. Stay for 15 to 20 seconds. Bring the arms down. Repeat from beginning with left thumb in front.

Position 5 (Garudasana)

Bend the elbows and cross them in front of the chest with the forearms stretching up and thumbs facing the head. Cross the left elbow over the right, fitting it snugly into the notch of the elbow. Moving the right hand toward the head and the left away from it, cross the hands and place the fingers of the right hand on the left palm. Raise the elbows to shoulder level. Stretch the hands and fingers up. Stay, breathing evenly, for 20 to 30 seconds. Release the arms and stand straight.

Position 6 (Gomukhasana)

Bend the left elbow behind the back and take the back of the hand high up the spine. Stretch the right arm up. (Taking the right arm back and the left arm up gives a different balance.) Bend the right elbow back, stretch the hand down, and clasp the left hand or wrist with the palms facing. Stay, breathing evenly, for 15 to 20 seconds. Keep the head straight and look ahead. Release the arms.

Position 7 (Namaste)

Gently press the palms and fingers of each hand against the palms and fingers of the other hand. As you breathe smoothly and evenly encourage the fingers away from their position of ulnar deviation. Hold for 1-2 breaths. Release pressure but maintain contact for 1-2 breaths.

Relaxation in a seated position (10 minutes)

- Importance to the program/disease

The relaxation response of Savasana (Corpse Pose) and meditation helps counter-act the energy-draining effects of prolonged stress and chronic pain. Deep relaxation helps restore more normal functioning of the immune system, which deteriorates with chronic stress, chronic pain, grief and depression.

- How to do it

Turning attention to your head. Let yourself imagine your entire forehead and scalp becoming smooth and at rest. Relax your eyes. Let them remain closed gently and comfortably. Relax your jaw. When the jaw is relaxed, your lips will be lightly parted. Relax your tongue. Press your head back as far as it can comfortably go and observe the tension in your neck. Straighten your head and bring it forward. Relax your throat. Let the relaxation deepen. Now relax your shoulders. Lower head down between your shoulders. Relax your shoulders. Drop them back and feel the relaxation spreading through your neck, throat and shoulders, pure relaxation, deeper and deeper.
Give your entire body a chance to relax. Feel the comfort and the heaviness. Now breathe in and fill your lungs completely. Hold your breath. Notice the tension. Now exhale, let your chest become loose. Continue relaxing, letting your breath come freely and gently.

Class will end with relaxation

Assignment: Practice positions learned.
Fifth Session: Basic Sitting Posture,
Clasping, Shaking, and Stretching
of the Arms and Hands

Yoga Positions for the Hands: Asanas for Arthritis
(50 minutes)

Position 1 Basic Sitting Position (Dandasana)

Sit on the chair with the trunk upright. Pressing
the hands into the seat extend the sides and the
back of the body up. Stretch the sacrum and
lumbar. Lift the rib cage; press the shoulder
blades into the back. Rotate the upper arms
outward and lock the elbows. Extend the front of
the body from the pubis up. Keep the lower
abdomen slightly pulled back, without tensing it.
Lift the sternum, the top ribs and the
collarbones. Move the shoulders back and down.
Open the chest and breathe evenly.

Position 2 (Urdhva Hastasana)

Stretch the arms and fingers forward, vertically
up. Lock the elbows by pressing the backs of the
elbows into the elbow joints and stretch the inner
elbows. Open the palms, keep the fingers
together. Lift the sides of the body. Do not
hunch the shoulders. Keep the shoulder blades in.
Stay for 20 to 30 seconds, then bring the arms
back down.

Position 3 Chair Twists (Bharadvajasana)

Sit sideways on a chair, with the right hip
against the back of the chair. Sit on the whole
seat. Stretch the trunk up and take the shoulders
back. Line up the trunk with the legs. Keep the
knees and feet together.

Exhale and turn toward the back of the chair,
synchronizing the movements of the right and left
sides. Move the back ribs in. Do not disturb the
position of the legs.

Place the hands on the back of the chair. Pull
with the left hand to bring the left side toward
the back of the chair and push with the right hand
to turn the right side away from it. Turn to the
maximum, keeping the trunk upright.
Turn the head and look over the right shoulder. Stay for 20 to 30 seconds, breathing evenly. Exhale, turn to the front. Repeat on the left. Afterward, sit on the front of the chair. Spread the legs and bend down, relaxing the back and the head.

**Position 4 (Parvatasana)**

Interlock the fingers with the right thumb base over the left, base of the fingers in contact. Turn the palms out and stretch the arms forward and up. Lock the elbows. Open the armpits. Pull up the trunk with the arms. Take the arms further back. Stay for 15 to 20 seconds. Bring the arms down. Repeat from beginning with left thumb in front.

**Position 5 (Garudasana)**

Bend the elbows and cross them in front of the chest with the forearms stretching up and thumbs facing the head. Cross the left elbow over the right, fitting it snugly into the notch of the elbow. Moving the right hand toward the head and the left away from it, cross the hands and place the fingers of the right hand on the left palm. Raise the elbows to shoulder level. Stretch the hands and fingers up. Stay, breathing evenly, for 20 to 30 seconds. Release the arms and stand straight.

**Warm-Up Hand Clasp Shoulder Stretch**

Sitting in Dandasana pose, interlace fingers behind your back. Move both hands to the left, placing back of right hand against left rib cage. Exhale, lower the shoulders, and draw shoulder blades together and down. The left elbow moves in toward the spine and down. Breathe high into the chest and lift the spine with each inhalation. Hold 15 to 20 seconds. Reverse. Helps to stretch chest, strengthen upper back, add mobility to shoulder girdle.

**Warm-Up Wrist Stretch**

Sit facing a wall. Bend the arms at the elbows, with fingers pointing up place fingers and as much of palm as possible on the wall. One each exhalation lean more heavily into the hands,
trying to get the entire palm on the wall. As flexibility increases, move hands higher up the wall.

Sit facing a wall. Bend the arms at the elbows, with fingers of left hand pointing to the left and fingers of right hand pointing to the right place fingers and as much of palm as possible on the wall. One each exhalation lean more heavily into the hands, trying to get the entire palm on the wall. As flexibility increases, move hands higher up the wall.

Sit facing a wall. Bend the arms at the elbows, turn the palms down so fingers point to floor. Place fingers and as much of palm as possible on the wall. One each exhalation lean more heavily into the hands, trying to get the entire palm on the wall. As flexibility increases, move hands higher up the wall.

Position 6 (Gomukhasana)

Bend the left elbow behind the back and take the back of the hand high up the spine. Stretch the right arm up. (Taking the right arm back and the left arm up gives a different balance.) Bend the right elbow back, stretch the hand down, and clasp the left hand or wrist with the palms facing. Stay, breathing evenly, for 15 to 20 seconds. Keep the head straight and look ahead. Release the arms.

Position 7 (Namaste)

Gently press the palms and fingers of each hand against the palms and fingers of the other hand. As you breathe smoothly and evenly encourage the fingers away from their position of ulnar deviation. Hold for 1-2 breaths. Release pressure but maintain contact for 1-2 breaths. Hold and encourage. Release. Hold and encourage. Release. Gently, firmly, and evenly press the palms together. Smoothly spread the fingers as wide as possible. Encourage even spreading with less and less ulnar deviation. Hold and encourage for 1-2 breaths. Release for 1-2 breaths. Hold and encourage. Release. Firmly and evenly press the palms together, especially the parts of the palm that form the base of each finger. Pull the fingers back into hyperextension, trying to increase the distance between the fingers of the

Relaxation in a seated position (10 minutes)

- Importance to the program/disease

The relaxation response of Savasana (Corpse Pose) and meditation helps counter-act the energy-draining effects of prolonged stress and chronic pain. Deep relaxation helps restore more normal functioning of the immune system, which deteriorates with chronic stress, chronic pain, grief and depression.

- How to do it

Turning attention to your head. Let yourself imagine your entire forehead and scalp becoming smooth and at rest. Relax your eyes. Let them remain closed gently and comfortably. Relax your jaw. When the jaw is relaxed, your lips will be lightly parted. Relax your tongue.

Press your head back as far as it can comfortably go and observe the tension in your neck. Straighten your head and bring it forward. Relax your throat. Let the relaxation deepen. Now relax your shoulders. Lower head down between your shoulders. Relax your shoulders. Drop them back and feel the relaxation spreading through your neck, throat and shoulders, pure relaxation, deeper and deeper.

Give your entire body a chance to relax. Feel the comfort and the heaviness. Now breathe in and fill your lungs completely. Hold your breath. Notice the tension. Now exhale, let your chest become loose. Continue relaxing, letting your breath come freely and gently.

Class will end with relaxation

Assignment: Practice positions learned.
Sixth Session: Basic Sitting Posture, Clasping, Shaking, and Stretching of the Arms and Hands

Yoga Positions for the Hands: Asanas for Arthritis (50 minutes)

Position 1 Basic Sitting Position (Dandasana)

Sit on the chair with the trunk upright. Pressing the hands into the seat extend the sides and the back of the body up. Stretch the sacrum and lumbar. Lift the rib cage; press the shoulder blades into the back. Rotate the upper arms outward and lock the elbows. Extend the front of the body from the pubis up. Keep the lower abdomen slightly pulled back, without tensing it. Lift the sternum, the top ribs and the collarbones. Move the shoulders back and down. Open the chest and breathe evenly.

Position 2 (Urdhva Hastasana)

Stretch the arms and fingers forward, vertically up. Lock the elbows by pressing the backs of the elbows into the elbow joints and stretch the inner elbows. Open the palms, keep the fingers together. Lift the sides of the body. Do not hunch the shoulders. Keep the shoulder blades in. Stay for 20 to 30 seconds, then bring the arms back down.

Position 3 Chair Twists (Bharadvajasana)

Sit sideways on a chair, with the right hip against the back of the chair. Sit on the whole seat. Stretch the trunk up and take the shoulders back. Line up the trunk with the legs. Keep the knees and feet together.

Exhale and turn toward the back of the chair, synchronizing the movements of the right and left sides. Move the back ribs in. Do not disturb the position of the legs.

Place the hands on the back of the chair. Pull with the left hand to bring the left side toward the back of the chair and push with the right hand to turn the right side away from it. Turn to the maximum, keeping the trunk upright.
Turn the head and look over the right shoulder. Stay for 20 to 30 seconds, breathing evenly. Exhale, turn to the front. Repeat on the left. Afterward, sit on the front of the chair. Spread the legs and bend down, relaxing the back and the head.

Position 4 (Parvatasana)

Interlock the fingers with the right thumb base over the left, base of the fingers in contact. Turn the palms out and stretch the arms forward and up. Lock the elbows. Open the armpits. Pull up the trunk with the arms. Take the arms further back. Stay for 15 to 20 seconds. Bring the arms down. Repeat from beginning with left thumb in front.

Position 5 (Garudasana)

Bend the elbows and cross them in front of the chest with the forearms stretching up and thumbs facing the head. Cross the left elbow over the right, fitting it snugly into the notch of the elbow. Moving the right hand toward the head and the left away from it, cross the hands and place the fingers of the right hand on the left palm. Raise the elbows to shoulder level. Stretch the hands and fingers up. Stay, breathing evenly, for 20 to 30 seconds. Release the arms and stand straight.

Warm-Up Hand Clasp Shoulder Stretch

Sitting in Dandasana pose, interlace fingers behind your back. Move both hands to the left, placing back of right hand against left rib cage. Exhale, lower the shoulders, and draw shoulder blades together and down. The left elbow moves in toward the spine and down. Breathe high into the chest and lift the spine with each inhalation. Hold 15 to 20 seconds. Reverse. Helps to stretch chest, strengthen upper back, add mobility to shoulder girdle.

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Sit facing a wall. Bend the arms at the elbows, with fingers of left hand pointing to the left and fingers of right hand pointing to the right place fingers and as much of palm as possible on the wall. One each exhalation lean more heavily into the hands, trying to get the entire palm on the wall. As flexibility increases, move hands higher up the wall.

Sit facing a wall. Bend the arms at the elbows, turn the palms down so fingers point to floor. Place fingers and as much of palm as possible on the wall. One each exhalation lean more heavily into the hands, trying to get the entire palm on the wall. As flexibility increases, move hands higher up the wall.

Position 6 (Gomukhasana)

Bend the left elbow behind the back and take the back of the hand high up the spine. Stretch the right arm up. (Taking the right arm back and the left arm up gives a different balance.) Bend the right elbow back, stretch the hand down, and clasp the left hand or wrist with the palms facing. Stay, breathing evenly, for 15 to 20 seconds. Keep the head straight and look ahead. Release the arms.

Position 7 (Namaste)

Gently press the palms and fingers of each hand against the palms and fingers of the other hand. As you breathe smoothly and evenly encourage the fingers away from their position of ulnar deviation. Hold for 1-2 breaths. Release pressure but maintain contact for 1-2 breaths. Hold and encourage. Release. Hold and encourage. Release. Gently, firmly, and evenly press the palms together. Smoothly spread the fingers as wide as possible. Encourage even spreading with less and less ulnar deviation. Hold and encourage for 1-2 breaths. Release for 1-2 breaths. Hold and encourage. Release. Firmly and evenly press the palms together, especially the parts of the palm that form the base of each finger. Pull the fingers back into hyperextension, trying to increase the distance between the fingers of the

Relaxation in a seated position (10 minutes)

- Importance to the program/disease

The relaxation response of Savasana (Corpse Pose) and meditation helps counter-act the energy-draining effects of prolonged stress and chronic pain. Deep relaxation helps restore more normal functioning of the immune system, which deteriorates with chronic stress, chronic pain, grief and depression.

- How to do it

Turning attention to your head. Let yourself imagine your entire forehead and scalp becoming smooth and at rest. Relax your eyes. Let them remain closed gently and comfortably. Relax your jaw. When the jaw is relaxed, your lips will be lightly parted. Relax your tongue.

Press your head back as far as it can comfortably go and observe the tension in your neck. Straighten your head and bring it forward. Relax your throat. Let the relaxation deepen. Now relax your shoulders. Lower head down between your shoulders. Relax your shoulders. Drop them back and feel the relaxation spreading through your neck, throat and shoulders, pure relaxation, deeper and deeper.

Give your entire body a chance to relax. Feel the comfort and the heaviness. Now breathe in and fill your lungs completely. Hold your breath. Notice the tension. Now exhale, let your chest become loose. Continue relaxing, letting your breath come freely and gently.

Class will end with relaxation

Assignment: Practice positions learned.
Seventh Session: Basic Sitting Posture.
   Clasping, Shaking, and Stretching
   of the Arms and Hands

Yoga Positions for the Hands: Asanas for Arthritis
(50 minutes)

   Position 1 Basic Sitting Position (Dandasana)
   Sit on the chair with the trunk upright. Pressing the hands into the seat extend the sides and the back of the body up. Stretch the sacrum and lumbar. Lift the rib cage; press the shoulder blades into the back. Rotate the upper arms outward and lock the elbows. Extend the front of the body from the pubis up. Keep the lower abdomen slightly pulled back, without tensing it. Lift the sternum, the top ribs and the collarbones. Move the shoulders back and down. Open the chest and breathe evenly.

   Position 2 (Urdhva Hastasana)
   Stretch the arms and fingers forward, vertically up. Lock the elbows by pressing the backs of the elbows into the elbow joints and stretch the inner elbows. Open the palms, keep the fingers together. Lift the sides of the body. Do not hunch the shoulders. Keep the shoulder blades in. Stay for 20 to 30 seconds, then bring the arms back down.

   Position 3 Chair Twists (Bharadvajasana)
   Sit sideways on a chair, with the right hip against the back of the chair. Sit on the whole seat. Stretch the trunk up and take the shoulders back. Line up the trunk with the legs. Keep the knees and feet together.

   Exhale and turn toward the back of the chair, synchronizing the movements of the right and left sides. Move the back ribs in. Do not disturb the position of the legs.

   Place the hands on the back of the chair. Pull with the left hand to bring the left side toward the back of the chair and push with the right hand to turn the right side away from it. Turn to the maximum, keeping the trunk upright.
Turn the head and look over the right shoulder. Stay for 20 to 30 seconds, breathing evenly. Exhale, turn to the front. Repeat on the left. Afterward, sit on the front of the chair. Spread the legs and bend down, relaxing the back and the head.

Position 4 (Parvatasana)

Interlock the fingers with the right thumb base over the left, base of the fingers in contact. Turn the palms out and stretch the arms forward and up. Lock the elbows. Open the armpits. Pull up the trunk with the arms. Take the arms further back. Stay for 15 to 20 seconds. Bring the arms down. Repeat from beginning with left thumb in front.

Position 5 (Garudasana)

Bend the elbows and cross them in front of the chest with the forearms stretching up and thumbs facing the head. Cross the left elbow over the right, fitting it snugly into the notch of the elbow. Moving the right hand toward the head and the left away from it, cross the hands and place the fingers of the right hand on the left palm. Raise the elbows to shoulder level. Stretch the hands and fingers up. Stay, breathing evenly, for 20 to 30 seconds. Release the arms and stand straight.

Warm-Up Hand Clasp Shoulder Stretch

Sitting in Dandasana pose, interlace fingers behind your back. Move both hands to the left, placing back of right hand against left rib cage. Exhale, lower the shoulders, and draw shoulder blades together and down. The left elbow moves in toward the spine and down. Breathe high into the chest and lift the spine with each inhalation. Hold 15 to 20 seconds. Reverse. Helps to stretch chest, strengthen upper back, add mobility to shoulder girdle.

Warm-Up Wrist Stretch

Sit facing a wall. Bend the arms at the elbows, with fingers pointing up place fingers and as much of palm as possible on the wall. One each exhalation lean more heavily into the hands,
trying to get the entire palm on the wall. As flexibility increases, move hands higher up the wall.

Sit facing a wall. Bend the arms at the elbows, with fingers of left hand pointing to the left and fingers of right hand pointing to the right place fingers and as much of palm as possible on the wall. One each exhalation lean more heavily into the hands, trying to get the entire palm on the wall. As flexibility increases, move hands higher up the wall.

Sit facing a wall. Bend the arms at the elbows, turn the palms down so fingers point to floor. Place fingers and as much of palm as possible on the wall. One each exhalation lean more heavily into the hands, trying to get the entire palm on the wall. As flexibility increases, move hands higher up the wall.

Position 6 (Gomukhasana)

Bend the left elbow behind the back and take the back of the hand high up the spine. Stretch the right arm up. (Taking the right arm back and the left arm up gives a different balance.) Bend the right elbow back, stretch the hand down, and clasp the left hand or wrist with the palms facing. Stay, breathing evenly, for 15 to 20 seconds. Keep the head straight and look ahead. Release the arms.

Position 7 (Namaste)

Gently press the palms and fingers of each hand against the palms and fingers of the other hand. As you breathe smoothly and evenly encourage the fingers away from their position of ulnar deviation. Hold for 1-2 breaths. Release pressure but maintain contact for 1-2 breaths. Hold and encourage. Release. Hold and encourage. Release. Gently, firmly, and evenly press the palms together. Smoothly spread the fingers as wide as possible. Encourage even spreading with less and less ulnar deviation. Hold and encourage for 1-2 breaths. Release for 1-2 breaths. Hold and encourage. Release. Firmly and evenly press the palms together, especially the parts of the palm that form the base of each finger. Pull the fingers back into hyperextension, trying to increase the distance between the fingers of the

Relaxation in a seated position (10 minutes)

- Importance to the program/disease

The relaxation response of Savasana (Corpse Pose) and meditation helps counter-act the energy-draining effects of prolonged stress and chronic pain. Deep relaxation helps restore more normal functioning of the immune system, which deteriorates with chronic stress, chronic pain, grief and depression.

- How to do it

Turning attention to your head. Let yourself imagine your entire forehead and scalp becoming smooth and at rest. Relax your eyes. Let them remain closed gently and comfortably. Relax your jaw. When the jaw is relaxed, your lips will be lightly parted. Relax your tongue.

Press your head back as far as it can comfortably go and observe the tension in your neck. Straighten your head and bring it forward. Relax your throat. Let the relaxation deepen. Now relax your shoulders. Lower head down between your shoulders. Relax your shoulders. Drop them back and feel the relaxation spreading through your neck, throat and shoulders, pure relaxation, deeper and deeper.

Give your entire body a chance to relax. Feel the comfort and the heaviness. Now breathe in and fill your lungs completely. Hold your breath. Notice the tension. Now exhale, let your chest become loose. Continue relaxing, letting your breath come freely and gently.

Class will end with relaxation

Assignment: Practice positions learned.
Eighth Session: Basic Sitting Posture, Clasping, Shaking, and Stretching of the Arms and Hands

Yoga Positions for the Hands: Asanas for Arthritis (50 minutes)

Position 1 Basic Sitting Position (Dandasana)

Sit on the chair with the trunk upright. Pressing the hands into the seat extend the sides and the back of the body up. Stretch the sacrum and lumbar. Lift the rib cage; press the shoulder blades into the back. Rotate the upper arms outward and lock the elbows. Extend the front of the body from the pubis up. Keep the lower abdomen slightly pulled back, without tensing it. Lift the sternum, the top ribs and the collarbones. Move the shoulders back and down. Open the chest and breathe evenly.

Position 2 (Urdhva Hastasana)

Stretch the arms and fingers forward, vertically up. Lock the elbows by pressing the backs of the elbows into the elbow joints and stretch the inner elbows. Open the palms, keep the fingers together. Lift the sides of the body. Do not hunch the shoulders. Keep the shoulder blades in. Stay for 20 to 30 seconds, then bring the arms back down.

Position 3 Chair Twists (Bharadvajasana)

Sit sideways on a chair, with the right hip against the back of the chair. Sit on the whole seat. Stretch the trunk up and take the shoulders back. Line up the trunk with the legs. Keep the knees and feet together.

Exhale and turn toward the back of the chair, synchronizing the movements of the right and left sides. Move the back ribs in. Do not disturb the position of the legs.

Place the hands on the back of the chair. Pull with the left hand to bring the left side toward the back of the chair and push with the right hand to turn the right side away from it. Turn to the maximum, keeping the trunk upright.
Turn the head and look over the right shoulder. Stay for 20 to 30 seconds, breathing evenly. Exhale, turn to the front. Repeat on the left. Afterward, sit on the front of the chair. Spread the legs and bend down, relaxing the back and the head.

Position 4 (Parvatasana)

Interlock the fingers with the right thumb base over the left, base of the fingers in contact. Turn the palms out and stretch the arms forward and up. Lock the elbows. Open the armpits. Pull up the trunk with the arms. Take the arms further back. Stay for 15 to 20 seconds. Bring the arms down. Repeat from beginning with left thumb in front.

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trying to get the entire palm on the wall. As flexibility increases, move hands higher up the wall.

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- How to do it

Turning attention to your head. Let yourself imagine your entire forehead and scalp becoming smooth and at rest. Relax your eyes. Let them remain closed gently and comfortably. Relax your jaw. When the jaw is relaxed, your lips will be lightly parted. Relax your tongue.

Press your head back as far as it can comfortably go and observe the tension in your neck. Straighten your head and bring it forward. Relax your throat. Let the relaxation deepen. Now relax your shoulders. Lower head down between your shoulders. Relax your shoulders. Drop them back and feel the relaxation spreading through your neck, throat and shoulders, pure relaxation, deeper and deeper.

Give your entire body a chance to relax. Feel the comfort and the heaviness. Now breathe in and fill your lungs completely. Hold your breath. Notice the tension. Now exhale, let your chest become loose. Continue relaxing, letting your breath come freely and gently.

Class will end with relaxation

Assignment: Practice positions learned.
APPENDIX D

EVALUATION FORMS
EVALUATION FORM  
(INITIAL/FOLLOW-UP)

NAME ____________________________ DATE __________________

ADDRESS ____________________________ PHONE __________________

BIRTH DATE ____________________________

RACE: BLACK ___ ORIENTAL ___ WHITE ___ OTHER __________________

DISEASE DURATION ____________________________

ARTHРИTIS MEDICATION USED: CURRENT (WITH DOSES) __________________

TAKEN IN PAST ____________________________

HOSPITAL ____________________________

<table>
<thead>
<tr>
<th>JOINTS INVOLVED</th>
<th>ROM</th>
<th>CIRCUMFERENCE</th>
<th>TENDERNESS (Kg)</th>
<th>HAND GRIP STRENGTH</th>
<th>GENERAL HAND PAIN *</th>
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<tbody>
<tr>
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<td>R</td>
<td>L</td>
<td>R</td>
<td>L</td>
<td>RIGHT</td>
</tr>
<tr>
<td>2nd PIP DIP</td>
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<td></td>
<td></td>
<td></td>
<td>RESTING PAIN</td>
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<td>Day of Testing</td>
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<td>3rd PIP DIP</td>
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<td>LEFT</td>
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<td>PAIN DURING/AFTER ACTIVITY</td>
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<td>Day of Testing</td>
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<td>R</td>
<td>L</td>
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<td>5th PIP DIP</td>
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</table>

* PAIN SCALE

0  5  10

NONE  MODERATE  SEVERE

SIGNATURE OF TESTING PHYSICIAN
## STANFORD HEALTH ASSESSMENT QUESTIONNAIRE
### FOR HAND FUNCTION

<table>
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<tr>
<th></th>
<th>Without Difficulty</th>
<th>With Difficulty</th>
<th>With Some Help From Another Person</th>
<th>Unable to Do</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DRESSING AND GROOMING</strong></td>
<td></td>
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<tr>
<td>Able to:</td>
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<tr>
<td>* Get your clothes out of the closet and drawers?</td>
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<tr>
<td>* Dress yourself including handling of closures (buttons, zippers, snaps)?</td>
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<tr>
<td>* Shampoo your hair?</td>
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<tr>
<td><strong>ARISING</strong></td>
<td></td>
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<tr>
<td>Able to:</td>
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<tr>
<td>* Stand up from a straight chair without using your arms for support?</td>
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<tr>
<td><strong>EATING</strong></td>
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<tr>
<td>Able to:</td>
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<tr>
<td>* Cut your meat?</td>
<td></td>
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<tr>
<td>* Lift a full cup or glass to your mouth?</td>
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<tr>
<td><strong>WALKING</strong></td>
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<tr>
<td>Able to:</td>
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<tr>
<td>* Walk outdoors on flat ground?</td>
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<tr>
<td><strong>HYGIENE</strong></td>
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<tr>
<td>Able to:</td>
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<tr>
<td>* Wash and dry your entire body?</td>
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<tr>
<td>* Use the bathtub?</td>
<td></td>
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<tr>
<td>* Turn faucets on and off?</td>
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</tr>
<tr>
<td>* Get on and off the toilet?</td>
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<tr>
<td><strong>REACH</strong></td>
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<tr>
<td>Able to:</td>
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<tr>
<td>* Comb your hair?</td>
<td></td>
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<tr>
<td>* Reach and get down a 5 lb. bag of sugar which is above your head?</td>
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<tr>
<td></td>
<td>Without Difficulty</td>
<td>With Difficulty</td>
<td>With Some Help From Another Person</td>
<td>Unable to Do</td>
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<tr>
<td><strong>GRIP</strong></td>
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<tr>
<td>Able to:</td>
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<td></td>
</tr>
<tr>
<td>* Open push-button car doors?</td>
<td></td>
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<tr>
<td>* Open jars which have been previously opened?</td>
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</tr>
<tr>
<td>* Use a pen or pencil?</td>
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<tr>
<td><strong>ACTIVITY</strong></td>
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</tr>
<tr>
<td>Able to:</td>
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</tr>
<tr>
<td>* Drive a car?</td>
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<tr>
<td>(For reasons other than arthritis, I do not drive ____.)</td>
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</tr>
<tr>
<td>* Run errands and shop?</td>
<td></td>
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<tr>
<td><strong>SEX</strong></td>
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</tr>
<tr>
<td>Able to:</td>
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<tr>
<td>* Have sex?</td>
<td></td>
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<tr>
<td>(I am not involved in a sexual relationship ____.)</td>
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</table>

Signature
APPENDIX E

POST-TEST SUBJECT EVALUATION FORM
POST-TEST SUBJECT EVALUATION

1. How often did you practice?

2. Did anything feel worse? If so, what was it and when did it occur?

3. Did anything feel better? If so, what was it and when did it occur?

4. How was your general feeling of well-being?
   
   _____ Better
   _____ Worse
   _____ Same

5. Do your hands feel:

   _____ Better
   _____ Worse
   _____ Same

6. Additional comments:
APPENDIX F

POSSIBLE AND ACTUAL OBSERVED RANGES

OF DEPENDENT VARIABLES
POSSIBLE AND ACTUAL OBSERVED RANGES
OF DEPENDENT VARIABLES

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<tr>
<th>Variable</th>
<th>Possible Most Positive</th>
<th>Possible Least Positive</th>
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<td>Hand Grip Strength</td>
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<td>At Rest</td>
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<td>During Activity</td>
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* Includes pre- and post-test scores.
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0 = Never Took Drugs
1 = Started/Stopped Analgesics
2 = Started/Stayed With Analgesics
3 = Started/Stopped Anti-Inflammatories
4 = Started/Stayed With Anti-Inflammatories
APPENDIX H

CHI-SQUARE RESULTS
CHI-SQUARE: RELATIONSHIP BETWEEN TYPE OF MEDICATION AND GROUP

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$\chi^2$ for 3 df = 4.04; $p = .257$.

0 = Never Took Drugs
1 = Started/Stopped Analgesics
2 = Started/Stayed With Analgesics
3 = Started/Stopped Anti-Inflammatories
4 = Started/Stayed With Anti-Inflammatories
APPENDIX I

SUBJECT ATTENDANCE RECORDS
## SUBJECT ATTENDANCE RECORDS

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✓ = Attended Session; A = Absent from Session; Total Absences = 28