THE VALUE OF ISOMETRIC AND STRETCH EXERCISES IN THE MANAGEMENT OF MECHANICAL LOWER BACK PAIN

A DISSERTATION SUBMITTED IN PARTIAL COMPLIANCE WITH THE REQUIREMENTS FOR THE MASTER'S DIPLOMA IN TECHNOLOGY IN THE DEPARTMENT OF CHIROPRACTIC AT TECHNIKON NATAL

BY

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"I, Ashleigh Jane Deall, declare that this dissertation represents my own work, both in conception and execution."

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ABSTRACT

Mechanical low back pain is a common clinical entity which needs professional treatment (Margo 1994). Due to the nature of mechanical low back pain, recurrence of pain is a common entity that can cripple a patient and the state financially. It is for this reason that the professionals need to establish a cost effective method of treatment that helps maintain the pain free state and prevent recurrences.

The objective of this study was to evaluate the effectiveness of chiropractic manipulative therapy combined with isometric exercise and stretch, as opposed to chiropractic manipulative therapy alone, in the treatment of mechanical low back pain.

Thirty subjects with mechanical lower back pain were screened and randomly assigned to one of two groups of fifteen. The experimental group received the combination of chiropractic manipulative therapy and isometric and stretch exercise, while the control group received chiroprctic manipulative therapy only.

The data was obtained through questionaires, range of motion measurements and patient diaries. The subjective response to treatment was evaluated in terms of questionaire and diary results which included scores of the Oswestry Back Disability Index and Short-Form McGill Questionaires. The objective response to treatment was obtained by the BROM (back range of motion device) readings, which measured range of motion. The Mann-Whitney-U and the Wilcoxin Signed Rank test were used to analyse the data statistically, for any significant differences between and within the two groups respectively at a 5% level of significance.

Disability, severity and frequency of pain all revealed statistically non significant results ($P > 0,05$) when analysed using the Mann Whitney-U test. However, all three variables showed statistically significant results ($P < 0,05$) when using the Wilcoxin Signed Rank test, except for the post-treatment period in the control group which was statistically non significant ($P > 0,05$), throughout all three variables. It is this difference between the experimental and control groups, in the post-treatment periods that supports the hypothesis, that the experimental group would benefit from the exercises combined with chiropractic manipulative therapy. The BROM goniometer results were inconsistent and widely spread, However, the only statistically significant result ($p < 0,05$) between the two groups was the comparison between follow up periods of extension range of motion, which favoured the exercise group.

It was concluded that the combination of chiropractic manipulative therapy and isometric and stretch exercise in the treatment of mechanical low back pain showed no statistically significant differences ($p > 0,05$) when compared to chiropractic manipulative therapy alone.

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LIST OF ABBREVIATIONS

LBP - Lower back pain;

MLBP - Mechanical lower back pain;

iEMG - Integrated Electromyography;

ROM - Range Of Motion;

BROM - Back Range of Motion Device;

EX. - Exercise group;

N.EX. - Non-exercise group;

TX. - Treatment;

FLEX. - Flexion;

EXT. - Extension;

L.L.F. - Left lateral flexion;

R.L.F. - Right lateral flexion;

L.ROT. - Left rotation and

R.ROT. - Right rotation.

INTRODUCTION

Kirkaldy-Willis reports that more than 80% of the population will sooner or later suffer from mechanical lower back pain. Mechanical lower back pain sufferers represent 35% of chiropractic patients (Kirkaldy Willis 1988:4).

This condition is a leading cause of work disability in persons younger than 45 years, with an anuual incidence of 5% and a prevalence of 15 to 20%, and its cost totals more than $24 billion annually for medical care and lost work time (Margo, 1994). Studies show that 40% to 85% of lower back pain patients will have recurrences within a year after their initial episode (Donelson, 1991). Gatterman and Panzer (1990: 163) states that a patient who has experienced previous attacks of mechanical low back pain will be predisposed to further attacks of lower back pain .

Equally important is the observation that recurrences are characterized by increased frequency, longer duration, greater disability, and more distal referral of pain (Donelson, 1991). Donelson (1991) noted that due to limited success in preventing this progression, 85% of the costs for lower back pain are spent on the 10% of patients whose condition has progressed to the point of chronicity and long term disability.

It has been observed that changes in muscle function play an important role in the pathogenesis of painful conditions within the motor system, and constitute an integral part of postural defects in general (Janda, 1974:29). The endurance capacity of the muscles is an expression of their fatigability. Therefore, individuals with low endurance levels of the back muscles, are more exposed to postural stress that may lead to incorrect loading of the spine, and consequent lower back problems (Nicolaisen and Jorgensen, 1985). The author has chosen to test the benefit of a program that incorporates increasing muscle endurance, through isometric and stretch exercise, to enhance natural spinal support, along with the already established benefit of chiropractic manipulative therapy (Meade **et. al.**, 1990). With the high prevalence of mechanical lower back pain in the population, and with the high frequency of recurrence in previous sufferers, and with long term impairment and disability having serious finacial and psychosocial consequences, it becomes all the more important to identify cost effective management programmes, both for the patients health and financial status (Donelson, 1991). The author hypothesizes that a combination of chiropractic manipulative therapy and isometric and stretch exercises will make a beneficial contribution to the management of mechanical low back pain along with finacial, psychological and psychosocial contributions.

If a cost effective management program can be established, the anatomical effects of recurrent LBP, eg: osteoarthritis, disc lesions and chronic disability, can be reduced (Gatterman and Panzer, 1990: 163). If such a management plan is effective, it will decrease medical costs for the patient and state, and with the patient playing an active role in their treatment any reduction in pain that is exprienced with the exercise will internalize their treatment goals and impart a sense of well being to the patient (Risch, **et.al.**, 1993).

CHAPTER ONE

THE PROBLEM AND ITS SETTING

1.1 PROBLEM STATEMENT

The purpose of this study is to establish the effectiveness of chiropractic manipulative therapy combined with isometric and stretch exercise as apposed to chiropractic manipulative therapy alone, on chronic mechanical lower back pain patients, in terms of the patient's perception of severity of pain, frequency of recurrence, disability and range of motion, in order to determine the relative effectiveness of isometric exercise and muscle stretching as an adjunct to spinal manipulative therapy in the treatment of mechanical lower back pain.

1.2 SUB-PROBLEMS

1.2.1 Sub-problem 1.

The first subproblem is to evaluate the patient's perception of the severity of back pain, disability and frequency, following isometric exercise and muscle stretch combined with chiropractic manipulative therapy, to determine the relative effectiveness of the exercises in the management of mechanical low back pain.

1.2.2 Sub-problem 2.

The second subproblem is to determine the relative effectiveness of isometric exercise and muscle stretch combined with chiropractic manipulative therapy has an effect on the patients range of motion.

1.2.3 Sub-problem 3.

The third subproblem is to analyse and to interpret the obtained data, in order to establish the relative effectiveness of isometric exercise and stretching in the management of mechanical lower back pain.

1.3 HYPOTHESES

1.3.1 Hypothesis 1.

Specific isometric exercises and stretches combined with chiropractic manipulative therapy will reduce the severity, disability and frequency of back pain.

1.3.2 Hypothesis 2.

Isometric exercise and muscle stretch combined with chiropractic manipulative therapy will improve the patients range of motion.

1.3.3 Hypothesis 3.

From the data we can ascertain that isometric exercise and muscle stretch combined with chiropractic manipulative therapy makes a beneficial contribution to the management of mechanical lower back pain.

1.4 DELIMITATIONS

1. This study only consided patients that suffered from mechanical lower back pain of 6 months or longer.
2. Patient's presenting with mechanical low back pain and who had previous back surgery were not excluded from the study.
3. This study did not include patients with diseases that related to the lower spine, such as inflammatory, infectious, tumors and metabolic disorders.
4. If a patient fell ill during the treatment period, they were only excluded from the if unable to keep appointments.
5. The age of the group ranged from 16 to 60.
6. The study did not discriminate against race and sex.
7. Patients on medication were included, but were asked not to take pain killers (analgesics) unless severity of the pain was totally unbearable, at which stage they were excluded from the study.
8. Patients receiving any other form of treatment for mechanical low back pain were excluded from the study.

1.5 <u>ASSUMPTIONS</u>

1. All patients would be compliant in filling in pain diaries, correctly.
2. Patients filled out questionaires as instructed and with honesty.
3. The Kirkaldy-Willis (1988:134) model of mechanical lower back pain is both reliable and valid.
4. Patients would comply with the requirements of the study.

1.6 DEFINITIONS

The Low Back Region:

The delimitation of the low-back region is, in accordance with recommendations published by an expert group appointed by the Nordic Council, the area between the 12th rib and the gluteal folds (Nicolaisen and Jorgensen, 1985)

Disease: Any deviation from or interruption of the normal structure and function of any part of the body. It is usually manifested by a characteristic set of signs and symptoms and in most instances the aetiology, pathology and prognosis is known. (Pocket Medical Dictionary, 1987:85)

Posture: The relative arrangements of the parts of the body. Good posture is that state of muscular and skeletal balance that protects the supporting structures of the body against injury or progressive deformity irrespective of the attitude (erect, lying, squatting, stooping) in which these structures are working or resting. (Krieger,1952 in Haldeman 1992:626)

Mechanical lower back pain: (MLBP) results from the inherent susceptibility of the lumber spine to static loads due to muscle and gravity forces and to kinetic deviations from normal function (Gatterman and Panzer, 1990:137).

Specific conditions to be included in this study are

(Kirkaldy-Willis, 1988: 134-154) :

1. Posterior facet syndrome.
2. Sacro-iliac syndrome.
3. Maigne's syndrome.
4. Myofacial pain syndrome.
5. Disc and facet degeneration.
6. Lateral canal stenosis.
7. Central canal stenosis.

Isometric exercises: During this type of exercise, the muscle exerts a variable force in a fixed position, without muscle shortening.(Basmajian and Wolf, 1990:62-65)

Endurance: The endurance capacity of a muscle is an expression of their fatigability (Nicolaisen and Jorgensen, 1985). An increase in endurance of a muscle reflects physiologically as an increase in oxidative potential.

Stretching: Separation of the origin and insertion of a muscle or attachments of fascia or ligaments by applying constant pressure at a right angle to the fiber of the muscle or fascia.(Arnheim and Prentice, 1990:45)

Chiropractic Manipulation: Broadly defined, spinal manipulative therapy includes all procedures where the hands are used to mobilize, adjust, manipulate, apply traction, massage, stimulate, or otherwise influence the spine and paraspinal tissues with the aim of influencing the patient's health (Haldeman, 1992:624).

A definition by Sandoz in Kirkaldy-Willis and Burton (1992:283), states a manipulation is a passive manual manoeuvre during which a synovial joint is carried suddenly beyond the normal physiological range of movement without exceeding the boundaries of anatomical integrity.

Chiropractic Manipulative Therapy: For purposes of this study, includes chiropractic maniupulation, mobilization and soft tissue.

Deconditioning: State in which the athlete's body loses its competitive fitness (Arnheim and Prentice, 1990:G2).

Trigger Points: A hyper irritable spot, usually within a taut band of skeletal muscle or in the muscles fascia, that is painfull on compression and that can give rise to characteristic referred pain, tenderness and autonomic phenomena (Travell and Simons, 1983:12).

Myofascial Pain and Dysfunction Syndrome: Pain and/or autonomic phenomena referred from active MFTP's with associated dysfunction. The specific muscle of muscle group that causes the syptoms should be identified (Travell and Simons, 1983:12).

Antagonist: Muscles, or portions of muscles, so attached anatomically, that when they contract, they develop forces that oppose each other (Travell and Simons, 1983:12).

Agonist: Muscles, or portions of muscles, so attached anatomically, that when they contract, they develop forces that reinforce each other (Travell and Simons, 1993:12).

CHAPTER TWO

REVIEW OF THE RELATED LITERATURE

2.0 INTRODUCTION

Kirkaldy-Willis (1988:4) reports that more than 80% of the population will sooner or later suffer from mechanical lower back pain, while 35% of patients seen in chiropactic practice present as mechanical lower back pain sufferers. Mechanical low-back pain is a leading cause of work disability in persons younger than 45 years (Margo, 1994), and accounts for nearly three times as many workdays lost, and three times as much restricted activity and disability as other disease states (Bowman, 1994). The cost of low back pain according to Donelson (1991), totals more than $20 billion annually for medical care and lost work time. Donelson (1991) also states that 40% to 85% of patients will have recurrences within a year after their initial episode. Gatterman and Panzer (1990: 163) supports this statement by explaining that a patient that has experienced previous attacks of mechanical low-back pain will be predisposed to further attacks of low back pain.

Equally important is the observation that recurrences are characterized by increased frequency, longer duration, greater disability, and more distal referral of pain (Donelson, 1991). 85% of the costs of mechanical low-back pain are spent on the 10% of patients whose condition has progressed to the point of chronicity and long term disability (Donelson, 1991). Not only is it important for professionals to find the most effective treatment, but for the patients to become more self sufficient in controlling their own injuries. It is only through research studies that professionals can find the answers to effective treatments and combinations thereof.

2.1 ETIOLOGY

According to Margo (1994), the specific causes of low back pain are often unknown and less than 3 percent of cases are secondary to a serious medical disease. Most causes of LBP are mechanical in origin (Margo, 1994). According to Haldeman (1992:0) mechanical lower back pain (MLBP) may be multifactorial in potental aetiology and pathogenesis and the flow diagram (over the page) sums up the etiology and progession.

From the flow diagram one can see that common daily activity can cause MLBP, from disuse viz: sitting in an office all day associated with lack of movement; injury eg: lifting a heavy object; or from poor posture. All three examples result in a joint dysfunction, which leads to pain, and finally to chronic disability. Systemic changes such as muscle spasm, neurochemical changes and visceral/autonomic responses may develop which result in even further pain and psychological disturbances (Kirkaldy-Willis and Cassidy 1988:294).

BIOMECHANICAL DYSFUNCTION OF SPINAL COLUMN AND RELATED STRUCTURES

1. Static dysrelationships
2. Kinetic dysrelationships
3. Postural dysrelationships

↓

JOINT DYSFUNCTION SUBLUXATION

1. Intervertebral disc pathology
2. Posterior facet dysfunction
3. Sacroiliac joint dysfunction

↙ ↘

PAIN SYMPTOMS

1. Acute pain
2. Chronic pain
3. Psychological disturbances

SYSTEMIC SYMPTOMS

1. Muscle spasm
2. Neurochemical changes
3. Visceral autonomic response

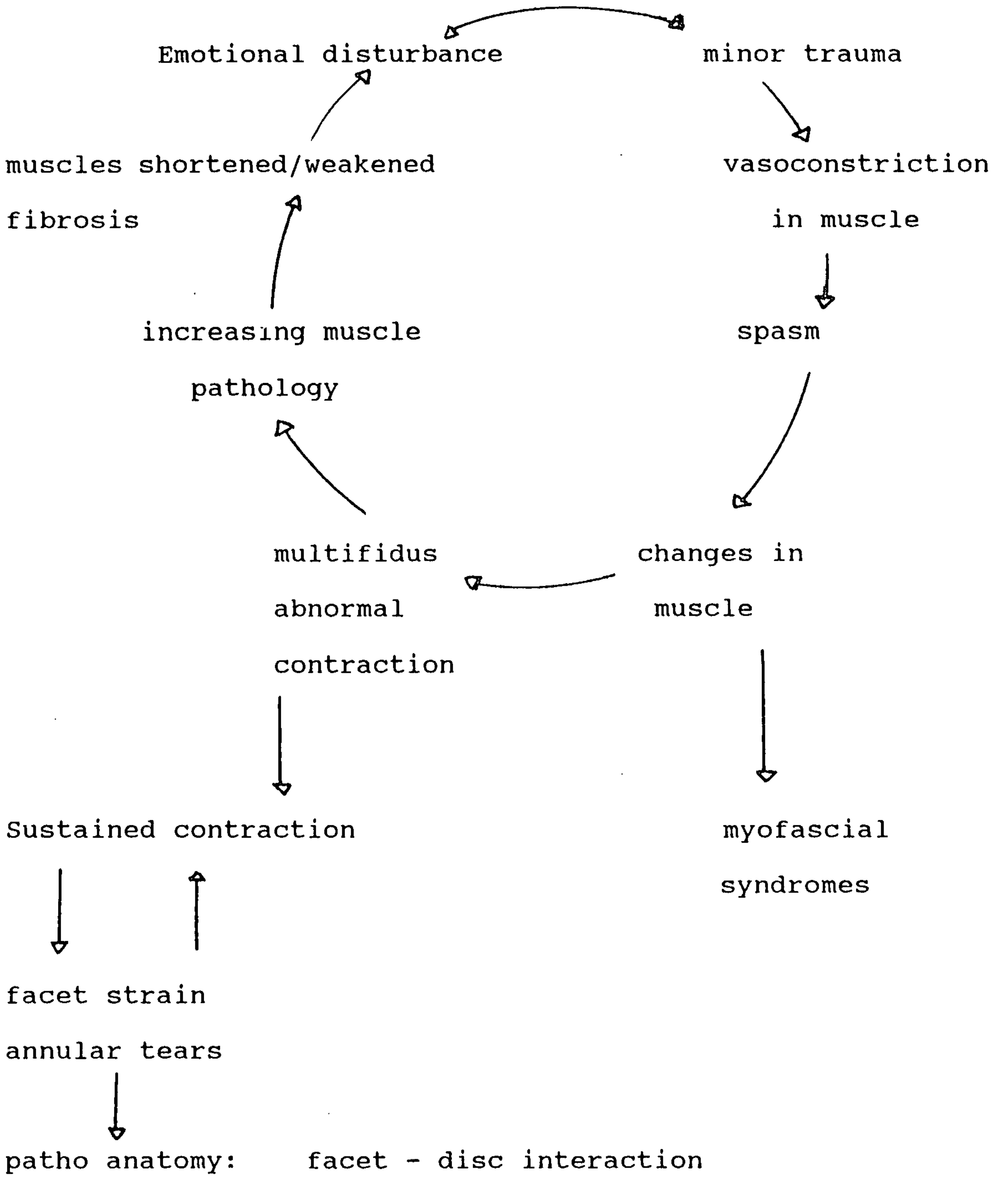
Bowman (1994) researched the "Chronic Pain Phenomenon", and realised that it was a complex experience with physical, social, and psychological components. His findings on 15 patients who were waiting admission into a pain management clinic, indicated that chronic low back pain is a multifactorial problem with many causes, and which can affect every aspect of an individual's life.

This only reiterates the fact that patients need to be treated as a whole. Gatterman and Panzer (1990:160) emphasises the three joint complex and acknowledges that spinal segments function as a whole, and if one part of the unit is affected, so too are the remaining parts of this complex.

Kirkaldy-Willis (1992:105-119) outlines three phases of degeneration that lead to disability. The earliest phase is dysfunction, characterised mainly by altered functional state. Anatomical changes are minimal at this stage. The unstable stage follows, resulting in joint instability with excessive movement. The third phase is restabilization when the apophyseal joints and disc become stiff from degeneration of cartilage and loss of disc substance, respectively. Fibrosis, and the formation of osteophytes around the posterior joints and disc are also characteristic of this stage (Kirkaldy-Willis, 1992:105-119).

Joint dysfunctions are more or less understood, but according to Janda joint dysfunction is an expression of the impairment as a whole, ie: both neuro muscular and osteoarticular components of the body are also involved (Janda, 1974:28). Kirkaldy - Willis and Burton (1992) support this theory with the Myofascial cycle.

MYOFASCIAL CYCLE



2.2 TREATMENT

Patients with chronic lower back pain can present a treatment dilemma for the physician as consensus on the most effective treatment does not exist (Meade **et. al.,** 1990). Despite its high prevalence, LBP is often difficult to treat. Many treatment techniques have been tested in the past, such as traction, immobilisation and heat therapy, with the results showing the most effective treatments available, such as traction, bed rest and medication, however these techniques prove temporary in effect (Faas **et. al.**, 1993).

In the following subheadings, various treatments are discussed and their efficacy noted, in order to substantiate the choice of treatments used in this study.

2.2.1. Bed Rest

For many years, bed rest was the mainstay treatment in patients with acute back pain. According to Waddell and Deyo, as cited by Margo (1994), lying flat with pillows placed beneath the knees, has been shown to decrease intradiskal pressure, while sitting and lying on ones side has been shown to increase intradiskal pressure. Therefore if bed rest is to be effective, the patient should lie flat in a supine position.

Duration of bed rest still remains a matter of controversy, with patients who have only 48 hours of rest benefiting more than those with longer periods of rest, because prolonged bed rest resulted in rapid muscle atrophy, deconditioning and an increased risk of thrombophlebitis (Waddell and Dayo as cited by Margo, 1994).

Ordet and Grand (1991:65) found that after 6 hours of immobilisation, there is a decreased impulse pattern in the motorneurons innervating the muscles resulting in muscle and bone atrophy. It follows therefore, that musculoskeletal difficulties may benefit from motion and early mobilisation, further supporting the concept of limited bed rest (Ordet and Grand, 1991:65).

2.2.2. Medication

Since most LBP is mechanical in nature, drugs are effective in pain reduction but rarely improve the underlying problem (Hansen **et.al.**, 1993). Another problem with drugs is that most analgesics, antidepressants and Anti Inflammatories, can only be used for a limited period of time without side effects eg. addiction and dependancy (Margo, 1994).

2.2.3. Physical Therapy

Margo (1994) found that although physical therapy has been a reliable treatment of patients with LBP, research has not supported many of the treatments used such as traction, immobilisation and heat therapy (Volinn **et.al.** (1991); Dimaggio and Mooney (1987) and Dayo (1991)). No evidence supports the theory that relaxation modalities such as ultrasound and deep heat provide any long-lasting benefits, although they may offer temporary relief of pain. Similarily, little evidence shows that traction has any benefit (Cox in Haldeman, 1992:505). In a recent study, Dayo **et.al.**(1991) as cited by Margo (1994), found that the use of Transcutaneous Electrical Muscle Stimulation (TENS) showed benefit no better than that of the placebo group, however details of the study were not given.

2.2.4. Injections

Injection therapy eg: facet joint injections, as a treatment for either acute or chronic LBP has failed to be scientifically supported (Margo, 1994). However, Kirkaldy-Willis and Burton (1992:248) noted that sacro-iliac and facet injections nearly always relieve the patient of pain for several hours. They noted that approximately 50% of cases, the patient is free of pain for weeks or months. In some cases, relief is permanent.

Kirkaldy-Willis and Burton (1992:251) found with regards to Myofascial Pain and Dysfunction syndrome, that when stretch and spray fails to relieve the pain and spasm, injection with 0.25% bupivacaine seems to relieve symptoms. The site of the injection is directly into the trigger point, and this seems to offer instantaneous relief of pain.

2.2.5. Surgery

Surgical treatment for LBP is controversial (Margo, 1994). The complications of surgery are serious if not performed correctly, namely nerve root damage, bleeding, wrong side and level, damage to dura and large blood vessels, postoperative adhesions and wound infections (Yong-Hing in Kirkaldy-Willis and Burton, 1992:347-350). Only a small percentage of people who are suffering from LBP are candidates for surgery and certain assumptions have to be made ie. an accurate diagnosis, proper conservative therapy has failed and the patient has been correctly selected as suitable for operation (Yong-Hing in Kirkaldy-Willis and Burton, 1992:347). Even after successful surgery, the relapse rate within four years is 15% according to Carlton, (1991) as cited by Margo (1994). It is a general opinion that conservative measures should be taken before invasive surgery.

2.2.6. Exercise

Back injuries occur 10 times more often in people who are less physically fit (Nicolaisen and Jorgensen, 1985). Therefore, the increased strength and flexibility in the back through specific exercise and training, helps to protect against low back injury, and in this way chronic mechanical low back pain patients can experience fewer recurrences and less pain (Gundewall **et.al.**, 1993).

In a study by Faas **et.al.**, (1993) it was shown that exercise therapy for patients with acute LBP has no advantage over usual care from the general practioner which was not specified. However, it did show that the exercise group had shorter duration of recurrences and felt less tired. (Refer to 2.4 for detailed disscusion.) These three studies mentioned above show potential for an inexpensive, non-invasive method of treatment (Nicolaisen and Jorgenson, 1985; Gundewall **et.al.**,1993 and Faas **et.al.**,1993).

2.2.7. Manipulation

According to Greenman, as cited by Margo (1994), chiropractors perform primarily manipulative therapy to "restore maximal, pain-free movement of the musculoskeletal system in postural balance". Kirkaldy-Willis, Cassidy and

Thiel (in Kirkaldy-Willis and Burton, 1992:288) together noted that in both acute and chronic spinal pain, joint movement, previously restricted, is increased by spinal manipulation. Increased movement causes an increase in proprioceptive input, which in turn has a reflex inhibition on the transmission of pain through the mechano-receptor substantia gelatinosa transmission (Kirkaldy-Willis, Cassidy and Thiel in, Kirkaldy-Willis and Burton, 1992:288).

Indications for manipulation:
- Posterior facet and sacro-iliac joint dysfunctions;
- Paraspinal muscle conditions;
- Disc herniation;
- Joint dysfunction in lateral and central canal stenosis;
- Joint dysfunction in spondylolisthesis;
- Sacro-iliac syndrome in post-operative low back pain.

Contra-indications of manipulation:

Relative:
- Osteopenia;
- Spondyloarthropathies;
- Patients on anti-coagulant

medication;

- Bleeding disorders; and
- Psychological overlay.

Absolute:
- Destructive lesions of the spine, ribs and pelvis;
- Healing fracture or dislocation;
- Gross instability;
- Cauda Equina Syndrome;
- Large abdominal aneurysm; and
- Visceral referred pain.

(Kirkaldy - Willis and Burton, 1992)

In a study undertaken by Meade **et.al.** (1990) it was found in 741 MLBP patients that chiropractic treatment was in the long term more effective than hospital outpatient management, mainly for patients with chronic or severe mechanical lower back pain. The long term benefits were most noticable in this study, with severity of pain experienced in the long term decreased by 7%.

Till (1993) in a personal communication, mentioned that chiropractic manipulation has proved itself as an effective means of therapy for back pain in terms of faster relief of pain and disability, especially the first four weeks.
However, MLBP may recurr, only to be more severe, of longer duration, with greater disability and with more distal

referral of pain (Donelson, 1991). What must be understood, is that with each recurring injury the patient causes more and more permanent damage to the area which in turn predisposes the patient to earlier disability and more severe pain. Therefore, a therapeutic adjunct such as exercise might help to maintain the benefits of chiropractic manipulative therapy, and decrease rate of recurrence.

2.3 COST

As expressed above, recurrence of pain results in the degenerative process being accelerated (Donelson, 1991). Not only that, but the cost of treatment would prove crippling to the patient and state with respect to work absenteeism. In a review of the literature, Andersson **et.al.** (1991:95-113) found that back injuries accounted for 21% of compensationable work inuries but averaged 33% of the total compensationable cost. Total compensation costs in the United States for low back pain in 1988 were estimated at $4.6-13.4 billion and $6,000 per case, where 25% of cases accounted for 90% of the cost. Education on prevention and effective treatment intervention is necessary for the entire population to prevent the high health expenditure. In 1980 one insurance company paid out a total of $217 million, which amounts to $1 million per working day (Bowman, 1994).

2.4 PREVENTION AND EXERCISE

Perhaps a successful means of maintaining a pain free spine, at cost effective measures, needs to be employed. What is also important is that the patient be in "control of his own destiny" (Shakespeare, "Othello"), in other words take an active role in the treatment.

The key to effective control of this problem is prevention, or rapid reversal of recurrent symptoms (Donelson, 1991). In the past, principle treatments have been largely pain relieving efforts such as soft tissue and rest (Hansen **et.al.**, 1992). These modalities do not deal with prevention.

Manniche **et.al.** (1992) reported that a common factor found amongst MLBP sufferers, was a noted decrease in trunk muscle endurance. In a study by Nicolaisen and Jorgensen (1985), it was found that in 77 postmen with no present LBP, the trunk muscles tended to be weaker among those who experienced a recurrence of LBP during a follow up year compared with those without recurrence. He could also demonstrate a reduction in strength of the flexors and extensors of the trunk in LBP patients compared with patients without LBP. However, the study did not stipulate the cause of back pain and thus did not eliminate systemic disease as the cause of back pain.

Risch, **et.al.**, (1993), noted that deconditioning from pain and avoidance of activity in chronic LBP patients resulted in muscular atrophy. This finding was substantiated by Cassisi, **et.al.**, (1993), who through intergrated electromyography (iEMG) showed that there were more low iEMG readings in chronic low back patients during isometric exercise when compared with patients with no low back pain. This indicated that there was muscle deficiency present in chronic MLBP sufferers. Significant differences between iEMG readings of treatment and control groups were constantly noted at all angles of isometric flexion, with the treatment group always with significantly lower readings than the control (P= 0,0001). However, these findings are not reflective of the population as the sample size was only 33 in total, with 21 in the treatment group and 12 healthy subjects in the control.This shows, indirectly, that weakened muscles do play a role in the occurance of MLBP.

This introduces the concept of <u>imbalance</u> of muscle support in and around the spine. Janda, (1974:32) looked at the mechanical low-back patients in society, and noted that there was a lack of variety of movement. Janda (1974:29) is a knowledgeable researcher who has presented many papers on this theory, namely Janda 1969a, 1969b, 1971, 1974, and Janda and Strara, 1970, 1971. He found that the predominantly static or postural muscles,ie. those which continuously work against gravity, showed a tendency to become tighter and be activated in various movement patterns relatively more than muscles with a predominantly dynamic, phasic function, which showed a tendency to become weak. He believes that from a therapeutic point of view, balanced muscle co-ordination is perhaps the best protection of our osteoarticular system, by creating correct posture habits, and thereby allowing the least amount of stress on spinal structures. He believed that from a therapeutic point of view, balanced muscle coordination in and around the spine (both postural and dynamic) is perhaps the best protection of our osteoarticular system (Janda, 1974:32)

Nicolaisen and Jorgensen (1985) stated that if a muscle is fatigued, there will probably be impaired co-ordination within the postural muscles. This mechanism can be explained physiologically by Arnheim and Prentice (1993: 46), who state that when a muscle (agonist) is stretched, the muscle spindles are also stretched, sending a volley of sensory impulses to the spinal cord that inform the central nervous system that the muscle is being stretched. Impulses return to the muscle fromthe spinal cord, which causes the muscle to reflexively contract, thus resisting the stretch. If the stretch of the muscle continues for an extended period of time, at least 6 seconds, the golgi tendon organs respond to the change in length and the increase in tension by firing off sensory impulses of their own to the spinal cord. The impulses from the golgi tendon organ, unlike the signals from the muscle spindle, cause a reflexive relaxation of the antagonist muscle. This reflexive relaxation serves as a protective mechanism that will allow the muscle to stretch through relaxation before the extensibility limits are exceeded, causing damage to the muscle fibres. Understanding this close link between agonist and antagonist helps to explain how when one muscle is affected, as per this research the rectus abdominus muscle, the antagonist, as per this research erector spinae muscle, will then over compensate causing an unbalance within the musculoskeletal system. Such patients are consequently more exposed to postural stress. Disturbances of the normal muscle coordination leads eventually to mechanical "failure loads" in the spine which in turn might be responsible for LBP. Hansen **et.al.** (1992) emphasises the concept of muscle balance in the treatment of MLBP, suggesting that a balanced system is more likely to handle stress than an imbalanced system.

In order to attain muscle balance, tight muscles must be relaxed and weak muscles strengthened. Janda's (1974:29-30) clinical experience and especially therapeutic results, support the assumption that, according to Sherrington's law of reciprocal innervation, tight muscles act in an inhibitory manner on their antagonists. Therefore it is better to stretch the tight muscles first, thus inhibiting the weakened, inhibited antagonists. Another advantage of stretching is that it is sometimes possible to inhibit the tight muscle to avoid undesirable overactivation during different movement patterns (Janda, 1974:29-30). He has also shown that after stretching of the tight extensor muscles of the back, the abdominal muscles acted alone in a sit up with no activation of the spine extensors. Stretching exercises have also been shown to improve musculoligamentous elasticity and spinal mobility which prepares the spinal segments for the intended movement (Donelson, 1991). Janda (1974:33) notes that fine muscle co-ordination is needed to prevent damage of a joint, especially during a fast movement. It is well known that, at the end of a fast movement, the active inhibition of the antagonist switches into rapid facilitation and contraction in order to slow down the movement and prevent injury.

Nicolaisen and Jorgensen (1985) stated that the endurance capacity (time period of sustained contraction) of muscles is an expression of their fatigability and that therefore one might presume that individuals with a low endurance of the back muscles are more exposed to postural stress that may lead to incorrect loading of the spine, and consequent LBP. He also showed that, even with the help of the intramuscular theory ie: hypertrophy of the muscle fibers as strength increased, persons with earlier attacks of LBP showed reduced endurance in their back muscles but showed no change in strength of these muscles. This only reiterates the importance of isometric exercise, which impacts on endurance rather than strength, even though one enhances the other (Ordet and Grand, 1992:96).

Hansen **et.al.** (1992) noted that previous studies have shown the effect of various exercise regimens but with contradictory results, and no specific type of exercise has been shown to be superior to others eg. physiotherapy, physical therapy and intensive muscle training.

Risch **et.al.**, (1993) studied the effects of exercise in lumbar extensor muscles in chronic lower back patients. Results indicated a significant increase in lumbar muscle strength and endurance and a significant reduction in reported pain when compared with the control group (P= 0,05). However the study did not follow up to note the long term results on the recurrence of the LBP. It is noted by Arnheim and Prentice (1993:48) that strength and endurance training go hand in hand ie. as muscle strength increases, there tends to be a corresponding increase in endurance.

2.5 LENGTH OF STUDY

In terms of muscle strengthening, many authors recommend isometric exercise as it is specific to the muscle being contracted (Ordet and Grand, 1992). Edstrom and Grimby (1986) described isometric exercise as increasing the endurance of the muscle through increasing the oxidative potential within the muscle therefore, the muscle becomes more efficient in its function. Other physiological changes include increased capillary density, and therefore increased blood flow to the injured area, along with increased time for the muscle to reach peak contraction during stimulation, thus increasing the resistance to fatigue. He stated that for the full effect of the isometric exercises to take place the exercise must be carried out for at least 2-4 weeks. These types of changes within a muscle help to conserve energy during activity.

2.6 SEX AND OCCUPATION

Nicolaisen and Jorgensen (1985) evaluated his results of isometric extension exercises, in terms of muscle fibre types and tried to explain his results in this manner, comparing male fast-twitch fibers to female slow-twitch fibers. He showed that men had a lower endurance capacity in relation to women, which explained the lower results obtained in the males. Hansen **et. al.** (1993) included all exercise modalities in his research on 150 males and females, intensive dynamic back muscle exercises, conventional physiotherapy including isometric exercises of the trunk and leg muscles, and a placebo group. Again these results could provide nothing substantial (P> 0,01) with relation to sex, as the females responded to the dynamic exercises and males to the isometric exercises, this contradicts Nicolaisen and Jorgensen (1985) above. Also noted was that patients doing sedentory/light work responded to dynamic exercises ie. those that work through the entire range of motion, and those with moderate to hard physical occupations responded best to the isometric exercises (no P-values were given). Review of the literature showed no consensus on sex and occupation with regard to response to exercise, therefore the author agrees with Janda's theory and disregards sex, occupation.

2.7 PSYCHOSOCIAL

As mentioned above, Bowman (1994) realised that chronic pain leads to physical, social and psychological components. A point noted in most exercise therapy approaches, was that the patient had the development of a sense of well being and became more positive towards their condition (Gundewall **et.al.**, 1993).

Risch **et. al.** (1993) noted that studies concerning workout programs and advisory activities had been successfully performed before, but, had been concerned with rehabilitation programs or training for persons already experiencing lumbar spine symptoms.

A study by Gundewall **et.al.**, (1993) consisted of a primary preventative program where nurses in a geriatric hospital, after following the exercise program for thirteen months, showed a lower incidence of back pain as well as a lower intensity of back pain experienced ($P < 0.018$). Along with these results, was a noted decrease in work absence due to back problems ($P=0.0044$). A common feed back was that "finally there was someone who cared", someone who took the time to teach them how to help themselves.

Another preventative study that was carried out was performed by Cady **et.al.** (1985), as cited by Gundewall **et.al.**, (1993) on firefighters. It was here that a link was found between lack of fitness and back injuries (no P- values given).

Gundewall **et.al.** (1993) showed that in a recent study by Kellet and Kellet, a workout program aimed at treating occupational LBP sufferes, performed during working hours by employees with low back symptoms, reduced the time spent off work by 51% ($P<0.004$). Again, it was noted that persons in the training group regarded the back training project as a positive event, improving their sense of well being (Gundewall **et.al.**, 1993). Poor sense of well being at work has been found eariler to have a connection with LBP (Risch **et. al.**,1993).

2.8 CONCLUSION

Janda (1974:32) emphasises the statement that creating muscle "balance" is the key to LBP management, which is in accordance with correct posture. He believes that all humans are constructed of the same parts, therefore they should be considered as a whole and treated as such. He also believed that irrespective of age, sex or occupation, exercise therapy to enhance muscular balance around the spine, would improve that patients condition. Janda (1974:29-31), as well as Hansen **et. al.**(1993), considered strengthening the abdominal and gluteal muscles and stretching their antagonists - the hamstrings and the trunk extensors.

Chiropractic manipulative therapy is an intervention that has been extensively investigated in the management of mechanical low-back pain, and recent studies (Meade **et. al.** 1990, and Kikaldy-Willis and Cassidy, 1988: 294) have indicated that chiropractic manipulative therapy relatively cost effective as compared with other physical treatment modalities. Therefore it would seem reasonable to compare the cost effectiveness of chiropractic manipulative therapy with that of chiropractic manipulative therapy and exercise.

Chronic lower back pain not only effects the patient physically but socially and psychologically as well.

Including the patient into the therapy, ie: making them participate with exercises, has been shown extensively to improve the patients outlook of their condition and decrease depression (Gundewall **et.al.**, 1993 ; Bowman,1994 ; Janda, 1974:27-40).

Perhaps the assessment of whether a combination of muscle and chiropractic manipulative therapy, (each of value in their own right), is better than either on their own is now well over due.

CHAPTER THREE

MATERIALS AND METHODS

3.0 INTRODUCTION

This chapter discusses the materials and methods used to carry out the study.

3.1 THE DATA

3.1.1 The Primary Data

The primary data was collected by clinical observation and communication with the patient. The primary data used specifically in this research has been taken from the following;

- Informed Consent Form (appendix A);
- Case History (appendix B);
- Physical Examination (appendix C);
- Regional Examination (appendix D);
- X-Ray Examination of the Lumbar Spine;
- Oswestry Back Disability Index Questionaire (appendix E);
- The Short Form Mc Gill Pain Questionaire (appendix F);
- A patient pain diary was filled in daily by the patients (appendix H);
- Range of Motion was measured using the Brom goniometer, and noted in the SOAP notes (appendix G).

The primary data was only available once the patients had been selected and once they had actually begun to participate in the research.

3.1.2 The Secondary Data

The secondary data was collected by a search of the related literature. The literature was found in the form of journal articles and books. The use of the library provided access to international and up to date information.

Remaining secondary data needed in order to complete sub-problem 3, was obtained from the examination findings and treatment recordings of sub-problems 1 and 2.

3.2 CRITERIA FOR ADMISSIBILITY

All patients included in this study were assessed in terms of ROM, severity of pain, disability and frequency of pain. Only the data from the above mentioned questionaires, Oswestry Back Disability Index and the Short form Mc Gill questionaires, that were completed correctly and under supervision were used. The diaries had to be explained by patients everytime one was handed in, to ensure that they were interpreted correctly. There was no patient non-compliance in this research.

The Range of Motion measurements were obtained by the author in a manner that was consistent throughout the research project.

Both the control and expeimental groups underwent the same tests and procedures, and differed only in the treatment.

3.3 RESEARCH METHODOLOGY

During 1994, 33 patients applied to take part in the research, of which 30 patients fulfilled the entrance requirements and were selected. The entrance requirements of the dissertation required the patient to have had chronic mechanical lower back pain for 6 months or longer and did not have contraindications for manipulation (as listed in literature review).

The sample consisted of 30 persons who have had chronic mechanical lower back pain of at least 6 months duration. The sample was located in the greater Durban area and the group presenting themselves at the Technikon Natal Chiropractic Day Clinic. This group was attracted to the clinic by the media ie. advertisments. There were a few referrals from other practitioners in the Durban area.
Only patients 16 years and over were selected, the reason being that the questionaires required a certain level of

maturity. The ages of the patients, ranged from 16 years old to 63 years old. The patients were selected regardless of sex or occupation. This group of 30 patients was then randomly divided into two groups of 15 patients each - one group received chiropractic manipulative therapy only, the other, chiropractic manipulative therapy and isometric and stretch exercise.

Process of randomisation:-
Six groups of four were formed and were numbered from 1-6. A dice was then thrown to get a number from 1-6 and that number was recorded. The die was thrown a total of 8 times and all numbers recorded. These numbers were then used to allocate the order that the groups of 4 would appear. The results were; 1) CECE; 2) CEEC; 3) CCEE; 4) ECEC; 5) ECCE; 6) CCEE; 7) CEEC; 8) EC.

'E' was representative of 'experimental' group who would receive isometric and muscle stretch exercises, in conjunction with chiropractic manipulative therapy (see definitions). 'C' was representative of 'control' group who would receive chiropractic treatment only.

The patients were informed, prior to the onset of treatment, that they would be taking part in the study and that which ever group they fell into, they would receive chiropractic manipulative therapy as indicated. The research duration and requirements were explained in detail, including instruction to keep activity levels unchanged for the duration of the study, at which time the patient had the option of withdrawing before the study began. At this time the patient received a typed informed consent form (Appendix A.) which was signed before commencement of the research program. Three patients chose not to continue in the program from this point.

The research followed three phases; pretreatment, treatment and post-treatment. Each phase was representative of 4 weeks. (The first month was to obtain an idea of the patients condition, the second month was to fit in two treatments per week and the third month was a follow up period). During the pretreatment, the patient was monitored and had two visits during that month at which all preliminary tests were performed ie. case history (Appendix B.), physical exam (Appendix C.), lumbar spine regional examination (Appendix D.) and a full series of lumbar spine radiographs. The division of the initial consultation into two visits, helped to maintain the patients interest and anticipation of what was to come. The pretreatment phase was used to arrive at an accurate diagnosis and eliminate the possibility of any hidden pathology. During the treatment phase, the patient came in twice a week for four weeks and received the appropriate treatment according to their respective group.

The 4 week treatment period was advised by Edstrom and Grimby (1986) who explained that for the full effect of isometric exercise to take place physiologically within the muscle, the exercise should be carried out for at least 2-4 weeks with a minimun of two treatments per week. In a study by Hansen **et. al.** (1993), a 4 week exercise period was used on 215 patients with statistically significant results in comparison to physical therapy and placebo groups. In the post-treatment phase, the patient only came in once at the end of the 4 week follow up to complete the questionaires and have ROM measured for a final time. At this time the patients were discharged.

The Oswestry Back Disability Index (Appendix E.) and Short Form McGill (Appendix F.) questionaires were completed, along with range of motion (ROM) measurements, as noted on the SOAP notes (Appendix G.) on the initial visit. These questionaires are universally accepted as being relatively valid and reliable (Mc Dowell and Newell, 1987: 239-240, 245-249). The ROM measurements were taken using the BROM (back range of motion device). This BROM is a new device for measuring trunk range of motion. Two authors have tested the validity and reliability of the tool, showing similarly within their 15 patient samples, that the BROM was a very reliable tool for measuring lumbar motions by the same researcher (Wang, 1991;

and Kingdon, 1989). Dayhuff **et.al.** (1994) then tested intertester and intratrial reliability of the device on 30 low back pain patients. The intertester reliability was fair to high at 0.76 to 0.95 and the intratrial reliability were good to high at reliability categories of 0.89 to 0.98. The patient was issued with daily pain diaries (Appendix H.) to fill in, recording the severity of pain experienced daily.

During the treatment phase, the control group patients received chiropratic manipulative therapy where indicated. The experiment group received the same as the control group, except that the author instructed the patient through an additional series of specific isometric exercises and muscle stretches. The author supervised and performed all exercises along with the patients. This ensured patient compliance and exercise consistency between patients. The author's active participation encouraged the patient to try harder and give full participation.

The patient was firstly required to stretch the posterior lumbar muscles (Figure A) and then the hamstring muscles (Figure B). Each position was held for 30 seconds and then repeated three times. Each stretch was held for 30 seconds to obtain true relaxation and lengthening of the muscle fibers by over riding the intramuscular theory. (See literature review for explanations of intramuscular theory.)

FIGURE A

LUMBAR MUSCLES

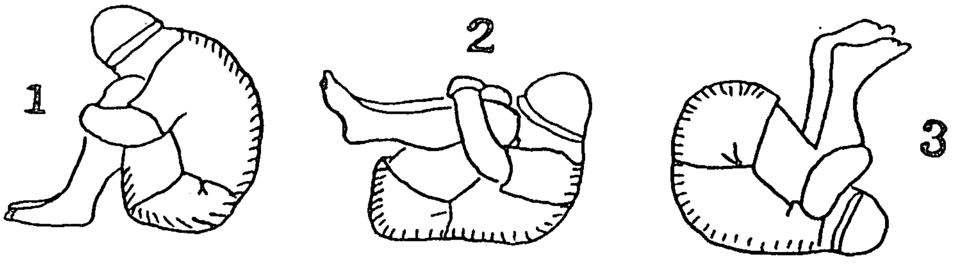
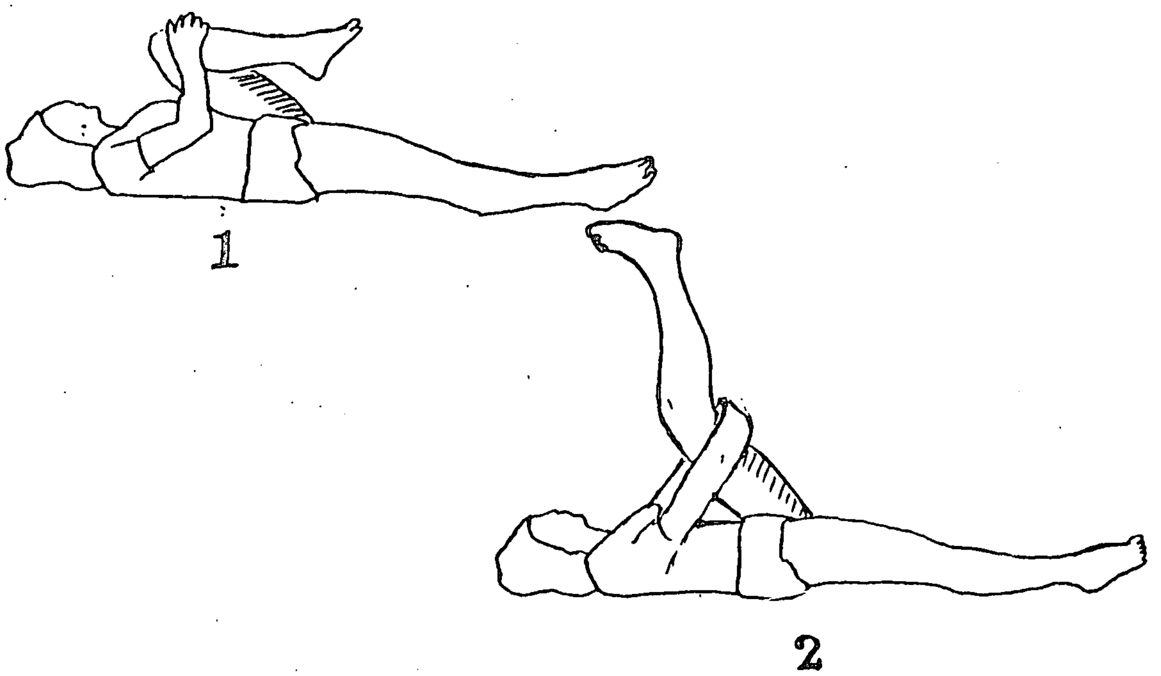


FIGURE B

HAMSTRING MUSCLES



The isometric exercises that were performed include:

1) Isometric Abdominal Strengthener, which involved the patient holding a specific position until tolerance. (Figure C)
2) Isometric Gluteal Strenghthener, which again involved the patient holding a specified position until tolerance. (Figure D)

Both these exercises were repeated five times.

<u>FIGURE C</u>

<u>ISOMETRIC ABDOMINAL STRENGTHENER</u>

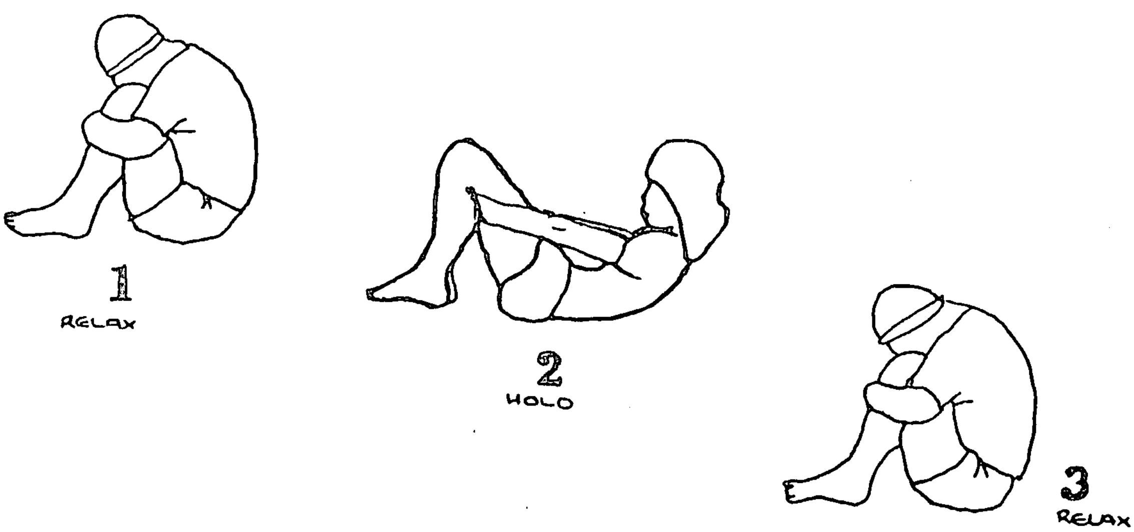
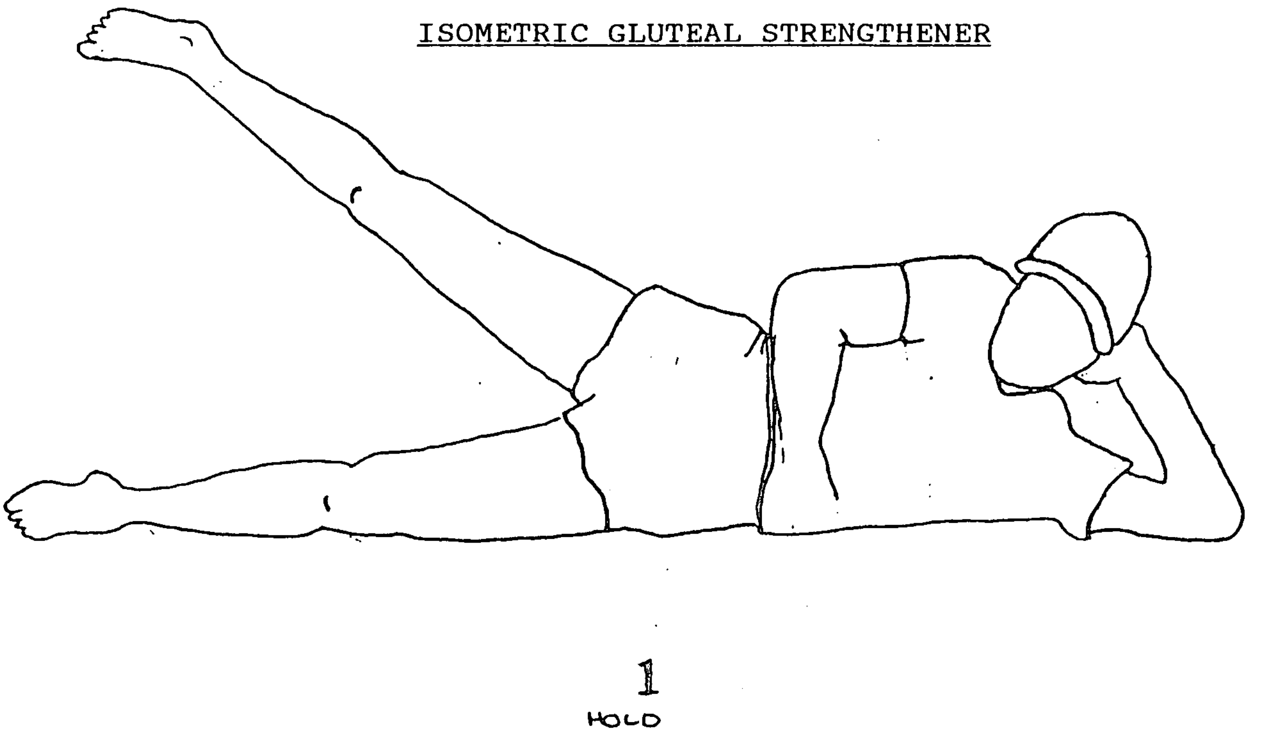


FIGURE D

ISOMETRIC GLUTEAL STRENGTHENER



The conditions seen were majority Sacro-Iliac Syndrome (13 patients), as well as Lumbar Spine Facet Syndrome at various levels (11 patients) and 6 patients presented with myofascial pain and dysfunction syndrome complicated by facet syndromes in the lumbar spine.

The final phase, post-treatment, involved the patient keeping a pain diary that was submitted at the end of the four week period. When the patient came in on the final visit at the end of this phase, the questionaires were filled out for the final time and range of motion was also measured for the last time. The patient was then discharged from the research.

Below is a schematic describing all research visits.

PRETREATMENT- WEEK 1 : Case History, Physical, Oswestry and McGill Questionaires filled out, Informed Consent Form signed, Daily Diaries Issued and Range of Motion measured.(1) (Appendices A,B,C,E,F,G,H)

WEEK 2 : Patient did not come in. The patient only filled out daily diaries.

WEEK 3 : As week 2.

WEEK 4 : Regional Examination (appendix D), Radiographs of the Lumbar Spine. Completed daily diaries taken in and questionaires filled out. Range of Motion measured. The intension of repeating these measurements at that stage was to have a record of how the patient felt before the treatment began.(2)

TREATMENT - WEEK 5 : The first treatment (3). See above for description of the treatments recieved, ie.Control group vs. Experimental group. The second treatment (4). Received completed diaries from patients, completed Oswestry and McGill questionaires and Range of Motion was measured.

WEEK 6 : The third (5) and fourth (6) treatments.To spread the eight treatments evenly throughout the 4 week treatment period the treatments were two or three days apart.

WEEK 7 : The fifth treatment (7). Received completed diaries from patients, filled out Oswestry and McGill questionaires and measured Range of Motion. The sixth treatment (8).

WEEK 8 : The seventh treatment (9).

The eighth treatment (10). This was the final treatment, and both questionaires and Range of Motion are all measured again.

Completed diaries were collected.

POST-TREATMENT-WEEK 9 : Patient doesn't come in, only keeps daily diaries.

WEEK 10 : As week 9.

WEEK 11 : As week 9.

WEEK 12 : Patient came in for the last time and handed in the last of the completed diaries. The Oswestry and McGill Questionaiares are filled in for a final time and Range of Motion was measured (11).

The patient is then discharged. (The numerical figures in () parentheses are referred to later in the methodology and stats.)

3.4. THE SPECIFIC TREATMENT OF SUB-PROBLEM ONE

The first subproblem was to evaluate the patient's perception of the severity of back pain, disability and frequency of recurrence, following isometric and muscle stretching exercises combined with chiropractic treatment, in order to determine the benefit of isometric and stretching exercises in the management of mechanical lower back pain.

3.4.1. Data needed.

The severity of back pain was measured by using numerical figures as perceived by the patient, as well as a maximum figure of 3 for each section of the Short Form McGill Pain questionaire (appendix F).

The disability of the patient was measured by numerical values as perceived by the patient, with a maximum figure of 6 for each question and a total of 60 on the Oswestry Back Disability Index questionaire (appendix E). The frequency of recurrence was represented by a numerical value that was derived from the pain diaries.

3.4.2. How the Data was Secured.

The data was derived from Oswestry Back Disability Index questionaires, the Short Form McGill Pain questionaires and the patient diaries.

The data was obtained from the Oswestry Back Disability Index questionaire, with a total out of 60. This was then converted into a percentage. The Short form McGill Pain questionaire that was completed by the patient, with a maximum score of 3 for each question, the sensory and affective components were combined and then converted into a percentage.Both questionaires were filled out at specific times throughout the 12 treatment weeks (See schematic above for the times). The pain diary was kept by the patient every day and a mark out of 7 was given each week.

The results were then listed on a spread sheet and analysed, finding the means by adding up the total scores and dividing by the number of patients. Non parametric tests were used ie. Wilcoxin Signed Rank test and Mann-Whitney-u test because sample sizes were too small to be representative of the whole population, therefore parametric tests were not used.

3.5. THE SPECIFIC TREATMENT OF SUB-PROBLEM TWO

The second sub-problem was to determine whether isometric exercise and muscle stretch combined with chiropractic treatment has an effect on the patients range of motion.

3.5.1. Data Needed.

The data was in the form of numerical measurements (degrees) that are quantified by the Brom goniometer.

3.5.2. How the Data was Secured.

The data was located by the author with the BROM goniometer. Each measurement was carried out in an identical fashion to keep measurements between patients consistent.

The data was collected every required week, namely visits 1,2,4,7,10 and 11, using the Brom goniometer.

3.6 THE SPECIFIC TREATMENT OF SUB-PROBLEM THREE

The third sub-problem was to integrate and interpret the obtained data, in order to establish the relative effectiveness of isometric and stretching exercises in the management of mechanical lower back pain.

3.6.1. Data Needed.

This data was in a numerical form as well as the statistical interpretations and conclusions drawn from sub-problems 1 and 2.

3.6.2. How the Data was Secured.

The data was located in the conclusions at the end of sub-problems 1 and 2 (sections 3.6.1. and 3.6.2.).

3.6.3. Means to obtain the data.

The data was obtained by referring to the interpretations made and conclusions drawn from sub-problems 1 and 2.

CHAPTER FOUR

THE RESULTS

4.0. INTRODUCTION

This chapter includes the statistically analysed results of questionaires and goniometer readings, that were obtained from the patients throughout the research. They encompass all aspects of the research ie:

- Frequency of pain (Daily diaries)
- Severity of pain (Mc Gill Short form pain questionaire)
- Disability (Oswestry Bcak Disability Index questionaire)
- Range of motion (Brom goniometer)

The statistically analysed means of the data were used as opposed to the medians because often the situation arose where the medians, ie: the middle values of two data sets, were identical, but the one data set consistently out performed the other in terms of the results.

The statistical tests used to analyse the data were two non-parametric tests, the reason being that, due to the small sample groups ie. 15 patients each, statistical results would not be representative of the population as a whole, therefore no assumptions could be made with relevancy to the population. The two non-parametric tests that were appropriate included the Mann-Whitney U Test and the Wilcoxin Signed Rank Test. The Mann-Whitney U test is used to compare two sets of independent samples ie: between the two groups, and the Wilcoxin Signed Rank test is used to compare two sets of samples that are dependent so that the results can be paired, ie: within the same group.

Results were performed at the 5% level of significance.

4.1. FREQUENCY OF RECURRENCE

TABLE 1 COMPARISON OF THE TWO TREATMENT GROUPS WITH RESPECT TO FREQUENCY OF RECURRENCE OF PAIN AS NOTED BY PATIENTS IN DIARIES AT SPECIFIC TIME INTERVALS. (VALUES REPRESENT TOTAL SCORES DIVIDED BY SEVEN)

	PRE-TREATMENT	TREATMENT	POST-TREATMENT
EXERCISE	1.48	1.2	0.91
NON-EXERCISE	1.17	0.91	0.82

WILCOXON SIGNED RANK TEST

EX.	Pre-TX. * TX.	**Significant**
	Pre-TX. * Post-TX.	**Significant**
	TX. * Post-TX.	**Significant**
N.EX.	Pre-TX. * TX.	**Significant**
	Pre-TX. * Post-TX.	**Significant**
	TX. * Post-TX.	Non Significant

MANN-WHITNEY U TEST

EX. * N.EX. Pre-TX.	Non Significant
EX. * N.EX. TX.	Non Significant
EX. * N.EX. Post-TX.	Non Significant

FIGURE 1 COMPARISON OF THE TWO TREATMENT GROUPS AT SPECIFIC TIMES WITH RESPECT TO FREQUENCY OF RECURRENCE OF PAIN (BAR).

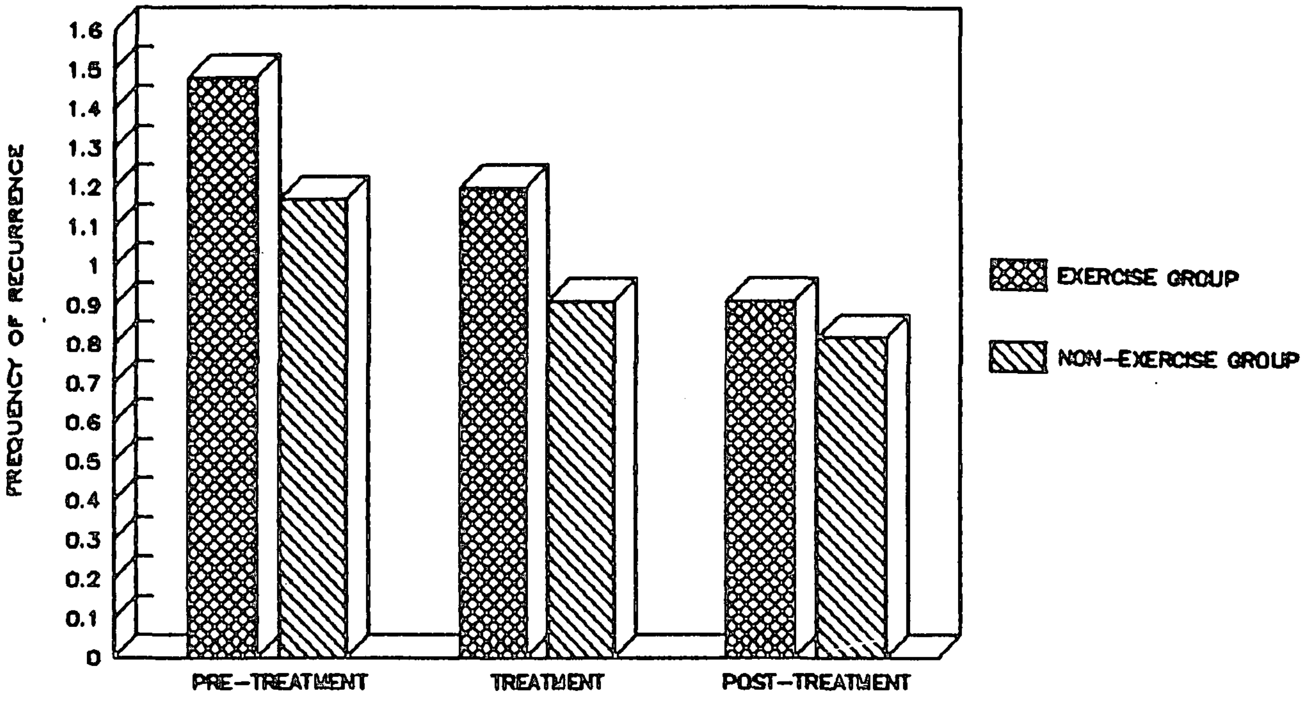
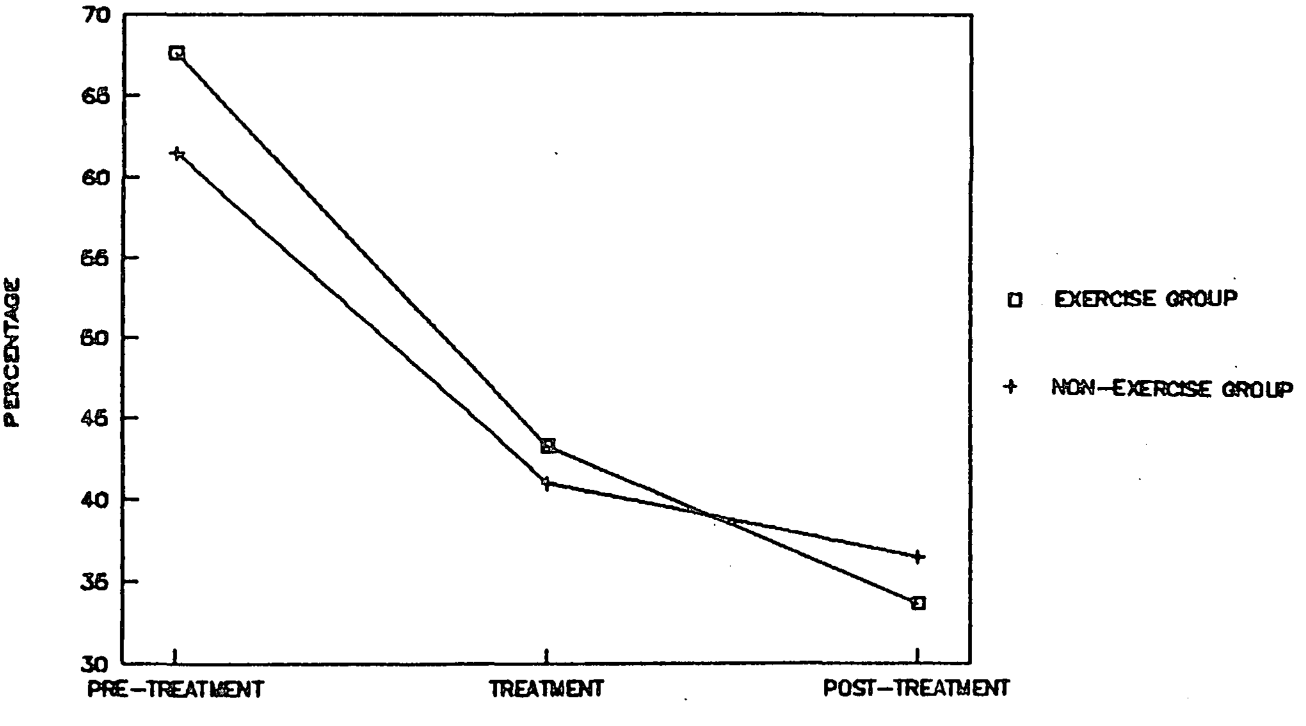


FIGURE 2 COMPARISON OF THE TWO TREATMENT GROUPS AT SPECIFIC TIMES WITH RESPECT TO FREQUENCY OF RECURRENCE OF PAIN (LINE).



4.2. SEVERITY OF PAIN

TABLE 2 COMPARISON OF THE TWO TREATMENT GROUPS WITH RESPECT TO PATIENTS PERCEPTION TO SEVERITY OF PAIN FELT AS RECORDED USING THE McGILL PAIN QUESTIONAIRE.(SCORES CONVERTED TO PERCENTAGE)

	PRE-TREATMENT	TREATMENT	POST-TREATMENT
EXERCISE	67.6	43.3	33.7
NON-EXERCISE	61.5	41	36.5

WILCOXON SIGNED RANK TEST

EX. Pre-TX. * TX. **Significant**
Pre-TX. * Post-TX. **Significant**
TX. * Post-TX. **Significant**

N.EX. Pre-TX. * TX. **Significant**
Pre-TX. * Post-TX. **Significant**
TX. * Post-TX. Non Significant

MANN-WHITNEY U TEST

EX. * N.EX. Pre-TX. Non Significant
EX. * N.EX. TX. Non Significant
EX. * N.EX. Post-TX. Non Significant

FIGURE 3 COMPARISON OF THE TWO TREATMENT GROUPS AT SPECIFIC TIMES WITH RESPECT TO SEVERITY OF PAIN (BAR).

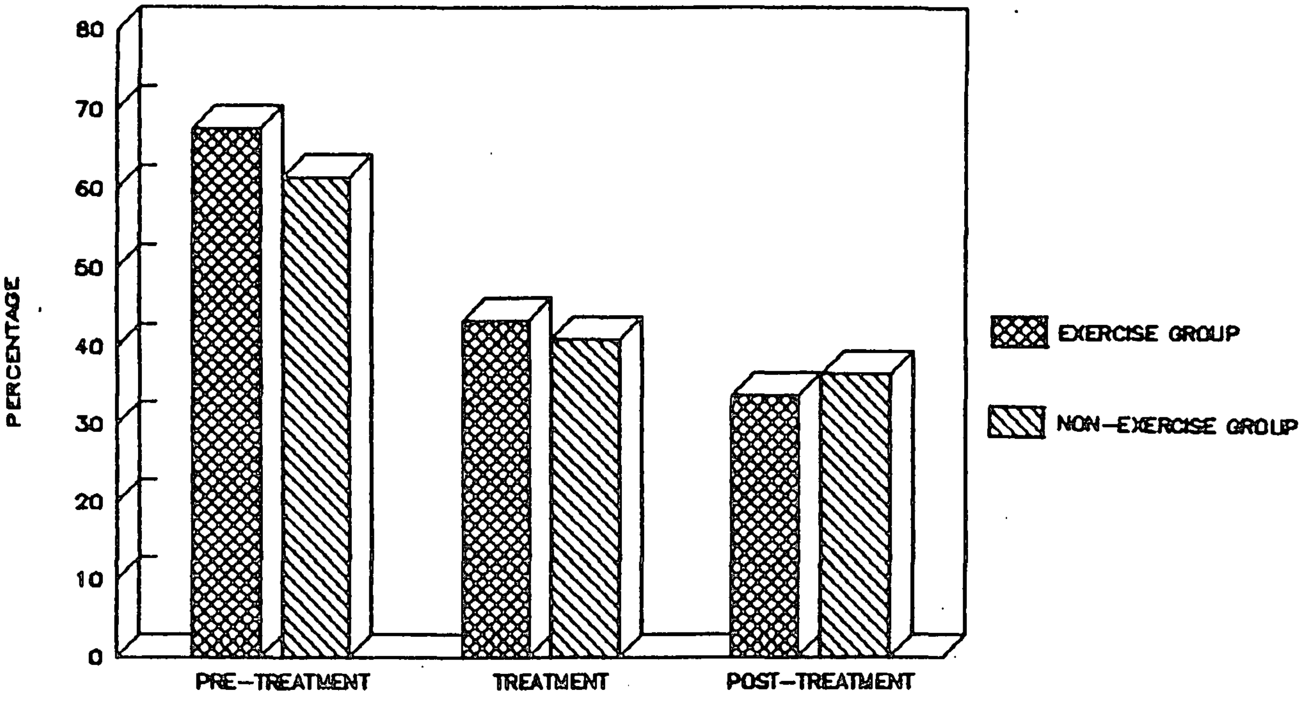
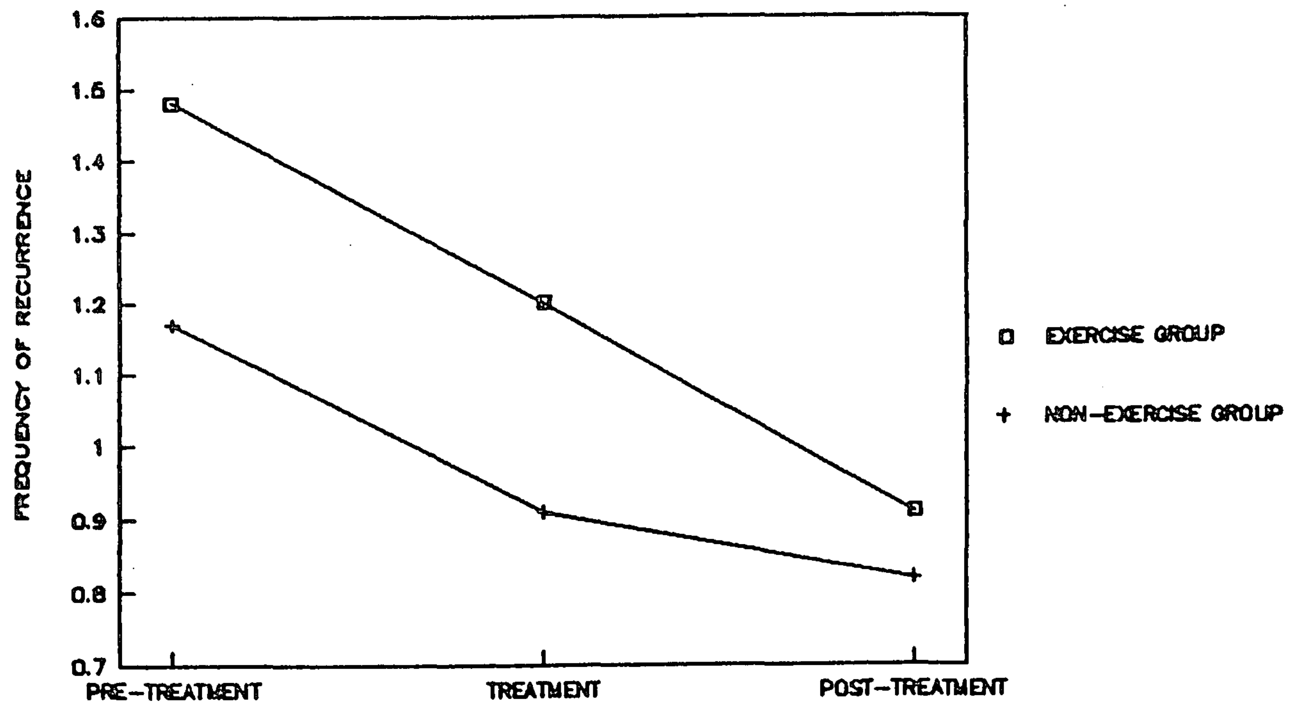


FIGURE 4 COMPARISON OF THE TWO TREATMENT GROUPS AT SPECIFIC TIMES WITH RESPECT TO SEVERITY OF PAIN (LINE).



4.3. DISABILITY

TABLE 3 COMPARISON OF THE TWO TREATMENT GROUPS WITH RESPECT TO DISABILITY AS RECORDED USING THE OSWESTRY BACK DISABILITY INDEX QUESTIONAIRE. (SCORES CONVERTED TO PERCENTAGE)

	PRE-TREATMENT	TREATMENT	POST-TREATMENT
EXERCISE	21	14.66	11.6
NON-EXERCISE	15.74	10	10

WILCOXON SIGNED RANK TEST

EX.	Pre-TX. * TX.		**Significant**
	Pre-TX. * Post-TX.		**Significant**
	TX. * Post-TX.		**Significant**
N.EX.	Pre-TX. * TX.		**Significant**
	Pre-TX. * Post-TX.		**Significant**
	TX. * Post-TX.		Non Significant

MANN-WHITNEY U TEST

EX. * N.EX. Pre-TX.	Non Significant
EX. * N.EX. TX.	Non Significant
EX. * N.EX. Post-TX.	Non Significant

FIGURE 5 COMPARISON OF THE TWO TREATMENT GROUPS AT SPECIFIC TIMES WITH RESPECT TO PATIENT DISABILITY (BAR).

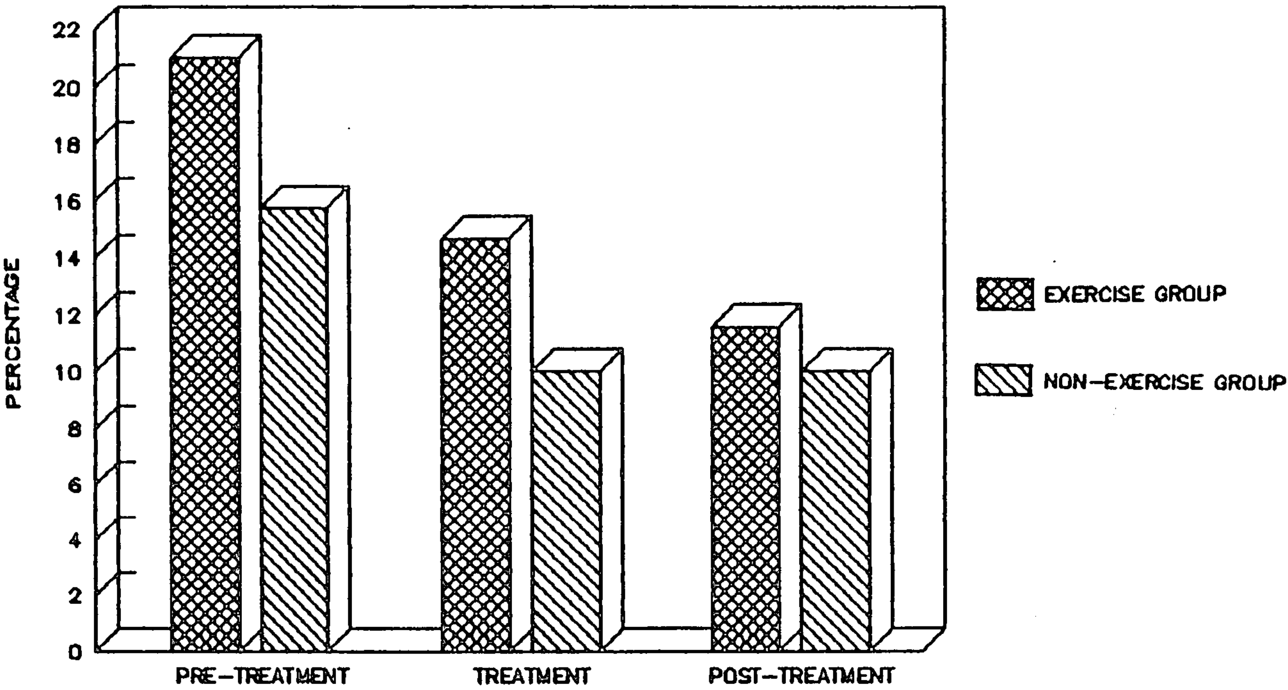
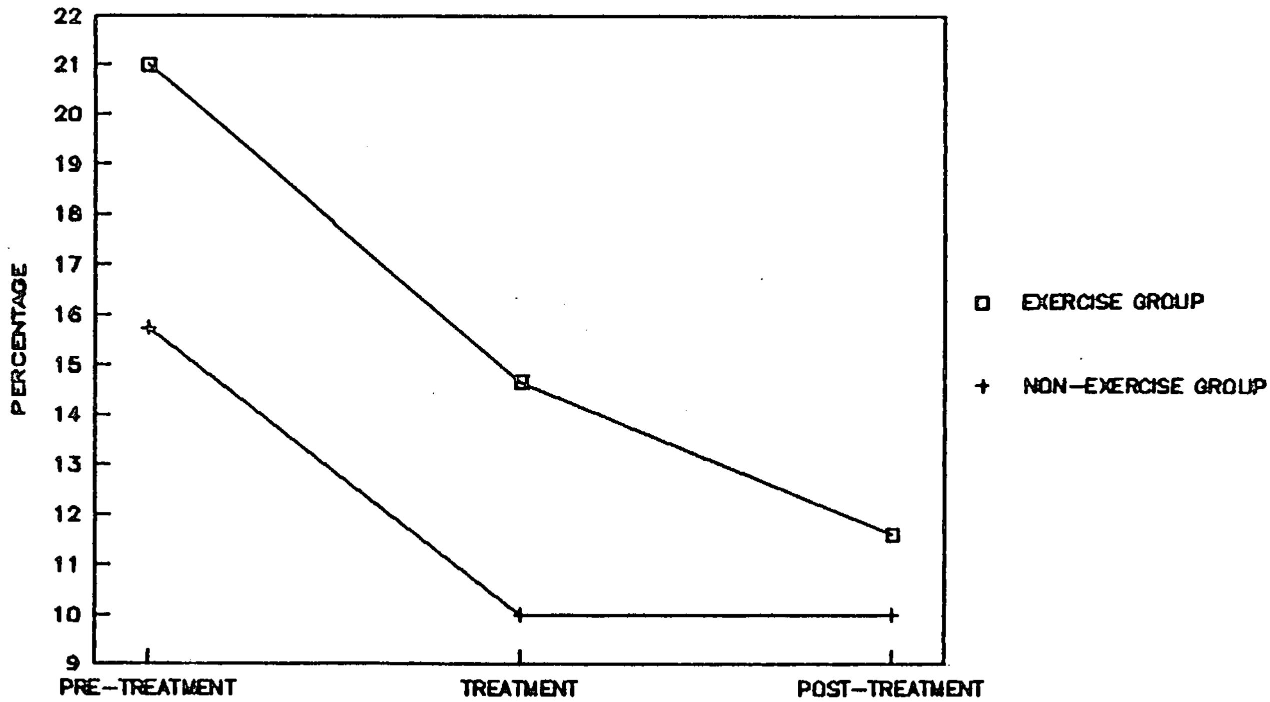


FIGURE 6 COMPARISON OF THE TWO TREATMENT GROUPS AT SPECIFIC TIMES WITH RESPECT TO PATIENT DISABILITY (LINE).



4.4. <u>RANGES OF MOTION</u>

TABLE 4 COMPARISON OF THE TWO TREATMENT GROUPS WITH RESPECT TO RANGES OF MOTION AS NOTED IN THE S.O.A.P. NOTES USING THE BROM GONIOMETER. (FIGURES REPRESENT DEGREES)

	A	B	C	D	E	F
FLEX. EX.	47.07	46.53	46.93	48.4	49.66	48.87
FLEX. N.EX.	46.47	47.87	47.6	50.4	50.47	48.67
EXT. EX.	19.87	17.33	18.27	18.53	20	21.07
EXT. N.EX.	14.13	14.67	14.8	16	15.93	14.13
L.L.F. EX.	27	26.4	27.4	26.93	31.87	33.2
L.L.F. N.EX.	30.33	31.53	30.8	32.67	31.47	30.53
R.L.F. EX.	28.93	27.13	30.33	29.6	32.47	33.2
R.L.F. N.EX.	30.07	33.53	32.73	35.07	34.4	32.87
L.ROT. EX.	24.87	24.6	25.27	24.47	27.73	29.06
L.ROT. N.EX.	20.67	23.87	26	25.07	23.27	22.27
R.ROT. EX.	26.73	28.93	28.6	27	28.27	30.73
R.ROT. N.EX.	23.67	25.13	26.13	25.47	25.73	25.13

4.4.1. Flexion

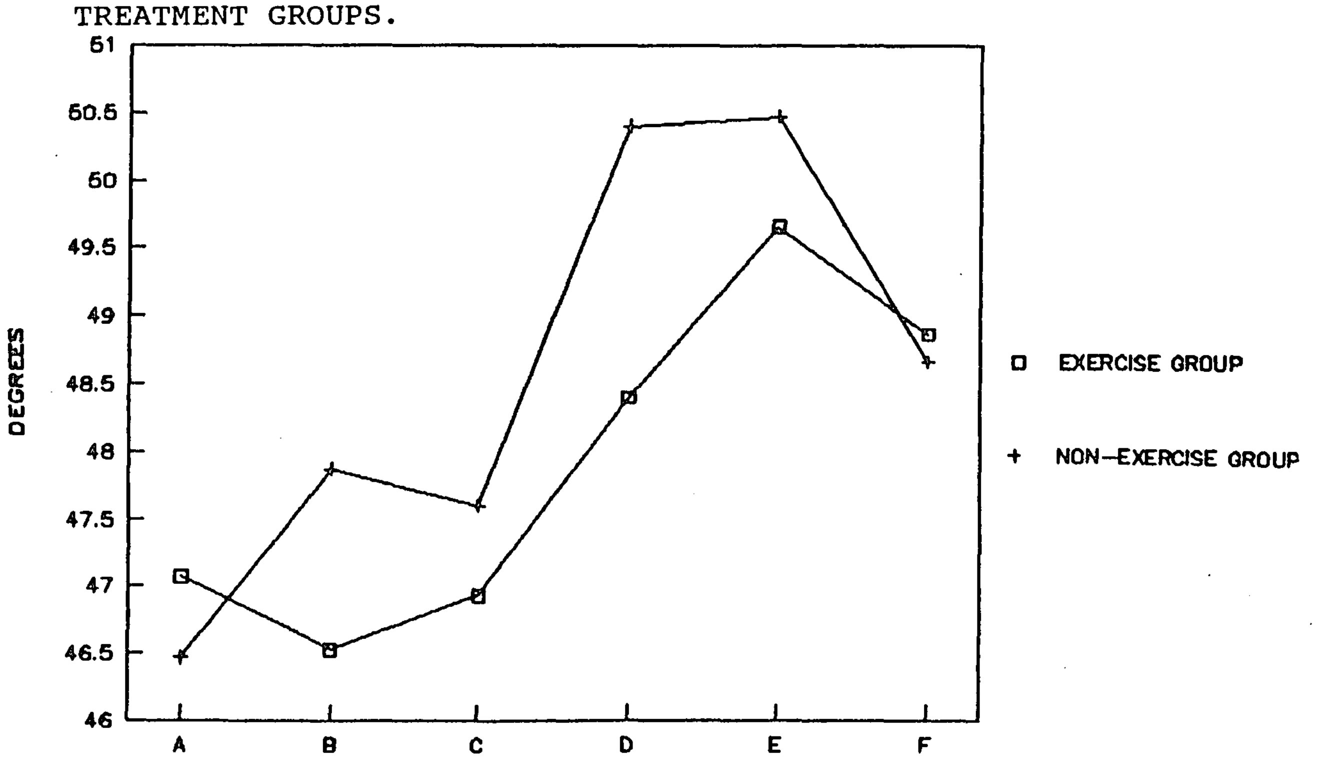
WILCOXON SIGNED RANK TEST

EX.	Pre-TX. * TX.		**Significant**
	Pre-TX. * Post-TX.		**Significant**
	TX. * Post-TX.		Non Significant
N.EX.	Pre-TX. * TX.		**Significant**
	Pre-TX. * Post-TX.		Non Significant
	TX. * Post-TX.		Non Significant

MANN WHITNEY U TEST

EX. * N.EX. Pre-TX.	Non Significant
EX. * N.EX. TX.	Non Significant
EX. * N.EX. Post-TX.	Non Significant

FIGURE 7 COMPARISON OF THE AMOUNT OF FLEXION BETWEEN THE TWO TREATMENT GROUPS.



4.4.2. Extension

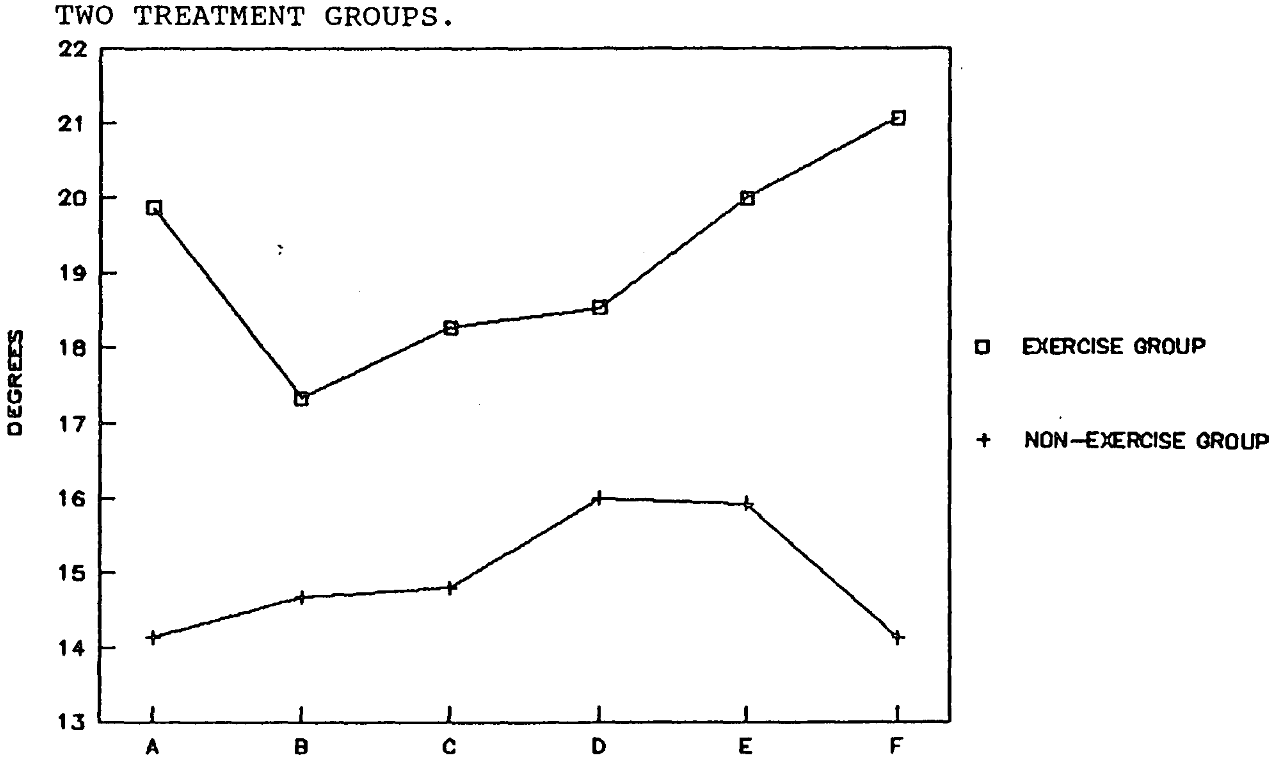
WILCOXON SIGNED RANK TEST

EX.	Pre-TX. * TX.	Non Significant
	Pre-TX. * Post-TX.	Non Significant
	TX. * Post-TX.	Non Significant
N.EX.	Pre-TX. * TX.	**Significant**
	Pre-TX. * Post-TX.	Non Significant
	TX. * Post-TX.	**Significant**

MANN WHITNEY U TEST

EX. * N.EX. Pre-TX.	Non Significant
EX. * N.EX. TX.	Non Significant
EX. * N.EX. Post-TX.	**Significant**

FIGURE 8 COMPARISON OF THE AMOUNT OF EXTENSION BETWEEN THE TWO TREATMENT GROUPS.



4.4.3. Left Lateral Flexion

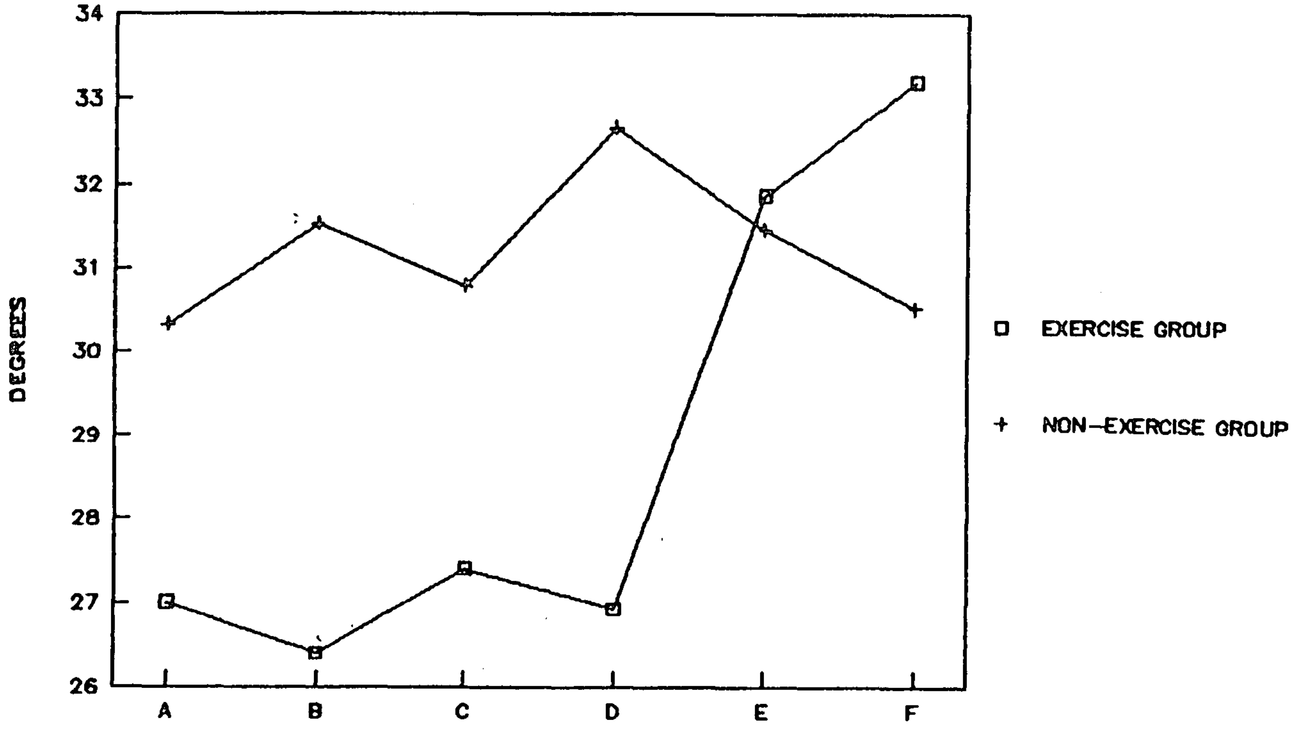
WILCOXON SIGNED RANK TEST

EX.	Pre-TX. * TX.	Significant	
	Pre-TX. * Post-TX.	Significant	
	TX. * Post-TX.	Non Significant	
N.EX.	Pre-TX. * TX.	Non Significant	
	Pre-TX. * Post-TX.	Non Significant	
	TX. * Post-TX.	Non Significant	

MANN WHITNEY U TEST

EX. * N.EX. Pre-TX.	Non Significant
EX. * N.EX. TX.	Non Significant
EX. * N.EX. Post-TX.	Non Significant

FIGURE 9 COMPARISON OF THE AMOUNT OF LEFT LATERAL FLEXION BETWEEN THE TWO TREATMENT GROUPS.



4.4.4. Right Lateral Flexion

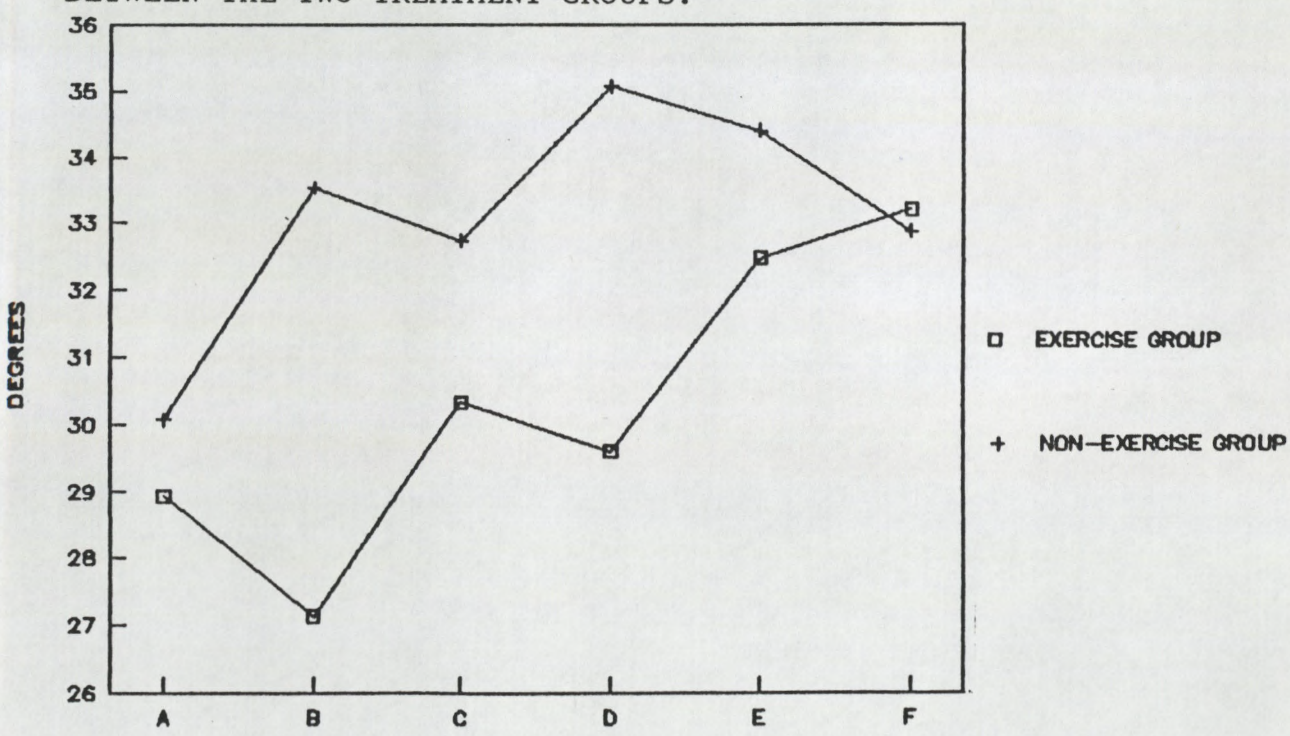
WILCOXON SIGNED RANK TEST

EX.	Pre-TX. * TX.	Non Significant
	Pre-TX. * Post-TX.	**Significant**
	TX. * Post-TX.	Non Significant
N.EX.	Pre-TX. * TX.	**Significant**
	Pre-TX. * Post-TX.	**Significant**
	TX. * Post-TX.	Non Significant

MANN WHITNEY U TEST

EX. * N.EX. Pre-TX.	Non Significant
EX. * N.EX. TX.	Non Significant
EX. * N.EX. Post-TX.	Non Significant

FIGURE 10 COMPARISON OF THE AMOUNT OF RIGHT LATERAL FLEXION BETWEEN THE TWO TREATMENT GROUPS.



4.4.5. Left Rotation

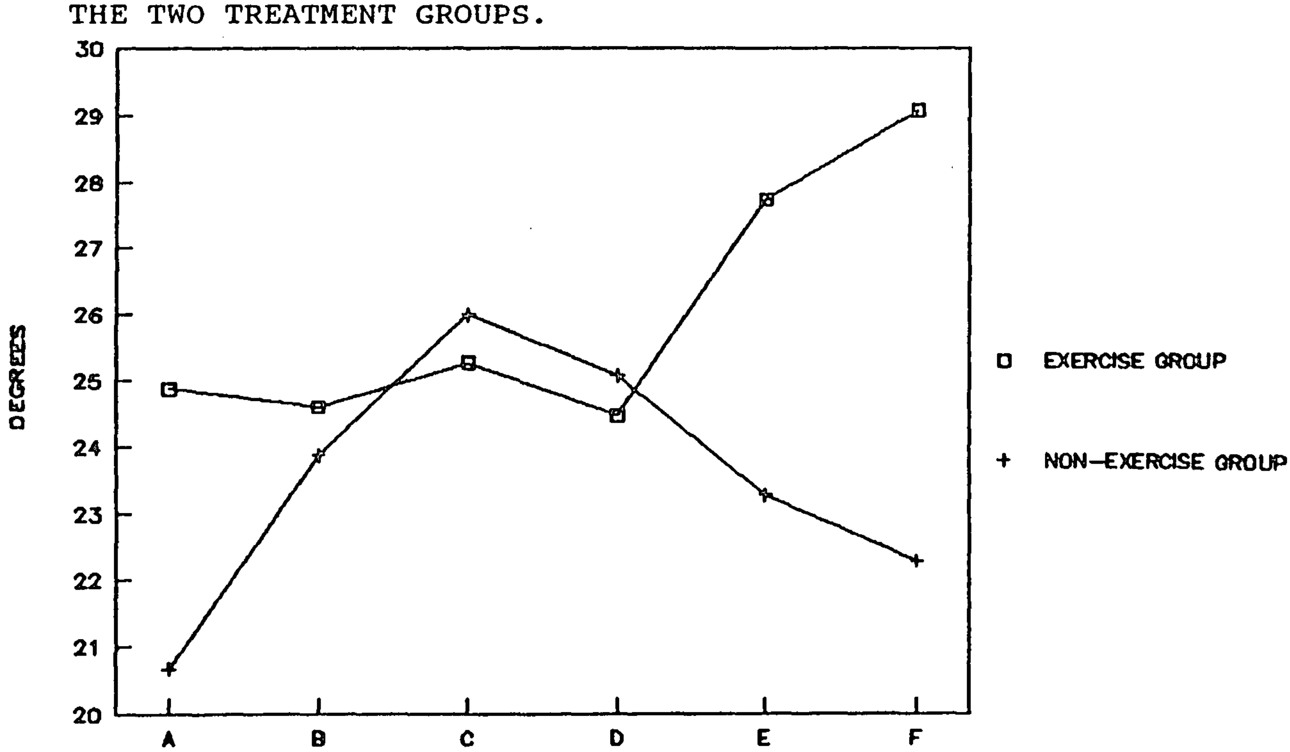
WILCOXON SIGNED RANK TEST

EX.	Pre-TX. * TX.	**Significant**
	Pre-TX. * Post-TX.	**Significant**
	TX. * Post-TX.	Non Significant
N.EX.	Pre-TX. * TX.	Non Significant
	Pre-TX. * Post-TX.	Non Significant
	TX. * Post-TX.	Non Significant

MANN WHITNEY U TEST

EX. * N.EX. Pre-TX.	Non Significant
EX. * N.EX. TX.	Non Significant
EX. * N.EX. Post-TX.	Non Significant

FIGURE 11 COMPARISON OF THE AMOUNT OF LEFT ROTATION BETWEEN THE TWO TREATMENT GROUPS.



4.4.6. Right Rotation

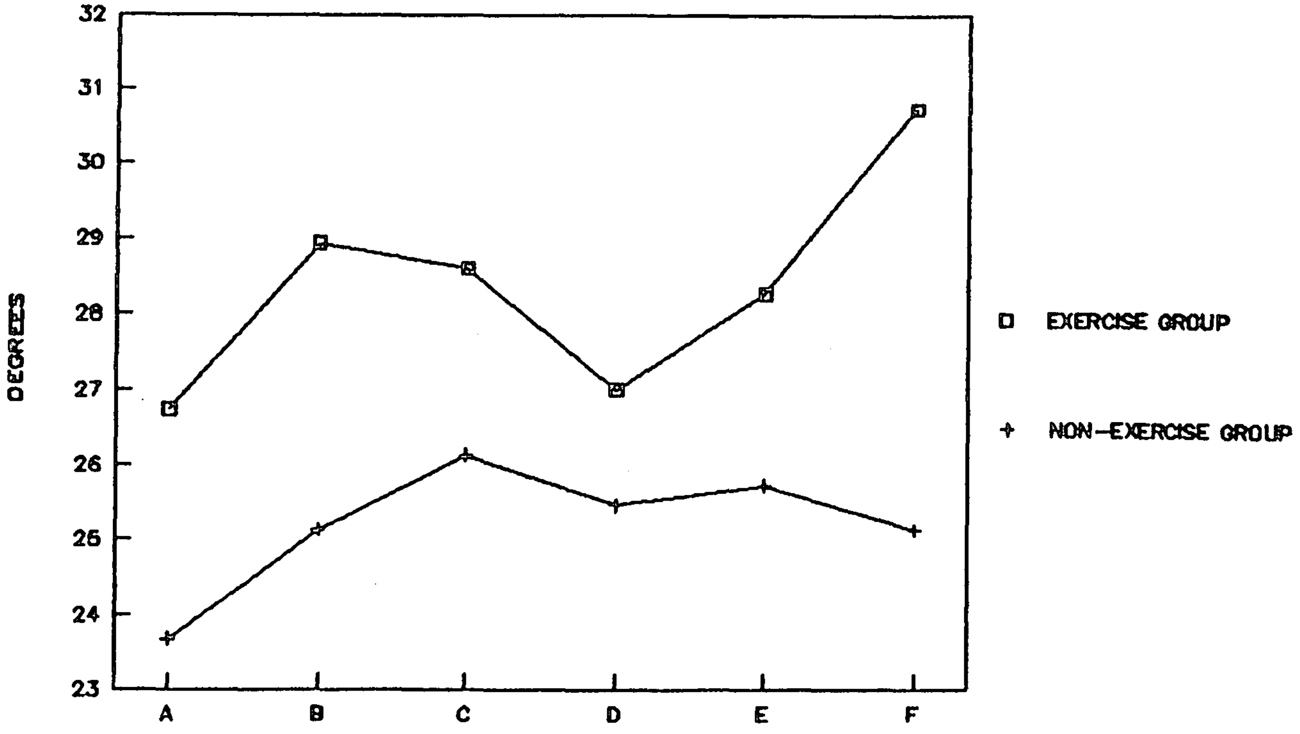
WILCOXON SIGNED RANK TEST

EX.	Pre-TX. * TX.	Non Significant
	Pre-TX. * Post-TX.	**Significant**
	TX. * Post-TX.	Non Significant
N.EX.	Pre-TX. * TX.	Non Significant
	Pre-TX. * Post-TX.	Non Significant
	TX. * Post-TX.	Non Significant

MANN WHITNEY U TEST

EX. * N.EX. Pre-TX.	Non Significant
EX. * N.EX. TX.	Non Significant
EX. * N.EX. Post-TX.	Non Significant

FIGURE 12. COMPARISON OF THE AMOUNT OF RIGHT ROTATION BETWEEN THE TWO TREATMENT GROUPS.



4.5 DEMOGRAPHIC DATA

TABLE 5 THE COMPARISON OF THE TWO TREATMENT GROUPS WITH RESPECT TO SAMPLE SIZE, AVERAGE AGE, SEX AND OCCUPATION (ACTIVITY) AS NOTED IN THE CASE HISTORY .

	EX. EXPERIMENT	N.EX. CONTROL
SAMPLE SIZE	15	15
AVERAGE AGE	37.67	35.27
SEX RATIO (MALE:FEMALE)	6:9	7:8
% ACTIVE LIFESTYLE	80%	66.6%

CHAPTER FIVE

CONCLUSIONS

AND

RECOMMENDATIONS

5.1 INTRODUCTION

The final chapter of this dissertation covers the results, as expressed in chapter 4. They are discussed with relevance to the subproblems, offering possible explanations for the outcomes. Where available, results of previous studies were incorporated and applied to this study explaining outcomes of this research. Thereafter, conclusions are drawn, summing up the efficacy of the study. The downfalls of the research are then analysed and recommendations for future studies are made.

5.2 SUB-PROBLEM ONE

The first subproblem was to evaluate the patient's perception of the severity of back pain, disability and frequency of recurrence, following isometric exercise and muscle stretch combined with chiropractic treatment, in order to determine the benefit of isometric exercises and stretch in the chiropractic management of mechanical low back pain.

-The Frequency of Pain-

Firstly, the data was analysed for significant changes within each group using the Wilcoxin Signed Rank test. The frequency of LBP experienced by the patients within the exercise group was significantly lowered throughout the entire research

period, ie. Pre-tx, tx and post-tx. On viewing the line graph (pg 47, Figure 2), the gradient is a straight line, showing that even when treatment ended the patient continued to improve at a constant rate. The follow up period was one month, where the patient recieved no treatment, and as is evident from the graph, there are no signs of regression.
But on examination of the non-exercise group, a significant difference was noted between the pre-tx and tx, and a significant overall difference between pre-tx and post-tx. However, what is noted, is that no significant difference was found between the tx and post-tx periods. On examination of the line graph (pg 47, Figure 2), the trend that is evident is that the rate of improvement slows down as soon as the treatment was completed. Faas **et. al.** (1993) found similar findings in his study which included 473 patients that were randomised into 3 groups, placebo, exercise and usual care of practitioner, and included patients with acute LBP only. His results showed statistically significant reduction in frequency of recurrence within the exercise group, but non significant results when comparing between the three groups.

Perhaps a reason for this trend would be that the exercise group had developed an increased endurance and muscle strength through the exercises carried out throughout the treatment period. The stretching exercises would have increased the conditioning of the muscles thereby preventing injury during the needed exercises. As shown by Janda (1974:29-34) and Nicolaisen and Jorgensen (1985), the possibility of this actually occuring is highly likely. The decrease in the rate of improvement in the non-exercise group can be substantiated using this theory, ie. due to a lack of endurance and muscle support, the improvements of the tx. were quickly lost due to easy muscle fatigue.

The data was then analysed using the Mann-Whitney U test, which compares the recordings between each group. Exercise pre-tx vs non-exercise pre-tx, exercise tx. vs non-exercise tx. and exercise post-tx. vs non-exercise post-tx, were all compared using this test. The results showed that all differences between each group at specific times, were non significant. From the histogram (pg 47, Figure 1) it is clear that there seems to be no marked changes in the comparison of the levels in the two groups, except in the post-tx where the difference in levels decreases. This indicates that both groups seemed to improve at a comparitive rate throughout the research period, and that even the change that occured at the post-tx. level is not marked enough to be signinficant at a 5% level of significance. But, referring back to the line graph, it is evident that, even though not significant, a difference between the two groups occured. Perhaps a longer post-tx. period would have shown more clearly the long term benefits of the exercises especially if the exercise groups gradient did not alter. It is important to note that exercises were not carried out during the post-tx. period.

-The Severity of Pain-

The Wilcoxin Signed Rank test was carried out on the data in order to evaluate the changes that took place within each group. In both groups, ie: exercise and non-exercise, pre-tx. vs tx. and pre-tx. vs post-tx. were significant. But, in the exercise group, tx. vs post-tx. was significant whereas in the non-exercise group, tx. vs post-tx. was non significant. On viewing the line graph,(pg 49, Figure 4) up to tx., the gradient of the exercise group is steeper than the non-exercise group, yet the gradient in the non-exercise group, though not as steep, was great enough to be significant. A marked drop in severity of pain was seen in both groups up until the end of the tx. period. This result can be explained through the chiropractic care the patients received, and the faster drop in pain severity experienced by the exercise group can probably be attributed to the exercises along with chiropractic manipulative therapy the patients were receiving. Nicolaisen and Jorgensen (1985) noted that an increase in muscle tone and balance within and between the flexors and extensors of the trunk had been shown to decrease experiences of back pain, and in this study, the extensors were stretched and the flexors strengthened to re-establish a balance. Following the line graphs beyond the tx. period paints a different picture.

The exercise group continued to have a significant decrease in severity of pain, however the magnitude of improvement was markedly decreased. In the non-exercise group, the line graph shows how the improvement rate almost plateaus from the ceasation of tx., giving the non-significant result. However, a point in favour of the non-exercise group is that no regression in the improvement occurs, this indicates the effectiveness of chiropractic treatment alone (Meade **et.al.**, 1990). These results show clearly how chiropractic, along with the increased muscle tone and balance brought about by specific exercise, benefits a patient with MLBP.

The Mann-Whitney-U Test was then performed on the data in order to compare the results between the two groups. A comparison between the two groups at all three stages was carried out, namely, ex vs n.ex during pre-tx; ex vs n.ex during tx and ex vs n.ex during post-tx. All results proved non significant at the 5% significance level. On examination of the histogram, figure 3, the bars drop fairly equally between the pre-tx and tx periods, explaining the lack of significance. However, the bars clearly indicate in the post-tx period that the exercise group continued to improve on a relative scale, whereas the non exercise group almost remained the same. But, even though the exercise bar moved below the level of the non-exercise bar, expressing the difference in improvement between the two groups, it was still too insufficient a change, to be statistically significant at the 5% level.

These results parallel those of Gundewall **et.al.**, (1993), who found that in 69 geriatric hospital nurses, after 13 months of controlled co-ordination exercises, not only did the incidence of LBP decrease, but also the intensity of the pain. He believed that his results were due to increase in back muscle strength and endurance, along with a psychosocial element. The psychosocial element can be eliminated during comparisons of the studies, as the patients in this study were not seen everyday, within their own working environment as occurred in Gundewall's research study (1993). Risch **et. al.**(1993), found as a coincidence, along with intended results, that the changes in muscle tone and strength were associated positively with decreased pain reports and increased physical and psychosocial functioning.

The findings in this research are strongly supported by other authors, namely Gundewall **et. al.** (1993), Risch **et. al.** (1993), Janda (1974:27-40) and Donelson (1991), indicating that improved muscle strength and endurance, which occur simultaneously (Arnheim and Prentice, 1993:48), definitely plays a role in the control of the severity of pain experienced by the patient (Risch **et. al.**, 1993 and Gundewall **et.al.**,1993).

-Disability-

Patient disability was measured using a marked percentage that was obtained from the Oswestry Back Disability Index Questionaire. The Wilcoxin Signed Rank test was carried out to evaluate changes that occurred within each group. In the exercise group, pre-tx vs tx; pre-tx vs post tx and tx vs post-tx were all significant. Whereas, in the non exercise group, pre-tx vs tx and pre-tx vs post-tx were significant and tx vs post-tx was non significant. This shows that both therapies are effective in their own right, but it is when treatment ends that the more superior treatment is noted in term of the long term benefits. On examination of the line graph, figure 6, the results become evident. Both groups seemed to improve at a similar rate until the end of treatment. The exercise group then continues to improve even though it is at a decreased rate, and the improvement remains significant at the 5% level of signifcance. The non exercise group however, plateaus immediately as the treatment ceases, with no further improvement or regression.

The data was then tested using the Mann-Whitney-U test, to compare the changes that took place between the two groups. The results of the comparisons, namely ex vs n.ex pre-treatment; ex vs n.ex treatment and ex vs n.ex post-treatment, were all non significant. Thus, even though there were significant changes within each group, the comparisons between the two groups were insignificant at the 5% level of significance. These results are reflected in the histogram, figure 5, and show clearly that the improvement between the two groups remain proportional, that is up until end of treatment. From there on, the exercise group continues to change proportionally, though the change is less evident, and the non exercise group seems to come to a stop as far as further improvement is concerned.

A probable reasoning for these results is that the non exercise group may have felt insecure and alone at the end of the treatment period, because up until then they were totally reliant and dependant on the researcher for the alleviation of their pain (Risch **et. al.**, 1993). They probably felt they no longer had support which potentially increases their psychological distress and pain (Risch **et. al.** 1993). Risch **et. al.** (1993), noted that the exercise group, continued to improve as they had been shown methods to control their pain experiences through understanding of the problem and corrective exercises and prevention. Risch **et. al.** (1993) noted that patients who are encouraged to take an active role in their rehabilitation, in this case through exercise, adapt an internal attribution for treatment success, which is associated with actual therapeutic goals. This deals with the psychological aspect which was not dealt with in this study, however it is a factor that can not be ignored (Risch **et. al.,** 1993).

This is a purely subjective presumption, as psychological responses are difficult to measure, but Manniche **et.al.** (1993), supports this reasoning in a study which showed that more intensive isometric exercises results in greater improvement in patients with LBP. In his study, 105 chronic LBP patients were randomised to one of three groups. The first group received heat and massage, with mainly isometric exercises repeated ten times for one hour, in eight sessions spanning a one month interval. The second and third groups performed the same exercises during 30 sessions for a three month interval; however the third group exercised twice as long (90 versus 45 minutes). The rates of improvement were 19, 42, and 74 percent respectively. The authors concluded that intensive exercise carried out for a longer time will counteract the conditioning effects of muscular fatigue and tenderness that are often encountered in the process of rehabilitating patients with chronic musculoskeletal pain by noting that rehabilitative exercises appeared to increase patient behavioral support, resulting in work capacity improvements and patient self rated disability levels.

A more objective theory for the results, would be that the exercises increased the endurance and subsequently strength of the muscles, therefore the patient could cope better with day to day activities (Rothman and Simone 1992:707). This is supported by Gundewall **et.al.**, (1993), who noted that fewer injuries occurred within the exercise group because the movements performed remained co-ordinated and intensional, and that is because they were performed by unfatigued muscles. Well trained muscles perform controlled movements thus preventing over extension of a movement and in so doing decreases the number of injuries that occur (Arnheim and Prentice 1993:36). By increasing the patients functioning capabilities, a natural decrease in disability will occur. Therefore, the results can be rationalised psychologically and physiologically.

In conclusion, sub-problem one, with its three divisions, namely frequency and severity of pain, and the disability experienced by the patient, all responded in a similar way. That is, all three aspects revealed statistically significant differences within each group. But, as seen by all the line graphs, figures 2,4 and 6, the exercise group seemed to continue improving at a significant rate after treatment had ceased, whereas, the nonexercise group had no further significant improvement after the ceasation of treatment. It can therefore be concluded that, the sustained improvement within the exercise group can only be attributed to the exercise therapy included in the treatment protocol.

It was hypothesised that specific isometric exercises and stretches combined with chiropractic treatment would reduce the severity of pain, disability and frequency of back pain experienced. This hypothesis is accepted since all changes relating to the exercise group are statistically significant.

5.3 SUB-PROBLEM TWO

The second sub-problem was to determine whether isometric exercise and muscle stretch combined with chiropractic treatment had an effect on the patients range of motion.

The ranges of motion, namely flexion; extension; left lateral flexion; right lateral flexion; left rotation and right rotation, were all analysed individually for statistically significant differences. All results were obtained by initially using the Wilcoxin Signed Rank test and then using the Mann-Whitney-U test. The Wilcoxin test was used to compare differences within each group, and the Mann-Whitney-U test was used to analyse between each group. It is important to note that the results show no consistancy or trend.

-Flexion-

The Wilcoxin Signed Rank test showed a significant change in the exercise group between pre-tx vs tx and between pre-tx vs post-tx. The non-exercise group showed only pre-tx vs tx to be significant. The remaining results proved non significant. By examining the line graph, figure 7, a definite improvement is seen in both groups initially, but then the results seem to plateau and even regress, as is the case with both the exercise and non execise groups, at the cessation of the treatment. What should be noted is that from the beginning of the pre-treatment to the end of treatment, both groups had statistically significant improvements.

But, in the exercise group, a significant change is noted between the beginning and the end of the research (P=0.01), but not in the non exercise group. The conclusion can be drawn that isometric exercise and muscle stretch, in conjunction with chiropractic treatment, not only improves flexion, but maintains it at a significant level.

The Mann-Whitney-U test was then carried out to note any significant changes between the two groups. These results were all non significant. Perhaps a conclusion can be drawn from these results, with reference to the figure 7. Chiropractic treatment proved beneficial in both instances, but a difference in the amount of regression after tx ended, shows that even though non significant, isometric exercise and muscle stretch slowed down the rate of regression.

-Extension-

On examination of the line graph, figure 8, it is clear that the exercise group was already superior to the non exercise group at the beginning of the research. However, the Wilcoxin Signed Rank test and the Mann-Whitney-U test analyse each trend individually before comparison.

In the exercise group, no changes were significant. In the non exercise group, pre-tx vs tx was significant, along with tx vs post-tx. It becomes difficult to explain results that are so random, however, a possible reason for the exercise group not improving initially, as did the non exercise group, is that by introducing isometric exercise and muscle stretch, the patient may have initially stiffened up from sore muscles (Arnheim and Prentice, 1993:37).

The Mann-Whitney-U test proved all comparisons non significant, except for ex vs n.ex at the post-treatment stage which was significant. On examination of the line graph (figure 8), it is obvious that the non exercise group ends up at the same point after treatment, as where they started. However, the exercise group gradually improved and continued to improve with no regression, even at the end of the treatment. This leads us to the conclusion that on comparing end results between the two groups, isometric exercise and muscle stretch not only improved, but maintained the improvement when compared to a non exercising group and is significant to 95% confidence levels.

-Left Lateral Flexion and Right Lateral Flexion-

Figures 9 and 10 will be discussed together as the results are both very randomly spread. The Wilcoxon Signed Rank Test showed significant results at the 5% level of significance in both groups when comparing pre. and post-treatment. On examination of both line graphs it becomes clear that the exercise group improved at a consistent rate with no regression. Looking at the range difference between the beginning and end points of the exercise group, it is clear that a significant change occurred between pre-tx and post-tx in both right and left lateral flexions. What is evident in both line graphs, is that the exercise group crosses over the non exercise group, showing clearly that the exercise group responded far superiorly to the treatment than the non exercise group.

In both right and left lateral flexion, the Mann-Whitney-U test proved non-significant. Even though the graphs indicate such a markedly positive response of the exercise group, when comparing the two groups, it was still not big enough a difference to be significant at the 5% level of significance. An obvious explanation for the good results in the exercise group, in both right and left lateral flexion, would be the fact that a well toned muscular system results in increased flexibility, conditioning and co-ordination (Ordet and Grand, 1992:75-77).

-Right and Left Rotation-

In this section, both right and left rotation are discussed together as the results strongly resemble each other. All tests were non significant when applying the Mann-Whitney-U test to compare between the two groups. But when using the Wilcoxin Signed Rank test,to compare within each group, one result commonly appears in both right and left lateral rotation. Both had a significant result when comparing pre-tx vs post-tx in the exercise group. On examination of the graphs, figures 11 and 12, where the exercise group response continues to improve, the non exercise group improves, but then regresses rapidly after treatment almost to the pre-treatment level. The significant results in the exercise group, that is a common response in both the right and left rotation graphs, can possibly be due to the increase in muscle co-ordination and function through the exercises (Gundewall **et. al.**, 1993).

Again we can presume that the results in the exercise group are due to increased flexibility from the combination of isometric exercises and the muscle stretches (Ordet and Grand, 1992:95, and Arnheim and Prentice, 1993:63). A reason for the non significance within the non exercise group could be that the increase in ROM was only due to being pain free, due to chiropractic manipulative therapy, that the patients returned to a ROM that is normal for them in a pain free state. The exercise group however, were not only restored to their personal normal ROM levels, but through the specific exercises, developed an even further ROM by increasing their flexibility. The increase in flexibility, as noted by Ordet and Grand (1992:95), is due to a combination of stretch exercise and active exercise. They explained how a combination of these two exercises enhances flexibility as all muscle components are included in the treatment ie: active and passive. By including both types of exercise, flexibility increases while at the same time support and strength increases around the skeletal structures.

It was hypothesised that isometric exercise and muscle stretch combined with chiropractic treatment would improve the patients range of motion. This hypothesis is accepted. Even though non significance prevailed between the two groups, the significant changes that occurred within the exercise group allows acknowledgement of the effectiveness of isometric exercise and muscle stretch.

5.4 SUB-PROBLEM THREE

The third subproblem was to integrate the data in order to obtain the relative effectiveness of isometric exercise and stretching in the management of mechanical lower back pain.

The results obtained have been discussed above, with reference to other authors namely, Janda (1974:27-40); Nicolaisen and Jorgensen (1985); Gundewall **et.al.** (1992); Risch **et.al.** (1993); Donelson (1991); Manniche **et.al.**(1993) and Hansen **et.al.** (1993), and the concepts strongly support one another. The effectiveness of the isometric exercises and muscle stretches is evident on all the graphs and in the results themselves. The Wilcoxin Signed Rank test that was carried out on all the different sections showed statistically significant changes occurred within the exercise group as well as within the non exercise group. With regards to the results within each group, a consistant difference between the exercise and non exercise group, was that the comparison between the tx vs post-tx period was non significant in the non exercise group, and significant in the exercise group throughout the first subproblem. This fact alone draws the conclusion that even though chiropractic treatment alone gives significant changes, the exercise group maintained significant changes even after treatment had ceased.

Is isometric exercise and muscle stretch effective in the management of lower back pain? Yes ! However, in can not be used alone, but in conjunction with chiropractic manipulative therapy. This point is supported by Ordet and Grand (1992:90), who noted a positive feedback cycle between muscle imbalance and spinal misalignment. They noted that even in an attempt to produce normal , balanced muscle actions, a misaligned spine will sometimes simply reinstate the imbalance (Ordet and Grand, 1992:90). The management of lower back pain does not end at treating the patient who is in pain, but also includes prevention of recurrence and maintainance of a pain free state. It is clear that the exercises are essential in the management of LBP, but what is also evident is that the isometric exercises and stretches proved successful in the maintainance of a pain free state.

The exercises appeared to help maintain the improvement, within the exercise group. The rewards are multiple from this evidence, namely, decreased dependancy on the physician, decrease in the cost of treatment, decrease in the number of recurrences and thus a decrease in early degeneration, a decrease in the number of days absent from work, an increase in well being of the patient, and finally a decrease in the cost of treatment.

It was hypothesised that from the data we can acertain that isometric exercise and muscle stretch combined with chiropractic makes a beneficial contribution to the management of mechanical lower back pain. This hypothesis is accepted, as it is shown that beneficial statistically significant differences occurred within the exercise group, with respect to decrease in patients perception to severity of pain, decrease in disability and decrease in frequency of pain, that did not occur in the non exercise group; ie. the post-tx period. However, it is important to acknowledge that when comparing the two groups, no significant changes occurred between the two at the 5% level of significance. The purpose of the study was not to establish a significant difference between the two groups, but rather to assess whether isometric exercise and muscle stretch proved beneficial to the treatment of mechanical lower back pain as an adjunct to chiropractic manipulative therapy.

5.5 DEMOGRAPHICS

30 patients took part in the research. They were randomly selected and allocated to a respective group. In the exercise group, the average age was 37.67 years old, and in the non exercise group it was 35.27 years old. The ratio of male:female in the exercise group was 6:9 and in the non exercise group, 7:8.

From the above it is clear that there was not much difference between the groups which makes comparison between the two groups standard. Both groups had suffered from mechanical lower back pain longer that 6 months or more.

Nicolaisen and Jorgensen (1985) found that his results were affected by the fact that one group had more women than men. This would have affected his results in that it is known that women show a larger endurance capacity than men (Nicolaisen and Jorgensen, 1985), however, in this research study, the exercise group only had one extra female in comparison to the non exercise group, thus this explaination is invalid for this study, as both groups were similar.

On correlation with these previous authors, the author that supports these findings is Janda (1974:33). His theory states that irrespective of sex, age and occupation, improvement of muscle endurance and balance would result in an improvement in that patients pain and level of disability. Janda's theory reflects this study most appropriately, as no correlation between age, sex and occupation can be used to explain the results.

5.6 CONCLUSIONS AND RECOMMENDATIONS

The specific isometric exercises and muscle stretches tested in this study for effectiveness in management of lower back pain proved to be beneficial, and surprisingly effective. The main finding was that in the follow up period (post-tx.), the exercise group continued to have significant changes, whereas the non exercise group had no further significant changes once treatment had ceased.

Although the design of the study aimed at an evaluation of the benefit of specific isometric exercises and muscle stretches, it might be too easy to use the improved muscle tone and balance, as accomplished through the exercises, as the only explanation for the successful results. Other factors, however more difficult to objectively analyse than improved muscle tone, could be the psychological aspect and taking responsibility for their own health. Also the fact that the exercises incorporated the patients into their treatment may have given them an inward drive to succeed in their treatment goals. As Risch **et. al.**(1993) noted, the subjects that experienced success through exercise and subsequent reductions in pain, were more apt to internalize their treatment goals. These findings suggest that patients who are encouraged to take an active role in their rehabilitation adapt an internal attribution for treatment success, which is associated with actual therapeutic gains (Risch **et. al.**,1993). Perhaps this finding may apply to this research study in that the exercise group became more involved with their treatment.

Another valid point made by Donelson (1991), was that the mechanical nature and pattern of symptoms of each recurrence of lower back pain tended to be identical to those of the previous episode. Further more, the experience obtained during self-treatment and recovery from an attack, is ideal in teaching patients how to monitor the early warning symptoms of recurrences. It seems to sensitize them to the precise nature of their on going vulnerability to recurrences, as well as to effective treatment tools to prevent and/or minimize future symptoms.

A few recommendations that might be included in the study are a longer follow up period, in order to assess the effectiveness of the exercise therapy in the long term. A study by Hansen **et.al.** (1993) had a 12 month follow-up period after 8 treatments, and showed promising results with respect to severity of pain and recurrence thereof ($P< 0,01$). However, the study included intensive back exercises not isometric exercises and stretch. Therefore a longer follow-up period may then show the significance of the results using the Mann-Whitney-U test. More research is needed to address the long term benefits of specific isometric exercise and muscle stretch in co-ordination with that of chiropractic treatment.

The cost of treatment for low back pain is increasing each year, with a direct impact on the individual, business, and national ecomomics. To contain costs, treatment must be intelligently applied by all health care providers for low back pain patients (Werneke, **et.al.** 1993). But an answer to this problem may lie in the theme of this research, ie: improve the patients muscle endurance and balance thus increasing the support about the spine and so too, protect against further injury. The author believes that physicians should aim at patient self reliance, through patient involvement, in effectively dealing with low back pain.

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PATIENT CONSENT FORM

INTERN: ....

Date: ....

I the undersigned, ..., give my informed consent to be examined, treated and/or x-rayed at the Technikon Natal Chiropractic Day Clinic, and will comply with the instructions as stipulated by the intern with regards to his/her research project.

Signature: ....

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

CASE HISTORY

Patient:______________________ Date # __________

File #:__________

X-ray #:__________

Age: ________ Sex:______ Occupation: __________

Intern: ____________________ Signature: ____________

FOR CLINICIAN'S USE ONLY

Initial visit clinician: Signature:

Case History:

Examination:

Previous: TN Other — Current: TN Other

X-ray Studies:

Previous: TN Other — Current: TN Other

Clinical path. lab.:

Previous: TN Other — Current: TN Other

Case status:

PTT: Conditional: Signed off: Final sign out:

Recommendations:

Intern's case history

1. Source of history:

2. Chief complaint: (patient's own words)

3. Present illness:

   Location

   Onset

   Duration

   Frequency

   Pain (character)

   Progression

   Aggravating factors

   Relieving factors

   Associated S & S

   Previous occurrences

   Past treatment and outcome

4. Other complaints:

5. Past history:

General health status

Childhood illnesses

Adult illnesses

Psychiatric illnesses

Accidents/injuries

Surgery

Hospitalizations

6. Current health status and life-style:
   - Allergies
   - Immunizations
   - Screening tests
   - Environmental hazards
     (home, school, work)
   - Safety measures
     (seat belts, condoms)
   - Exercise and leisure
   - Sleep patterns
   - Diet
   - Current medication
   - Tobacco
   - Alcohol
   - Social drugs

7. Family history:
   - Immediate family:
     - Age
     - Health
     - Cause of death
     - DM
     - Heart disease
     - TB
     - HBP
     - Stroke
     - Kidney disease
     - CA
     - Arthritis
     - Anaemia
     - Headaches
     - Thyroid disease
     - Epilepsy
     - Mental illness
     - Alcoholism
     - Drug addiction
     - Other

8. Psychosocial history:

Home situation

Daily life

Important experiences

Religious beliefs

9. Review of systems:

General

Skin

Head

Eyes

Ears

Nose/sinuses

Mouth/throat

Neck

Breasts

Respiratory

Cardiac

Gastro-intestinal

Urinary

Genital

Vascular

Musculoskeletal

Neurologic

Haematologic

Endocrine

Psychiatric.

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Underline abnormal findings in RED and elaborate on back of relevant page, if necessary.
Mark "NAD" if normal.

Patient:________________________________ File #______

Last name First name

Clinician:__________________ Signature:_______________

Intern:____________________ Signature:_______________

Date:_________________

Height:____________ Weight:___________ Temp:___________

Rates: Heart:_______ Pulse:_______ Respiration:__________

Blood pressure: Arms: L / R /

Legs: L / R /

General appearance:

STANDING EXAMINATION.

Minor's sign
Skin changes
Posture
erect
Adam's
Ranges of motion:

T/L spine: Flexion: 90 Fingers to floor
Extension: 50
R.lat.flex.: 30 Fingers down leg
L.lat.flex.: 30 Fingers down leg
Rot.to R.: 35
Rot.to L.: 35

Flex.

L.Rot. R.Rot.

L.lat flex. R.lat. flex.

Ext.

/ = pain-free limitation; // = painful limitation.

Romberg's sign.
Pronator drift.
Trendelenburg's sign.
Gait.
rhythm
balance
pendulousness
on toes
on heels
tandem
Half squat.
Scapular winging.
Muscle tone.
Spasticity/Rigidity.

Shoulder:
  skin
  symmetry
  ROM - glenohumeral
        scapulo-thoracic
        acromioclavicular
        elbow
        wrist
Chest measurement
  inspiration
  expiration
Visual acuity

Breast examination:
  Inspection:
    skin
    size
    contour
    nipples
    arms overhead
    hands against hips
    leaning forward.
  Palpation:
    axillary lymph nodes.

<u>SEATED EXAMINATION.</u>

Spinal posture
Head
  scalp
  skull
  face
  skin
Eyes
  conjunctiva
  sclera
  eyebrows
  eyelids
  lacrimal gland
  nasolacrimal duct
  alignment
  corneal reflex
  ocular movement

L			R		
III	IV	VI	III	IV	VI

  visual fields
  accomodation
  iris
  pupils
  red reflex
  optic disc

- vessels
- general background
- macula
- vitreous
- lens

Ears:
- auricle
- ear canal
- drum
- auditory acuity
- Weber test
- Rinne test

Nose:
- external
- internal
  - septum
  - turbinates
  - olfaction

Sinuses (frontal & maxillary):
- tenderness
- transillumination

Mouth and pharynx:
- lips
- buccal mucosa
- gums and teeth
- roof
- tongue
  - inspection
  - movement
  - taste
  - palpation
- pharynx
  - inspection
  - CN X

Neck:
- posture
- size
- swelling
- scars
- discoloration
- hair line

ROM:

Flexion:	45	chin to larynx chin to sternum
Extension:	55	forehead parallel to floor
L.lat.flex:	40	
R.lat.flex:	40	
L.rot.:	70	
R.rot.:	70	

Flex.

L.Rot. R.Rot.

L.Lat. flex. R.lat. flex.

Ext.

lymph nodes
trachea
thyroid
carotid arteries (thrills, bruit)
CN V
CN VII
CN VIII (nystagmus)
CN IX
CN XI
TMJ --
Inspection
ROM
deviation
Palpation
crepitus
tenderness

Neurological:
- Dermatomes
  - C5
  - C6
  - C7
  - C8
  - T1
- Tendon reflexes
  - biceps
  - triceps
  - brachioradialis
- Muscle strength
  - C5
  - C6
  - C7
  - C8
  - T1
- Coordination:
  - point-to-point
  - dysdiadochokinesia

Thorax:
- Chest:
  - Inspection:
    - skin
    - shape
    - respiratory distress
    - rhythm (respiratory)
    - depth
    - effort
    - intercostal/supraclavicular retraction
  - Palpation:
    - tenderness
    - masses
    - respiratory expansion
    - tactile fremitus
  - Percussion:
    - lungs (posterior)
    - diaphragmatic excursion
    - kidney punch
  - Auscultation:
    - breath sounds
      - vesicular
      - bronchial
    - adventitious sounds
      - crackles (rales)
      - wheezes (rhonchi)
    - voice sounds
      - broncophony
      - whispered pectoriloquy
      - egophony

Cardiovascular:
auscultation (aortic murmurs)
Allen's test

SUPINE EXAMINATION

JVP
PMI
auscultation heart (L.lat.recumbent)
respiratory excursion
percussion chest (anterior)
breast palpation
The abdomen:
Inspection:
skin
umbilicus
contour
peristalsis
pulsations
hernias (umbilical/incisional)
Auscultation:
bowel sounds
bruit
Percussion:
general
liver
spleen
Palpation:
superficial reflexes
cough
light
rebound tenderness
deep
liver
spleen
kidneys
aorta
intra-/retro-abdominal wall mass
shifting dullness
fluid wave
Acute abdomen:
where pain began and now
cough
tenderness
guarding/rigidity
rebound tenderness
Rovsing's sign
psoas sign
obturator sign
cutaneous hyperaesthaesia
rectal exam
Murphy's sign.

Male genitals and hernias.

Inspection:

- skin
- prepuce
- glans
- meatus
- nits/lice
- scrotum
- inguinal/femoral bulges

Palpation:

- penis (tenderness/induration)
- testes
- epididymis
- inguinal canal
- femoral canal
- cremasteric reflex

Auscultation:

- scrotal mass.

Peripheral vasculature:

Inspection:

- skin
- nail beds
- pigmentation
- hair loss

Palpation:

- pulses - radial, brachial, femoral, popliteal, post.tibial, dorsalis pedis
- lymph nodes - epitrochlear, femoral (horizontal & vertical)
- temperature (feet & legs)

Manual compression test

Retrograde filling (Trendelenburg) test

Arterial insufficiency test

Musculoskeletal:

ROM

hip

- flex. 90/120
- ext. 15
- abd. 45
- add. 30
- int rot 40
- ext rot 45

knee

- flex. 130
- ext. 0/15

ankle

- plantar flex 45
- dorsiflex 20
- inversion 30
- eversion 20

leg length

Neurological:
dermatomes
L1
L2
L3
L4
L5
S1
muscle strength
hip flexion
knee extension
ankle dorsiflexion
plantar flexion
tendon relexes
patellar
Achilles
plantar reflex
Rectal examination:
Inspection
sacrococcygeal & perianal areas
Palpation
sphincter tone
tenderness
indurat
nodules
prostate
seminal vesicles

Mental status
Appearance and behaviour:
level of consciousness
posture and motor behaviour
dress, grooming, personal hygiene
facial expression
affect
Speech and language:
quantity
rate
volume
fluency
aphasia (prn)
Mood
Thought processes (logical, relevant, organized)
Memory and attention:
orientation (time, place, person)
remote memory
recent memory
new learning ability
Higher cognitive functions:
information and vocabulary (general & specialised knowledge)
abstract thinking.

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC.

REGIONAL EXAMINATION -- LUMBAR SPINE AND PELVIS.

PATIENT: ____

FILE # : ____________________ DATE: ____________________

INTERN/RESIDENT: ________________________________

SUPERVISING CLINICIAN : __________________________

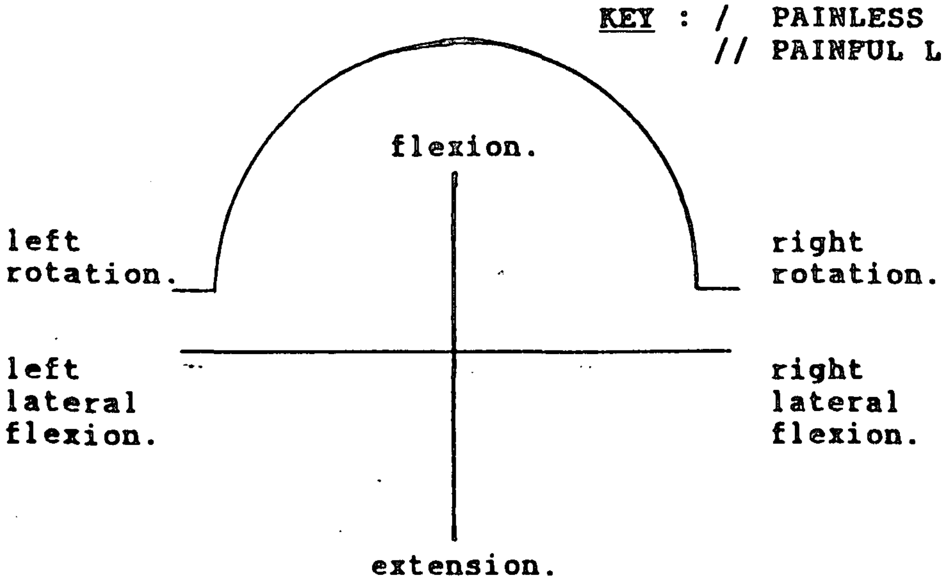
STANDING :

Posture
Minor's Sign
Skin
Scars
Discoloration
Muscle tone
Bony and soft tissue contours
Spinous percussion
Schober's Test (6cm)
Treadmill
Body Type
Attitude

RANGE OF MOTION.

Forward Flexion = 40-60 degrees.(15cm from floor)
Extension = 20-35 degrees.
L/R Rotation = 3-18 degrees.
L/R Lateral flexion = 15-20 degrees.

KEY : / PAINLESS LIMITATION.
// PAINFUL LIMITATION.



SUPINE :

Skin.
Hair.
Nails..

Observe abdomen
Fasciculations
Abdominal reflexes
Auscultate abdomen/groin
Palpate abdomen/groin
Pulses (abdomen)
Pulses (extremities)

SLR
Bowstring
Plantar reflex
Circumference (thigh, calf)
Leg length :
- actual
- apparent

Sciatic notch
Patrick Faber
Gaenslen's Test
Gluteus Maximus Stretch
Hip medial rotation
Psoas Test
Thomas' Test :
- hip joint
- rectus femoris

LATERAL RECUMBENT :

S-I compression
Ober's Test
Femoral nerve stretch
Myotomes :
- QL
- Gluteus Medius

NON-ORGANIC SIGNS :

Pin Point Pain.
Axial Compression.
Trunk Rotation.
Burn's Bench Test.
Flip Test.
Hoover's Test.
Ankle Dorsiflexion Test.

PRONE :

Gluteal skyline
Skin rolling
Iliac crest compression
Facet joint challenge
S-I tenderness
Erichson's Test
Pheasant's Test
Myotomes :
- GluteusMaximus

Active MF Trigger Points:
- QL
- Glut. Med.
- Glut. Max.
- Glut. Min.
- Piriformis
- Hamstrings
- TFL

MOTION PALPATION :

Jt.play		Left						Right					Jt.play	
/A	Lat	Fle	Ext	LF	AR	PR		Fle	Ext	LF	AR	PR	P/A	Lat
							T10							
							T11							
							T12							
							L1							
							L2							
							L3							
							L4							
							L5							
					U	L	SI	U	L					

APPENDIX E.

OSWESTRY BACK DISABILITY INDEX

PATIENT NAME:______________________________________ FILE #:______ DATE:_______

This questionnaire has been designed to give the doctor information as to how your back pain has affected your ability to manage in everyday life. Please answer every section and mark in each section only the ONE box which applies to you. We realise you may consider that two of the statements in any one section relate to you, but please just mark the box which most closely describes your problem.

Section 1 - Pain Intensity

- ☐ I have no pain at the moment.
- ☐ The pain is very mild at the moment.
- ☐ The pain is moderate at the moment.
- ☐ The pain is fairly severe at the moment.
- ☐ The pain is very severe at the moment.
- ☐ The pain is the worst imaginable at the moment.

Section 2 - Personal Care (Washing, Dressing etc.)

- ☐ I can look after myself normally without causing extra pain.
- ☐ I can look after myself normally but it causes extra pain.
- ☐ It is painful to look after myself and I am slow and careful.
- ☐ I need some help but manage most of my personal care.
- ☐ I need help every day in most aspects of self care.
- ☐ I do not get dressed, I wash with difficulty and stay in bed.

Section 3 - Lifting

- ☐ I can lift heavy weights without extra pain.
- ☐ I can lift heavy weights but it gives extra pain.
- ☐ Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned, for example on a table.
- ☐ Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.
- ☐ I can lift very light weights.
- ☐ I cannot lift or carry anything at all.

Section 4 - Walking

- ☐ Pain does not prevent me walking any distance.
- ☐ Pain prevents me walking more than 1 mile (2.2 km).
- ☐ Pain prevents me walking more than 1/2 mile (1.1 km).
- ☐ Pain prevents me walking more than 1/4 mile (0.5 km).
- ☐ I can only walk using a stick or crutches.
- ☐ I am in bed most of the time and have to crawl to the toilet.

Section 5 - Sitting

- ☐ I can sit in any chair as long as I like.
- ☐ I can only sit in my favorite chair as long as I like.
- ☐ Pain prevents me from sitting more than 1 hour.
- ☐ Pain prevents me from sitting more than 1/2 hour.
- ☐ Pain prevents me from sitting more than 10 minutes.
- ☐ Pain prevents me from sitting at all.

Section 6 - Standing

- ☐ I can stand as long as I want without extra pain.
- ☐ I can stand as long as I want, but it gives me extra pain.
- ☐ Pain prevents me from standing for more than one hour.
- ☐ Pain prevents me from standing for more than 30 minutes.
- ☐ Pain prevents me from standing for more than 10 minutes.
- ☐ Pain prevents me from standing at all.

Section 7 - Sex Life

- ☐ My sex life is normal and causes no extra pain.
- ☐ My sex life is normal but causes some extra pain.
- ☐ My sex life is nearly normal but it is very painful.
- ☐ My sex life is severely restricted by pain.
- ☐ My sex life is nearly absent because of pain.
- ☐ Pain prevents any sex life at all.

Section 8 - Social Life

- ☐ My social life is normal and gives me no exta pain.
- ☐ My social life is normal but increases the degree of pain.
- ☐ Pain has no significant effect on my social life apart from limiting my more energetic interests, for example, dancing.
- ☐ Pain has restricted my social life and I do not go out as often.
- ☐ Pain has restricted my social life to my home.
- ☐ I have no social life because of pain.

Section 9 - Sleeping

- ☐ I have no trouble sleeping.
- ☐ I can sleep well only by using pills.
- ☐ Even when I take pills I have less than six hours sleep.
- ☐ Even when I take pills I have less than four hours sleep.
- ☐ Even when I take pills I have less than two hours sleep.
- ☐ Pain prevents me from sleeping at all.

Section 10 - Travelling

- ☐ I can travel anywhere without extra pain.
- ☐ I can travel anywhere but it gives me extra pain.
- ☐ Pain is bad but I manage trips over two hours.
- ☐ Pain restricts me to trips of less than one hour.
- ☐ Pain restricts me to trips under 30 minutes.
- ☐ Pain prevents me from travelling, except to the doctor or hospital.

PATIENT NAME : ______________________

FILE # : _________ DATE : ______________

	NONE	MILD	MODERATE	SEVERE
1 THROBBING	0) ____	1) ____	2) ____	3) ____
2 SHOOTING	0) ____	1) ____	2) ____	3) ____
3 STABBING	0) ____	1) ____	2) ____	3) ____
4 SHARP	0) ____	1) ____	2) ____	3) ____
5 CRAMPING	0) ____	1) ____	2) ____	3) ____
6 GNAWING	0) ____	1) ____	2) ____	3) ____
7 HOT-BURNING	0) ____	1) ____	2) ____	3) ____
8 ACHING	0) ____	1) ____	2) ____	3) ____
9 HEAVY	0) ____	1) ____	2) ____	3) ____
10 TENDER	0) ____	1) ____	2) ____	3) ____
11 SPLITTING	0) ____	1) ____	2) ____	3) ____
12 TIRING-EXHAUSTING	0) ____	1) ____	2) ____	3) ____
13 SICKENING	0) ____	1) ____	2) ____	3) ____
14 FEARFUL	0) ____	1) ____	2) ____	3) ____
15 PUNISHING-CRUEL	0) ____	1) ____	2) ____	3) ____

McGILL PAIN QUESTIONNAIRE

APPENDIX G.

PATIENT NAME: ______________________ FILE#: ________ PAGE# ____

DATE: ________ VISIT# ______ INTERN: ______________ CLINICIAN: ______________

S:

A:

O:

P:

SPECIAL ATTENTION TO:

NEXT APPOINTMENT:

DATE: ________ VISIT# ______ INTERN: ______________ CLINICIAN: ______________

S:

A:

O:

P:

SPECIAL ATTENTION TO:

NEXT APPOINTMENT:

DATE: ________ VISIT# ______ INTERN: ______________ CLINICIAN: ______________

S:

A:

O:

P:

SPECIAL ATTENTION TO:

NEXT APPOINTMENT:

APPENDIX H.

DAILY DIARY

WEEK:

DAYS	1	2	3	4	5	6	7
Severe Pain							
Moderate Pain							
Mild Pain							
No Pain							

DAILY DIARY

WEEK:

DAYS	1	2	3	4	5	6	7
Severe Pain							
Moderate Pain							
Mild Pain							
No Pain							

DAILY DIARY

WEEK:

DAYS	1	2	3	4	5	6	7
Severe Pain							
Moderate Pain							
Mild Pain							
No Pain							

DAILY DIARY

WEEK:

DAYS	1	2	3	4	5	6	7
Severe Pain							
Moderate Pain							
Mild Pain							
No Pain							