

THE COMPARISON OF McMANNIS TRACTION AND INTERMITTENT TRACTION BOTH IN CONJUNCTION WITH CHIROPRACTIC SPINAL MANIPULATION IN THE MANAGEMENT OF CHRONIC MECHANICAL LOWER BACK PAIN.

BY MELANIE JANE PALMER

Dissertation submitted in compliance with the requirement for a Master's Degree in Technology: Chiropractic in the Department of Chiropractic at the Natal Technikon.

I declare that this dissertation represents my own work

Melanie Palmer

25-11-1996

Date

SUBMISSION APPROVED FOR EXAMINATION

\_\_\_\_\_  
Dr H Kretzmann - Supervisor

25-11-96

Date

Mast. Dipl. in Technology: Chiropractic

## **DEDICATION**

**It gives me great pleasure to dedicate  
this project to my parents, Bugs and Barbara  
whose support, love and assistance I truly  
appreciate. They taught me to choose a  
goal in life and to achieve it.**

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## ABSTRACT

The purpose of this study was to compare the effects of McMannis traction and Intermittent traction, both in conjunction with chiropractic manipulation in the treatment of chronic i.e. longer than four weeks, mechanical lower back pain. It was hypothesised by the author that McMannis traction would be the traction treatment of choice, as it enables the joints of the lumbar vertebrae to be moved through their normal anatomical range of motion while being tractioned axially. In addition this type of traction is more specific and allows the therapist to determine the amount of traction that is being applied to the patient because it is being applied manually. Intermittent traction on the other hand is a motorised, non-specific traction and affects several joints at one time (Saunders 1979).

The costs to society of back pain and its ensuing disability are staggering, both economically through work absenteeism, social security payments and health care; and in terms of the pain and suffering to the patient and his or her family. It is particularly disturbing, therefore, that our health care system has failed to provide effective means to alleviate the problem and, as a consequence there is now a well founded demand from many areas for more research, especially into the treatment of back pain. (Bolton 1994).

This study was a randomised uncontrolled clinical study where the objectives were to assess each of the two treatment groups (McMannis traction and Intermittent traction), for intra-group performance. Once this had been achieved, an inter-group statistical analysis could determine which of the two treatments, if any, was more effective. The more effective of the two could then be considered to be the traction treatment of choice in the chiropractic management of chronic mechanical lower back pain.

Thirty-six subjects, all over the age of eighteen, who presented to the Technikon Natal Chiropractic Day Clinic complaining of chronic mechanical lower back pain were included in the study. These patients were carefully screened, by means of a case history (Appendix B), physical examination (Appendix C), lumbar spine regional examination (Appendix D) and Lumbar spine and Sacro-iliac x-rays (where clinically indicated) to detect the presence of lumbar facet syndrome, sacro-iliac syndrome or a combination of these two entities. This thorough examination also ensured that they had no contra-indications to chiropractic spinal manipulation or lumbar traction (See literature review-Chapter 2). They were then divided into two groups.

Each patient received 8 treatments (consisting of a lumbar spine or sacroiliac manipulation followed by either McMannis or Intermittent traction) over a four week period i.e. two per week. However, if the patient was symptom free before the completion of the eight treatments they no longer received treatment and their follow- up consultation was brought forward to a month after their final treatment.

The data was collected prior to the first and final treatments, in order to compare pre- and post-treatment results. At the follow-up consultation one month after the final treatment the data was again collected.

The Numerical Pain Rating Scale 101 (Appendix 8.5), Pain Diagrams (Appendix 8.6), the Short-form McGill Pain Questionnaire (Appendix 8.7) and Oswestry Back Disability Index (Appendix 8.8) were used to record the patients response to pain in a subjective manner. A goniometer (BROM II) was used to measure the subjects lumbar spine range of motion and an algometer ("FDK 20 Force Dial") was used to record the subjects pain sensitivity (pressure was applied to the spinous processes of the affected joints). These were recorded by the researcher to detect the objective response of the patients.

The Wilcoxin Signed Rank test (intra-group analysis) was used to determine whether any significant change occurred between the initial and final treatments; and the final treatment and the follow-up visit, within each respective study group. The Mann-Whitney U-test (inter-group analysis) was used to determine whether there was any significant difference between the two groups at the time of initial consultation, final treatment given and at the follow-up visit one month later. All confidence intervals were constructed at a 95% confidence interval, i.e.  $\text{Alpha} = 0.05$ .

In terms of the patients subjective response to treatment the results varied considerably. The McMannis group showed a statistically significant decrease in the disability (Owestry Back Disability Index) associated with low back pain during the treatment period and both groups showed a statistically significant difference in their perception of the extent to which they felt pain (Short-form McGill Pain Questionnaire). Although the remainder of the readings resulted in no statistically significant difference, they all demonstrated a decrease in the mean scores during the treatment period, thus indicating a clinically significant improvement. During the one month follow-up these mean scores improved slightly (i.e. decreased), indicating that the improvement was maintained.

The results of the subjective data did not show any statistically significant difference between the two groups at any time of data collection. This does not support the alternate hypothesis, which states that McMannis traction is the treatment of choice in the chiropractic management of low back pain.

In terms of objective data the Intermittent group showed statistically significant improvement in terms of Forward Flexion and pain sensitivity (Algometer readings) during the one month follow-up period.

The overall implications of the Mann-Whitney U-test were that the McMannis group showed no statistically significant changes than the Intermittent group. These results once again indicate a rejection of the alternate hypothesis which states that McMannis traction is the treatment of choice in the chiropractic management of mechanical lower back pain.

According to Bolton (1994) if there is a failure to demonstrate a beneficial effect of a treatment modality, consideration should be given to the possibility that this is not because the treatment is not efficacious, but that the outcome measures, for whatever reason, have failed to detect it. As with any practical procedure there is scope for much individual variation. Clearly, caution is indicated in drawing broad conclusions on the values of

mobilisation and or manipulation from any study (Sims-Williams et al. 1979).

The results of this investigation are based on a small number of patients and require confirmation and modification using a larger sample size, so as to represent a normal distribution of the population. Long term trials in which patients are monitored for at least a year are also required. This may result in the production of more significant results.

On the basis of this study, the data shows statistically significant differences for both groups in terms of the Wilcoxin test, however, these results are insufficient to support or refute the efficacy of McMannis traction over Intermittent traction in conjunction with spinal adjustment for patients with chronic mechanical lower back pain.

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## TABLE OF ABBREVIATIONS

BROM - Back Range of motion

1st tx - First treatment

F tx - Final treatment

F/up tx - Follow-up treatment

I group - Intermittent group

IVD - Intervertebral disc

IVF - Intervertebral foramen

M group - McMannis group

NRS 101 - Numerical Pain Rating Scale 101

P value - Exceedence probability value

ROM - Range of motion

Z value - Large sample statistic

## DEFINITIONS

1) McMannis traction is a doctor-controlled, distractive force applied to a specific level of the spine with or without articular facet adjustment. Flexion-distraction tables provide for patient positioning that stabilises the torso from the area of the mid-lumbar region upwards and allows pivoting of the thoraco-lumbar and sacral areas through the movement of the caudal portion of the table which supports the pelvis and legs. (Haldeman 1992:477, 503).

2) Intermittent traction for the purpose of the study was the mechanical application of a tractive force applied and withdrawn, to the lumbar spine, in relatively short periods. It was an unassisted multilevel traction applied to the spine. (Haldeman 1992:503).

3) Chiropractic treatment for the purpose of the study was limited to the manipulative procedure, comprising of a spinous hook, lumbar roll, upper sacro-iliac or lower sacro-iliac side posture technique, in conjunction with either McMannis or Intermittent traction.

4) Joint fixation is a non-pathological reversible mechanical problem whereby an articulation has become temporarily immobilised or restricted within its normal physiological range of motion. (Gatterman 1990:408, Rahlmann 1987).

5) Chronic for the purpose of the study referred to any mechanical lower back pain that had been present for 4 weeks or longer.

6) Mechanical lower back pain for the purpose of the study referred to an alteration in the normal biomechanics of the lumbar spine and sacro-iliac joints, excluding those alterations caused by any organic lesions. (Personal definition).

7) Subjective clinical findings for the purpose of the study referred to the data obtained from the patient through the use of the Numerical Pain Rating Scale 101, Pain Diagrams, Short-form McGill Pain Questionnaire and the Oswestry Back Disability Index.

8) Objective clinical findings were obtained from recording the patients range of motion using a goniometer and their sensitivity to pain was measured using an algometer.

9) Spinal manipulative therapy for the purpose of this study refers to a specific form of direct articular manipulation utilising a short lever and characterised by a dynamic, high velocity, low amplitude thrust. i.e. spinal adjustment.

## **CHAPTER 1**

### **INTRODUCTION**

Paquet et al. (1994) stated that low back pain constitutes one of the main health problems in industrialised countries, resulting in substantial financial costs. He further noted that despite the growing number of therapeutic modalities, the treatment of lower back pain remains a problem.

Low back pain has recently become a popular topic for epidemiological investigations as a result of the enormous costs of treatment and disability for this condition.(Kirkaldy-Willis 1992:2-3). Although the condition is usually a benign process and is self-limiting in the majority of cases, the sheer numbers of those affected are of major concern; for example, according to Kirkaldy-Willis (1992:2-3) up to eighty percent of the population will experience lower back pain at some time in their life. Moreover, a small but significant number of those affected develop chronic pain resulting in long-term disability and enormous expense. He further states that according to studies done on workers compensation claims involving lower back pain, eighty percent of all back pain sufferers return to work within six weeks. However, the remaining twenty percent account for eighty percent of the financial costs of caring for back pain.

Despite the high incidence of back pain, its chronic and recurrent nature in many patients and its contribution as a main cause of absence from work (Meade et al. 1990), very little is known about the value of different methods of treatment in patients with back pain (Haldeman 1992, Rush and Shore 1994 and van der Heijden et al. 1995c). Consequently, patients not only frequently seek assistance from more than one specialist but also often receive conflicting advice as to the appropriate management of the condition.

Spinal adjustive therapy is one of the oldest as well as one of the most common forms of treatment used for patients suffering with low back pain (Giles 1989:160). Clinical studies have shown spinal manipulative therapy to be consistently more effective than any of the array of comparison treatments (Waagen et al. 1986, Anderson et al. 1992 and Kirkaldy-Willis 1992:292). Results of the study conducted by Meade et al. (1990), concluded that for patients with low back pain, in whom manipulation was not contra-indicated, chiropractic almost certainly was worthwhile in respect of long-term improvement in comparison with hospital outpatient management. The benefits were seen mainly in those patients with chronic or severe pain.

Chiropractic manipulation coupled with adjunctive procedures such as traction, massage, cryotherapy, heat and exercise therapy, provides relief for many patients suffering from disorders of the lumbar spine (Gatterman 1990:173).

Traction is widely used in various ways in orthopaedic practice, but its use in the past has been restricted to attempt to restore presumed shifts of disc material to its 'proper place' (Grieve 1988:567).

When the sole basis for using traction is the notion of mechanically 'putting' the disc 'back' or 'shifting it off the nerve root', the therapist is denied a much wider range of application of this useful treatment method. Alternatively, if traction is conceived as a flexible and freely adaptable method of mobilisation, its field of usefulness is considerably widened. (Grieve 1988:567).

Lumbar traction is indicated for a wide spectrum of painful conditions, based on its physiological effects of vertebral separation, widening of the intervertebral foramina, and possibly muscle relaxation. (Geiringer et al. 1988:278).

It must be emphasised that spinal traction is only a part of the total management-treatment regimen, which includes other forms of physical therapy (as mentioned above). Without a total management program, spinal traction, like many other empirical methods, has little chance of long-range benefit. (Saunders 1982).

Low back pain and disability continue to plague our patients and to stress industrial and health economies. As health care and compensation costs increase without evident resolution of this disability 'epidemic', questions about the quality of care become increasingly urgent. Quality assessment depends heavily on valid and reliable treatment and outcome measures. (Hazard et al 1993). Meade et al. (1990) in their study on the efficacy of chiropractic treatment, found that the potential economic, resource and policy implications of the results were extensive. (Supported by the Manga Report 1994 and Frymoyer 1988). There is, therefore, economic support for the use of chiropractic in low back pain, though the obvious clinical improvement in pain and disability attributable to chiropractic treatment is in itself an adequate reason for considering chiropractic.

It is essential to study the effectiveness of various treatment modalities used by chiropractors, so as to determine the most effective treatment in

terms of duration of the disability, financial costs and the length of time the patient remains symptom free.( Bergquist-Ullman 1985; Assendelft et al. 1992; Haldeman 1990; Abenhaim and Bergeron 1992 and Bolton 1994).

Thus it is the purpose of this study to contribute to the establishment of a solution, by determining the efficacy of two different types of traction, both in conjunction with chiropractic spinal adjustment, in the chiropractic management of chronic mechanical lower back pain.

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## **CHAPTER 2**

### **2. REVIEW OF THE RELATED LITERATURE**

#### **2.1 INCIDENCE OF LOW BACK PAIN**

The lumbar spine may be the site of numerous orthopaedic ailments but by far the most common one is low back pain (Nachemson 1976). It is a disease that needs a great deal of study and understanding, for it remains an enigma of medical science, for the patient, the insurance carrier, attorneys, employers and family members (Caillet 1991:v). It is vital to understand the socio-economic importance of this disease, the underlying cause of it, try to find better methods of treatment for it, as well as subject the old methods to critical analysis (Nachemson 1976). The magnitude of low back pain problem is financially formidable (Caillet 1991:v).

Although most attacks of back pain remit either spontaneously or after treatment, there is a high incidence of recurrence (Williams et al. 1979). After 3 months of low back pain, only 5 % of patients have persisting symptoms yet it is this population that accounts for 85 % of the costs in terms of compensation and loss of work due to low back pain (Frymoyer 1988 and Kirkaldy-Willis 1992).

## 2.2 AETIOLOGY OF LOW BACK PAIN

Lewin et al. and Hirsch et al. in Hyde (1994) pointed out that the basic anatomical and functional unit of the vertebral column is the articular triad consisting of the fibrocartilagenous intervertebral joints and the two synovial zygapophyseal joints. The function of the posterior facet joints is to guide and restrain movement between vertebrae and to protect discs from shear forces, excessive flexion and axial rotation. The mechanical properties of the disc allow for load transmission and shock absorption.

According to Cox (1979) each lumbar vertebrae is capable of 5 basic movements, viz. flexion, extension, lateral bending, rotation and circumduction. This normal anatomical range of mechanical movements is a pre-requisite to efficient pain-free movement. He further states that a joint capable of producing these movements in a pain-free manner is a healthy articulation.

Among the wide variety of pathological conditions that can affect the lumbar spine are congenital malformations, fractures, infectious and neoplastic diseases, inflammatory, metabolic and various miscellaneous disorders.

However, certain pathological conditions that underlie common forms of low back pain syndrome and which involve only minor structural abnormalities occur very frequently and are referred to as mechanical low back pain. These disorders involve altered biomechanics of the spine and result in minor aberrations of structure or in injury of the lumbar spine. Although these are usually due to minor injuries they can have quite major short and long term consequences. (Bogduk and Twomey 1991:139).

Despite the apparent ignorance in determining the exact aetiology of back pain in a single individual, there has been substantial biomechanical, physiological and psychosocial research which has produced information concerning the risks predisposing to back pain and disability in the population. It is now possible to extract 6 factors that appear important in the pathogenesis of back pain:

- 1.Ageing
- 2.Acute trauma
- 3.Mechanical occupational stresses
- 4.General health
- 5.Exercise
- 6.Psychosocial factors. (Haldeman 1993).

According to the Kirkaldy-Willis classification (1992:121) examples of mechanical low back pain include posterior facet syndrome; sacro-iliac syndrome; Maigne's syndrome; disc herniation; facet and disc degeneration; central and lateral canal stenosis and myofascial pain dysfunction syndrome.

The zygapophyseal joint facet syndrome and some muscle syndromes are common, but because these lesions usually do not demonstrate abnormalities radiographically they are frequently overlooked. (Kirkaldy-Willis 1987).(cited by Giles 1989).

According to Mennel (1960) in Giles (1989:161) the difficulty in diagnosing and treating back pain results in part from the failure of physicians to think in mechanical terms when approaching the patient with a back complaint.

Two main mechanisms by which pain may arise are:

- 1) Mechanical pinching of synovial fold tissue, which may result in traction on the pain sensitive tissues and tissue damage with cell rupture. The subsequent release of pain producing substances, results in nerve impulses arising from the nociceptors. This accounts for the low back pain sensation and discomfort that the patient feels.(Giles 1989:159).

2) Traumatic synovitis causing ischaemia with the genesis of ischaemic pain.(Giles 1989:159).

According to Bogduk and Twomey (1991:34) and Lewit (1985) in Rahlman (1987), intra-articular structures of the lumbar zygapophyseal joints project only five millimetres into the joint cavity. Three types of intra-articular structures were identified by Engel and Bogduk (1984) in the lumbar joints i.e. Adipose tissue pads, fibroadipose meniscoids and connective tissue rims.(Bogduk and Twomey 1991).

In addition to the general nutritive and lubricating functions of the synovial membrane, synovial folds have a packing or “space-filling” function which allows movement of adjacent structures. Thus Tondury in Hyde (1994) maintains that the principal function of the synovial folds in zygapophyseal joints is to fill space between peripheral non-congruent parts of the articular surfaces, moving in and out of the joint freely in response to joint movement and forces.

Therefore, it seems reasonable to speculate that mechanical “nipping “ of synovial folds or traumatic synovitis with chemical irritation of nerve endings due to the release of noxious chemical stimuli in the synovial fold could result in pain. The entrapment of “meniscoid inclusions”, may

mechanically interfere with movement leading to pain and muscle spasm. (Hyde 1994). When large fibrous tips of synovial folds are present, it is conceivable that these fibrous structures could also cause mechanical dysfunction with locking of a joint at that level (Giles 1989:159, Kos and Wolf 1975 and Bogduk and Engel 1984).

Tondury and Kirkaldy-Willis in Hyde (1994) believe impingement is accompanied by oedema, synovitis and the distension of the capsule causing nerve root irritation. (Supported by Giles 1989:159 and Kos and Wolf 1975). Movement would stress the well innervated joint capsule at the point where the meniscoid attaches to it. Reflex muscle spasm would then serve to restrict motion at the joint (Rahlmann 1987). It is known that chronic inflammation and fibrosis in the synovium and capsule of the zygapophyseal joints may produce persistent severe back pain. (Giles 1989:159).

The structures in the lumbar spine that receive a nerve supply are the zygapophyseal joints, the ligaments of the posterior elements, the paravertebral muscles, the dura-mater, the anterior and posterior longitudinal ligaments and the intervertebral disc. Each of these structures has been incremented as a source of low back pain. (Bogduk and Twomey 1991:152).

Given that various structures in the lumbar spine have been shown to be capable of producing low back pain, it is important to realise that in each case the mechanism involved is the stimulation of nerve endings in the affected structure. There are only two mechanisms by which the nerve endings may be stimulated i.e. mechanical and chemical irritation. (Bogduk and Twomey 1991:152)

Chemical irritation occurs in inflammatory diseases or follows tissue damage. Mechanical irritation on the other hand, involves stretching of connective tissue. Exactly how mechanical irritation causes pain remains obscure, but a plausible explanation is that when an array of collagen fibres (in a ligament, periosteum or joint capsule) is placed under tension, it deforms and closes the available space between individual collagen fibres. Nerve endings within the array would then be stimulated by being squeezed between the encroaching collagen fibres. (Bogduk and Twomey 1991:153). Homewood (1977) in Gatterman (1990:39) is in agreement with Bogduk and Twomey and states that mechanical, chemical and mental stresses create the structural distortion that interfere with the nerve supply and result in altered function to the point of demonstrable cellular changes known as pathology.

Homewood (1977) further states, "The site of the actual subluxation is likely to be pre-ordained by the structural weakness of past history of injury, occupational or recreational abuses which may have produced frank trauma or merely microtrauma which tend to summate, or by mechanical force being concentrated upon a localised area."

Thus from the above the author concludes that spinal joint fixation compromises neural elements, which produces irritation and or compression of these structures. Nerve irritation results in an increased neuronal activity through facilitation, while the pressure that produces nerve compression leads to tissue degeneration.(Gatterman 1990:41).

Korr (1947-1978) in Gatterman (1990:41) has written extensively on the clinical significance of the facilitated state due to nerve irritation. His definition of the facilitated state is that the spinal cord segments adjacent to the fixed vertebral motion segment have at least some of the neurons mediating sensory, motor and autonomic function maintained in a state of hyper-excitability.

This facilitation of anterior horn cells affects motor outflow, resulting in sustained muscular tensions, postural asymmetries and limited, painful motion. The richly innervated muscles, tendons, ligaments and joint

capsules may subsequently produce intense and exaggerated streams of afferent impulses with resultant pain. Facilitation of the posterior horn cells expedites impulses to the central nervous system, including the higher centres, magnifying painful stimuli.(Gatterman 1990:41).

### 2.3 MECHANISM OF JOINT FIXATION

More commonly recognised than nerve irritation, within the chiropractic profession, has been the hypothesis that the subluxation complex causes nerve compression (Leach 1986:49). Neural structures normally have ample room as they exit the intervertebral foramen (IVF), being protected by loose areolar tissue and adipose tissue. However, several factors may compromise this margin of safety. The most widely acknowledged cause of nerve compression at the IVF has been intervertebral disc pathology. Inflammation and osteophyte formation of the zygapophyseal joints may significantly alter the size of the IVF and entrap the nerve (Anderson 1985).(cited by Gatterman 1990:41).

Sunderland (1978) in Gatterman (1990:42) states that the veins, along with the spinal nerves, are primary structures passing in the IVF. These may be affected by the compression, restricted movement (fixation) and inflammation associated with the subluxation complex. Resultant venous

congestion with impaired flow of blood may then interfere with neural transmission.

The cause of restricted intervertebral mobility or joint fixation has generated much speculation. Some possible theories that merit further investigation include meniscoid entrapment, displaced intervertebral disc fragments (disc disruption), segmental or intersegmental muscle spasm and periarticular connective tissue adhesions. The two questions that need to be addressed for each theory are:

- a)How does each mechanism restrict intervertebral movement?
- b)How does a high velocity manipulation restore movement and relieve symptoms? (Rahlmann 1987).

1) Meniscoid entrapment - as described previously.

2) Displaced intervertebral fragments (disc disruption) - Certain authors are convinced that the intervertebral disc is the key to understanding joint locking in the spine (Cyriax 1974:57-66; Maigne 1972:27-34). According to Cyriax (1974:57-66) the only way a joint can become suddenly fixed within its normal range is an internal derangement of the disc i.e. "A broken fragment of disc displaced and jamming the joint." The proposed mechanism of disc derangement is outlined by Sandoz (1971).(cited by

Rahlmann 1987). A number of authors point out that joint locking occurs in the spine at joints that have no discs i.e. Atlanto-occipital and atlanto-axial joints. (Lewit 1985; Rahlmann 1987 and Bourdillon 1992).

Although this is a valid point it also emphasises the possibility that more than one type of mechanism may be involved in joint locking, and that different mechanisms may be regionally variable (Rahlmann 1987).

3) Muscle spasm - As a cause of acute joint locking has been implicated by Korr (1975) and Fetz (1979) in Rahlmann (1987). The possible mechanisms that could induce a spasm in the para-vertebral muscles are trauma induced spasm or splinting. The vertebral motion unit is well supplied with both plexiform and free nerve ending nociceptive fibres which respond to both mechanical and chemical irritation (Rahlmann 1987).

One major reference that contradicts the theory of joint fixation caused by muscle spasm is that of Lewit (1985) in Rahlmann (1987). In this study the cervical spine of ten patients were examined prior to surgery. During general anaesthesia with myorelaxants, they were re-examined. In all cases, the movement restriction remained unchanged and was even more easily recognisable. Lewit believes this refutes the theory of muscle spasm

restricting joint movement. However, the details of this study have not been published (Rahlmann 1987).

Where pain originates in the muscles is not fully understood. Ischaemia has been implemented as a cause. The accumulation of metabolites such as substance P, kinins, prostaglandins, histamine, lactate and numerous others have been considered a cause of muscle nociception. Accumulation of tissue metabolites has been attributed to a sustained muscular contraction or to mechanical trauma to the muscle (Cailliet 1991:71).

4) Periarticular connective tissue adhesions - An often repeated explanation for joint movement restriction has been "fibrous adhesions". Two different types of adhesions occur. Those associated with a joint which first undergoes trauma, which is followed by inflammation and repair, which leads to scar tissue formation. A second process leading to adhesions is joint immobilisation, without inflammation or trauma.(Rahlmann 1987).

5) The inequality of ligament tension, due to shortening or contracture formation, has also been implicated as a cause of intervertebral joint fixation. (Gatterman 1990:45).

The term 'deconditioning syndrome' has been implied to the cumulative disuse changes produced in the chronically disabled patient suffering from spinal dysfunction. It is initially produced by the immobilisation and inactivity attendant on injury. It is supplemented by disruption of spinal soft tissue and scarring resulting from a surgical approach or repetitive microtrauma. As pain perception is enhanced, learned protective mechanisms lead to a vicious cycle of inactivity and disuse. As physical capacity decreases the likelihood of fresh sprains or strains to unprotected joints, muscles, ligaments and discs increases. These inevitable alterations of pain and function are perceived by the patient as a 'recurrence' or 'reinjury'. (Haldeman 1992:535).

Thus by restoring movement to the fixated spinal segments using spinal manipulation and traction, this cycle or 'reinjury' or 'recurrence' can be interrupted.

## **2.4 THE EFFICACY OF SPINAL MANIPULATION**

Faye (1986) has formulated a model based on the scientific principles of chiropractic, termed "the chiropractic subluxation complex". The rationale for this model is that chiropractic manipulation restores normal

physiological motion to joints that have been fixed and their adjacent tissues compromised.

The exact mechanism by which manipulation relieves pain remains a subject of significant debate. The more prominent theories are as follows:

(1) Change in pain threshold - Terrot and Vernon (1984) attempted to investigate this phenomenon by measuring tolerance to electrically induced pain in paraspinal tissues and compared manipulation to joint play. Although both groups showed increases in pain tolerance the increase was significantly higher in the group undergoing manipulation, this is supported by Lewit (1979). The possibility that there may be a release of endorphins has been raised but not confirmed (Haldeman 1993). According to Geiringer et al. (1988:283) spinal manipulation mechanically produces an afferent signal to the cord and directly diminishes pain awareness by a gate effect. They further state that the restoration of normal spinal motion results in the elimination of pain secondary to disturbed biomechanics.

(2) Release of muscle spasm - Recent studies by Zhu et al. (1992) noted in Haldeman (1993) report normalisation of magnetically induced muscle contraction cortical evoked responses following manipulation. They suggest that this may reflect changes in muscle spindle activity. All forms of manipulation are thought to interfere with abnormal muscular contraction,

either by production of afferent stimuli which attenuate a hyperexcitable gamma system, or by elimination of proprioceptive input which stimulates the gamma system as a result of the muscle lengthening. In addition thrust and possibly articulatory and isometric techniques can stimulate golgi tendon organ input (Korr 1947). The net result of muscle relaxation is that the vertebra will regain normal play and active and passive range of motion and the forces needed to produce them will be normalised. Pain is reduced secondary to the return of function (Geiringer et al. 1988:285).

(3) Reduction of disc protrusion - According to Cyriax (1974) the goal of spinal manipulation is to put the disc fragment back into place and therefore restore movement to a ‘jammed joint’. The proposed mechanism of disc derangement is outlined by Sandoz (1971) in Rahlmann (1987). Sandoz (1976) also describes the role of a rotatory manipulative thrust coupled with traction in returning the fragment to its ‘normal’ position. Side posture long axis traction is used to open the disc space and provide a suction mechanism for the fragment.

However, Bourdillon (1982) observes that if sequestered nuclear material is returned to its normal space by manipulation, what prevents it from returning to the preformed fissure it protruded into? Rahlmann (1987) concludes that the disc fragment sequestration theory requires that all cases

of joint locking must be accompanied by some degree of annulus degeneration. He states it is illogical to believe this is the case.

Shekelle et al. (1992) state that spinal manipulation has not been shown to reduce a herniated nucleus pulposus physically. In fact, two studies cited by Shekelle et al. (1992) showed no difference myelographically in disc protrusion before and after manipulation. However, many patients reported an improvement in symptoms despite the apparent absence of a change in their disc protrusion. Thus, although many different theories exist about the effect manipulation has on a disc protrusion, the authors do agree that spinal adjustment can offer symptomatic relief.

(4) Increased range of motion (ROM) - This is the most popular theory regarding the effect of manipulation. It has been incorporated in theories of chiropractic, medical, osteopathic and physical therapy practitioners of manipulation (Haldeman 1993). Waagen (1986) demonstrated an increase in gross ROM of the lumbar spine following manipulation. According to Lewit (1979) in Gatterman (1990:397) the one effect of manipulation for which there is no substitute, is the reversal of the restricted joint movement. It is the restoration of normal joint movement that has earned chiropractic its unique place in the health care system. This is supported by Geiringer et al. (1988:28).

(5) Scham (1973) in Giles (1989:160) states that manipulation of the lumbosacral spine has long been known to give relief of symptoms to a large number of patients, with a very low risk of complications, but the mechanism of action is ill defined. However, in a group of patients manipulated during an operation in the lateral position, the laminae were seen to move apart, stretching the fibres of the ligamentum flavum and the fibrous joint capsule. Therefore it is quite conceivable that as the capsular ligaments are stretched during a rotatory manipulation, the synovial fold could be retracted from between opposing facet surfaces. This concept is supported by Kraft and Levinthal (1951); Kirkaldy-Willis 1983:147 and Cui et al. (1984).

(6) Psychological effect of manipulation - there is growing recognition of the close relationship between psychological and psychosocial factors and back pain and disability. The strong enthusiasm and positive attitude of both patients and practitioners of manipulation may do more to reduce pain and disability than some of the other proposed mechanisms. (Haldeman 1993).

## **2.5 THE PHYSIOLOGICAL BOUNDARIES OF A TYPICAL CHIROPRACTIC ADJUSTMENT**

The phases are:

- 1) The normal range of active movement of a joint in one plane e.g. flexion, extension, rotation.
- 2) When a joint is mobilised passively, the range of movement is slightly increased in both directions.
- 3) At the end of the passive range of movement, a resistance is felt, the so called elastic barrier of resistance. In ordinary mobilisation such as performed by physiotherapists, the joint is passively moved back and forth in both directions up to the elastic barrier of resistance. If a sudden give is then felt, a crack is perceived and the range of movement is increased beyond the usual physiological limit. The added range of movement is called the parapsychological space.
- 4) At the end of this reserve space of movement, a second ultimate barrier of resistance is encountered: this is the limit of anatomical integrity. (Sandoz 1976).

The qualities of an adjustment should be such as to permit to overcome the elastic barrier of resistance without however, exceeding the barrier of anatomical integrity. (Sandoz 1976).

After an adjustment the range of active and passive movement of a joint is temporarily increased, the paraphysiological space being added to the range of passive movement. This gain in the range of movement does not only occur in the direction which the joint was adjusted, but in all other directions as well. This can be explained by the disappearance of the normal co-active forces of the joint. (Sandoz 1976).

After an adjustment with cracking, it may seem useless and even dangerous to attempt a second adjustment. One must keep in mind that during the refractory period, the first barrier of resistance encountered is the barrier of anatomical integrity.

At times, it may however seem useful to carefully force the movement well into the barrier of anatomical integrity, this is best done when following an adjustment, the joint is mobilised slowly and repeatedly, without using an actual thrust. (Sandoz 1976).

Thus, it is hypothesised that by applying McMannis or Intermittent traction following a chiropractic adjustment this additional gain in range of movement may be achieved.

All the synovial joints of the body, including the zygapophyseal joints of the vertebral column, are provided with four varieties of receptor nerve endings. Three of the varieties of receptors i.e. Type I, II and III are corpuscular mechanoreceptors that are stimulated by an increase in tension in the tissue in which they are embedded. Type I are located in the superficial layers of the joint capsule and respond to both static and dynamic influences. They fire when movement (active or passive) occurs, during axial traction or whenever tension is placed on that portion of the capsule in which they are located (e.g. with joint swelling). Type II mechanoreceptors are located within the deep layers of the joint capsule. Inactive at rest these fibres respond with a burst of activity when tension is applied to the joint. The type IV variety is represented by non-encapsulated unmyelinated nerve fibres that provide the articular nociceptive system that is normally inactive but which becomes active when abnormally high tensions develop in the articular tissues or when the nerve terminals are exposed to high concentrations of irritant chemical substances. The Type IV receptor system is of special importance as it is this system whose irritation is responsible for evoking joint pain. (Wyke 1984:72; Rahlmann 1987).

Input provided in static situations permits the maintenance of body posture and in dynamic situations allows for locomotion and positioning of body parts in space. Loss of this input from the mechanoreceptors located in the joint capsules results in abnormalities of posture and movement, impairment of postural and kinaesthetic sensation and a decrease in the pain threshold. Thus degenerative, inflammatory or traumatic affections of joints results in loss of the mechanoreceptor system but not the nociceptive system in the joints. (Wyke 1984:75).

Application of passive manipulation or traction through the spinal joints has many reflexogenic and perceptual consequences. When manipulative procedures are applied to the vertebral column, changes in the joint capsule tension will result in those joints through which the manipulative forces are applied. (Wyke 1984:76).

When a joint is moved by manipulation in any direction there is a diphasic response from the mechanoreceptors located in the region of the joint capsule that is thereby being stretched. This consists of an initial brief burst of impulses from the Type II receptors that melts into a prolonged increase in Type I receptor in the opposing region of the joint capsule which is simultaneously destretched. (Wyke 1984:74).

On the other hand, when traction is applied axially, the mechanoreceptors on all aspects of the joint are stimulated simultaneously. (Wyke 1984:74).

Articular mechanoreceptors also exert reciprocally co-ordinated reflexogenic influences on muscle tone and on the excitability of stretch reflexes in all striated muscles. It is through this mechanism that manipulation of the joints by the therapist gives rise to the reflex change in muscle tone and therefore helps to balance the activity of the muscles by restoring normal movement (Wyke 1984:75). Thus a high velocity thrust delivered to the affected spinal segment relieves the muscle spasm (Rahlmann 1987). Of particular importance is the pain suppressive effect exerted by stimulation of articular mechanoreceptors. (Wyke 1984:75). Pain is reduced secondary to the return of function i.e. Normal vertebral joint play and active and passive ROM. (Geiringer et al. 1988:285).

The nociceptive afferents from the Type IV receptor system in the joint tissues project polysynaptically to the alpha motoneurone pools of the muscles related to the joint in question, thereby giving rise to abnormal reflex activity in such muscles when the articular nociceptive system is irritated. Also in the spinal cord, they give off collateral branches that synapse with neurones located in the basal nucleus of the spinal grey

matter, whose axons ascend into the brain in the antero-lateral spinal tracts. It will therefore be apparent that the essential prerequisite for evoking joint pain is the transmission of nociceptive afferent activity derived from the irritated Type IV receptor system through the 'gateway' synapses in the basal spinal nucleus up into the brain. This transmission can be modulated by peripheral mechanoreceptors discharge. (Wyke 1984:75).

The apical spinal interneurons which synapse within the basal spinal nucleus are inhibitory in nature. It will be apparent that activation of these neurones as a result of peripheral mechanoreceptor stimulation, such as by joint and soft tissue manipulation will provide presynaptic inhibition of nociceptive afferent activity. (Wyke 1984:75).

Since massage, compression and stretching of tissues are all procedures that stimulate the mechanoreceptors embedded therein it is suggested that it is primarily through controlled stimulation of peripheral tissue mechanoreceptors, by the application of static or phasic forces, that manipulative therapists are able to produce relief of pain and normalisation of muscle tone and autonomic activity. (Wyke 1984:75).

The mechanoreceptors described above, found in the articular capsule, the ligaments and the fat pads of the posterior joints are supplied by large and

medium-sized nerve fibres. Small sized nerve fibres in these structures as well as in the walls of blood vessels supply pain receptors, free nerve endings and plexuses. (Kirkaldy-Willis 1988:78).

Pain is not perceived through direct stimulation of the small diameter fibres that pass directly to a pain centre in the brain. It is perceived because of the summation of impulses from both large and small diameter nerve fibres that activate transmission cells in the dorsal horns of the spinal cord. Impulses pass to the reticular formation in the brain stem, to the mid-brain and to the cerebral cortex with the resultant perception of pain. (Kirkaldy-Willis 1988:78).

The substantia gelatinosa is situated in the dorsal horns of the spinal cord. It contains cells that exhibit an inhibitory effect of the impulses leading to the perception of pain. Impulses passing along the large fibres stimulate the substantia gelatinosa and increase the inhibition of pain whereas impulses passing along the small fibres decrease the inhibitory effect on the substantia gelatinosa and facilitate central pain transmission. The activity of the gate formed by the substantia gelatinosa cells is also modulated by descending feedback from the reticular system, the thalamus and the cerebral cortex.

Immobilisation either from inactivity or produced by segmental muscle hypertonic contraction tends to enhance the perception of pain. This is due to the loss of large fibres by injury, degeneration of the peripheral nerves or painful inhibition.

Inhibition of pain is increased by stimulating the mechanoreceptors. The physician can therefore control pain considerably by therapy that promotes activity and movements. The pain-free intervertebral three-joint complex is one in which normal movement and rhythm take place. (Kirkaldy-Willis 1988:78-79).

In a study conducted by Williams et al. (1979) they compared the effect of mobilisation and manipulation with placebo physiotherapy for non-specific lumbar pain. They found that most patients (placebo and experimental) improved but that immediately after treatment there were small but definite advantages in favour of mobilisation and manipulation. These differences were less pronounced two months later and at 1 year there were no differences between the groups. They failed to identify any real advantage of mobilisation and manipulation compared to placebo and concluded that patients who did the best were those with the shorter duration of symptoms. Their treatment protocol was based on that prescribed by Maitland. They did state that 'there are many forms of mobilisation and manipulation,

which may be practised in different ways by physicians, surgeons, physiotherapists and other practitioners. As with any practical procedure there is scope for much individual variation. Clearly, caution is indicated in drawing broad conclusions on the values of mobilisation and manipulation from any study.”

Since then numerous studies have been conducted. In a study undertaken by Kirkaldy-Willis and Cassidy (1985), 283 patients with chronic low back pain were treated by spinal manipulation for two or three weeks. Results showed that eighty one percent of the patients with referred pain improved markedly and had no pain or mild intermittent pain and no restriction for work or other activities.

Meade et al. (1990) felt the effect of chiropractic seemed to be long term, as there was no consistent evidence of return to pre-treatment pain scores during the two years of follow-up, whereas those patients who were treated in hospital may have begun to deteriorate after six months to a year. Chiropractic was particularly effective in those with fairly intractable pain i.e. Those with a history and severe pain. According to Meade’s study (1990) there is economic support for the use of chiropractic in the management of low back pain, though the obvious clinical improvement and

disability attributable to chiropractic treatment is in itself an adequate reason for considering the use of chiropractic.

Of the 21 randomised clinical trials reviewed by Abenhaim and Bergeron (1992) on the effect of manipulative therapy they concluded that it offers some positive short-term results, but it is not clear whether the long term effects of treatment have been evaluated.

Manga et al. (1993) make reference to the New Zealand Commission Report of 1979. This Commission's findings were very supportive of chiropractic, declaring it safe and effective for musculoskeletal spinal disorders, including low back pain, and several other conditions.

The conclusion drawn by reviewers on spinal manipulative therapy has not been unanimous. Nevertheless, there appears to be consensus that manipulation is a therapeutic approach that in many cases offers more immediate relief to patients with spinal related disorders than any other form of conservative therapy, particularly so in the case of low back pain. (New Zealand Commission Report 1979; Kirkaldy-Willis and Cassidy 1985; Waagen et al. 1986; Rand Health Report 1990 and Haldeman 1992:437).

Chiropractors rely on spinal manipulation as their primary therapeutic tool in reversing the subluxation complex. Certain people might therefore argue that the use of therapeutic modalities should be left to the physical therapist. However, isn't it the chiropractor's purpose to restore health to the patient as quickly and effectively as possible? We should then employ whatever means are reasonable and necessary for achieving that purpose. Thus the therapeutic procedures deserve high priority, as they support chiropractic manipulative treatment. Relief of symptoms, reversal of the disease process and recovery time can all be enhanced by the appropriate use of these modalities. (Gatterman 1990:331).

## 2.6 THE EFFICACY OF LUMBAR TRACTION

Various forms of traction have been described since the time of Hippocrates, for the relief of pain. Much of the literature is incomplete and seldom describes such things as the exact techniques used, the body type and weight of the subjects, the poundages used, or the duration of the treatments. Many physicians, therapists and patients recall the continuous traction that was used for many years with poor results.( Saunders 1979; Geiringer et al. 1988:276). Continuous spinal traction is applied for several hours at a time and the long duration requires that only small amounts of weights be used. It is generally believed that this type of traction,

especially in the lumbar spine, does not effectively separate the spinal structures, as patients cannot tolerate weights great enough to cause separation of the vertebrae for the required time (Saunders 1983).

All of this misunderstanding and confusion has caused many physicians and therapists to become disinterested in using spinal traction. However, when used correctly on appropriate conditions, traction can be a very effective and beneficial method of treatment. (Saunders 1979; Geiringer et al. 1988:276).

Little is known about the mechanism by which traction could be effective. The rationale for using lumbar traction is based on mechanical and neuroreflexic mechanisms. (Saunders 1983; Geiringer et al. 1988:277). The literature shows that there is some disagreement about the effects of lumbar traction. Cailliet (1988:130) states that lumbar traction causes some vertebral distraction but suggests that its principle effect is to decrease the lordosis, while Cyriax (1978) in Twomey(1985) states unequivocally that not only are the vertebrae distracted, but a negative pressure is developed within the joint that “sucks” back any protrusion. However, there is no clear evidence favouring any of these proposed mechanisms. According to van der Heijden et al. (1995c) rationale for the use of traction therapy are

mainly based on the mechanical effects of traction: the elongation of the spine and the stretch on structures.

Studies by Gillstrom et al. (1985) and Larsson et al. (1980) have shown traction to have a short lived benefit in low back pain and another study by Pal et al. (1986) in Frymoyer (1988) concluded that traction simply reinforced the need for rest and had no specific additive benefit.

According to Geiringer et al. (1988:278) the principle reason for traction to fail is inadequate weight with improper body positioning or a combination of these two.

Traction can be regarded as a form of mobilisation, since it involves the passive movement of joints by mechanical means (Saunders 1979). One of the greatest advantages of traction is that the cost of this modality can be clearly controlled (Swezey 1983).

Spinal traction has been used for treatment of the following conditions:

- 1) Spinal nerve root impingement (Colachis and Ströhm 1969), which can be caused by:

a) Herniated disc - Traction reduces pressure within the nucleus pulposus, thereby reducing the bulging of the annulus fibrosus. It may also reposition fragments of the disc which may be irritating the nerve.

b) Ligament encroachment - Swelling or thickening of the ligamentum flavum can cause encroachment upon the spinal root in the IVF. Traction may be an effective treatment for this syndrome as it causes a widening of the IVF and relieves some of the impingement. During traction ligaments are also stretched and exercised in order to help improve their tensile strength. (Swezey 1983; Saunders 1979; Cyriax 1977:286).

c) Narrowing of the IVF - As traction causes a distraction or separation of the vertebral bodies and a widening of the IVF.

d) Osteophyte encroachment

e) Spinal nerve root swelling

f) Spondylolisthesis

2) Vertical separation underlies the therapeutic use of traction and several researchers have attempted to measure separation both during and after lumbar traction (Colachis & Ströhm 1969). Spinal elongation due to intervertebral widening is likely to occur with a traction force of above but not below the 25% of total body weight (Colachis & Ströhm 1969).

3) Joint hypomobility - By passively moving the joints traction has an effect on the articular facets. There is a freeing of fixations and a restoration of

the zygapophyseal joints to their normal position, with an increase range of motion between adjacent vertebra. In degenerative joint disease there is a decrease range of motion and by applying traction, not only is motion restored but many patients also experience relief of pain because of stimulation of the mechanoreceptors.

4) Extrinsic muscle spasm - With lumbar traction forces below 25% of the total body weight, relaxation of spinal muscles are usually assumed to play an important role according to Gillström et al. (1985), Onel et al. (1989), Reilly et al. (1979), Hood et al. (1981) and Murphy (1991) in van der Heijden et al. (1995a). However, so far credible empirical evidence for this mechanism is lacking (van der Heijden et al. 1995a).

Traction elongates the erector spinae muscles causing relaxation and release of protective spasm. This is most likely achieved through the mechanism of decreased stimulation of the sinuvertebral nerve which has a sensory and autonomic supply. There is a freeing of longitudinal adhesions by stretching the paraspinal muscles. In addition traction improves the fluid interchange of tissues and aids nutrition to the motor unit structures.

5) Vascular congestion - The blood supply is affected by restricted movement (fixation), in any area of the spine, because the blood supply of

the spine is in direct ratio to the movement of its segment, according to Illi (1951). By increasing the range of movement in the restricted spinal area, traction may increase the vascular and lymphatic flow, thus, reducing stasis, oedema and coagulation in chronic congestion. (Taylor 1978).

When a joint is submitted to an axial traction, the soft tissues (synovial folds, meniscoids and even to a certain extent articular capsule) tend to become invaginated or aspirated centripetally because the joint cavity is air tight. When the limit of possible invagination is reached, an elastic resistance is felt. Up to the elastic barrier of resistance, behaviour of the joint is an elastic one, if the traction is released before the crack occurs, the joint surfaces elastically return to their original position. (Sandoz 1976). It is also suggested that traction as a therapy exerts a beneficial effect on some patients by its' stretching influence on the mechanoreceptors present in the discs; ligaments and apophyseal joints (Wyke 1978) or by a direct mechanical effect on the richly innervated apophyseal joints (Twomey 1985).

Motorised traction produces continuous or intermittent application of a reproducible force. Most patients tolerate greater forces of pull if given intermittently. Its advantages over home traction also include close

therapist monitoring of patient positioning and effect of traction on symptoms (Geiringer et al. 1988:277).

**Intermittent traction** for the purpose of this study refers to the mechanical application of a tractive force, which is applied and withdrawn every few seconds. According to Haldeman (1992:503) it is an unassisted, multilevel traction force applied to the spine. Thus intermittent traction can be regarded as a form of mobilisation, since it involves the passive movements of joints by mechanical means. One argument against the use of intermittent traction is that it is non-specific and affects several joints at one time (Saunders 1979). However, when traction is applied to a series of spinal segments, each segment in the series receives an equal amount of traction, if that amount is sufficient to mobilise the segment, it is irrelevant that other segments are also receiving the same amount of traction unless, of course, traction is contraindicated at these other segments. If this is the case a more specific technique of joint mobilisation should be selected. (Saunders 1983).

**McMannis traction** on the other hand is a doctor-controlled, tractive force applied to a specific level of the spine. In the McMannis table a universal joint produces a multi-directional movement of the spine and sacro-iliac joints allowing flexion and extension in addition to axial traction

(Haldeman 1992:477). Thus McMannis traction is a much more appropriate application of traction, as it enables the joints of the lumbar vertebrae to be moved through their normal anatomical range of motion while being tractioned axially (Taylor 1978). In addition this type of traction is more specific and allows the therapist to feel the amount of traction that is being applied to the patient because it is being applied manually. It should always be remembered that with its diverse movements, McMannis traction is not an approach which replaces spinal manipulation, but supplements it, by restoring functional equilibrium of the vertebral column (Taylor 1978).

The refractory period is the time during which a second crack can not be elicited (approximately 15-20 minutes) and is thought to represent the time needed for the gases to become resorbed and for the articular capsule to regain its original length.(Sandoz 1976).

An important question which remains to be investigated experimentally is that if joint traction is repeated several times during the refractory period, can the limit of anatomical integrity be stretched slightly further without harm? (Sandoz 1976).

The rationales presented give some evidence for the explanation of short-term effects of traction but offer none for long-term effects of traction.

Maybe we have to look for neuroreflective mechanisms by which traction can cause an effect. (Van der Heijden et al. 1995c). For example, traction might exert a beneficial effect on some patients by its stretching influence on the mechanoreceptors present in discs, ligaments, facet joints and muscles (Wyke 1980). (Cited by van der Heijden et al. 1995c).

## **2.7 Contraindications**

### **TRACTION**

1. Inadequate expertise in the application of traction constitutes the single greatest contraindication to its use, because it is the most commonly flouted. (Geiringer et al. 1988. 279)
2. Tumour of the spine.
3. Osteopaenia.
4. Pregnant woman.
5. Infectious processes of the spine or supporting soft tissues.
6. Restrictive lung disease or breathing disorders.
7. External anxiety of patient as muscle relaxation is vital.
8. Ligamentous instability. (Geiringer et al. 1988. 279)

## MANIPULATION

1. Vertebral malignancy.
2. Infection or inflammation.
3. Cauda equina syndrome.
4. Myelopathy or Spondylolysis.
5. Multiple adjacent radiculopathies.
6. Vertebral bone diseases.
7. Vertebral joint instability, e.g. fracture or dislocation.
8. Severe diabetes.
9. Artheroscleroses.
10. Severe degenerated joint disorder.
11. Ligamentous instability.
12. Aseptic necroses.
13. Abdominal aneurysm.
14. Osteoporosis.
15. Spinal deformity such as severe scolioses and kyphoses. (Geiringer et al. 1988: 283).

## 2.8 SUMMARY

Although back pain is the most frequently presented disorder of the musculoskeletal system in general practice, there is no consensus about its management (Frymoyer 1988; van der Heijden et al. 1995a).

Haldeman stated in his 1990 presidential address to the North American Spine Society that “it is increasingly evident that a conservative or surgical cure for back pain is unlikely to be found. Although the capability of easing pain and suffering even temporarily and of reducing periods of disability cannot be diminished in importance, it is essential that the larger picture of back pain be addressed. It is increasingly difficult for society to deal with a disease which affects workers for periods of 3 weeks to 6 months and that is estimated to cost between 14 and 18 billion dollars per year.”

The growing understanding of the intricate relationship of natural ageing, acute injury, occupational stresses, general health, physical fitness and psycho-social factors to spinal pathology and more importantly, to spinal symptomatology and disability, holds that greatest promise of understanding disabling back pain, we cannot stop developing more means of treating vertebral pathology. We cannot give up on the further development and testing of conservative treatment such as medication, manipulation, exercise

and physical modalities that may reduce pain and suffering in our patients. We must however, also address the greatest picture of how we can reduce the social and financial costs of this disease. Greater research effort must be made to study the social, psychological and industrial factors that are responsible for the most intractable and costly patients with back pain including methods for reversing disability in this group of patients. (Haldeman 1990).

Spinal manipulation is an application of forces to the muscles, tendons, ligaments, joints and capsules, bones and cartilage of the vertebral column, the major goal of which is the restoration of normal spinal motion and the elimination of pain secondary to disturbed biomechanics. (Geiringer et al. 1988:280).

Shekelle et al. 1992 reviewed the use of spinal manipulation as a treatment for low back pain and noted that, on the basis of the studies they reviewed the data was insufficient to support or refute the efficacy of spinal manipulation for patients with chronic low back pain. From their analysis they concluded that there may be several beneficial components for therapy of low back pain and that spinal manipulation, in some patient groups, is one of these components. This is supported by Waagen et al. (1986), Meade et al. (1990), Haldeman (1992) and The Manga Report (1993). The extent to

which other treatments contribute to the efficacy of spinal manipulation is unknown and should be studied further.

Rationale for the application of lumbar traction to treat low back pain patients are numerous: to decrease muscle spasm, stretch muscles, rupture adhesions, stretch the facet capsule, achieve intervertebral joint distraction, reduce herniated or prolapsed disc, decrease pain, cause spinal ligaments to become taut and mobilise hypomobile joints. (Lechtuman and Deusinger 1993).

The choice of physiological therapeutics can be a difficult one. Most modalities have a number of possible effects, and many overlap in their repertoire of effects (Gatterman 1990: 331). However, those procedures deserve high priority, as they support chiropractic manipulative treatment.

Thus if manipulation in conjunction with traction can shorten the duration of symptoms for some patients' suffering, economic productivity and the reduction of costs of medical treatment, it seems relevant to investigate the effectiveness of different therapeutic modalities.

## CHAPTER 3

### 3. MATERIALS AND METHODS

The object of this study was to evaluate the relative effectiveness of two forms of traction as an adjunct in the chiropractic management of chronic mechanical lower back pain, all the treatment and statistical analysis was geared towards measuring the effectiveness of the treatment protocol used.

This study was a randomised uncontrolled study where the objectives were to assess each of the two treatment groups (McMannis traction and Intermittent traction), for intra-group improvement. Once this had been achieved, an inter-group statistical analysis could determine which of the two treatments, if any, is more effective. The more effective of the two could then be considered to be the traction treatment of choice in the chiropractic management of chronic mechanical lower back pain.

Patients were recruited by placing advertisements in the Natal Mercury, Berea Mail and Highway Mail indicating that free treatment would be given to patients suffering from low back pain who would be willing to participate in the research programme. On reply patients had the research programme explained to them and an initial consultation was arranged.

A sample size of thirty-six subjects who were screened prior to the treatment by means of a comprehensive case history, physical examination and regional lumbar examination to determine if they complied with the criteria set out. viz:

- a. Only subjects suffering from mechanical low back pain syndrome for more than four weeks were selected. The diagnosis of mechanical low back pain was based on Kirkaldy-Willis model for the classification of mechanical low back disorders (Kirkaldy-Willis 1992:121).
- b. Subjects presenting with clinical signs and symptoms of intervertebral disc herniation were not included in the study.
- c. Subjects who exhibited any contra-indications to traction and/or manipulation were excluded from the study.(See literature review - Chapter 2).
- d. Patients younger than 18 years of age were excluded from the study.
- e. Patients who became asymptomatic before the treatment period was up and then experienced a subsequent episode of pain due to a different injury were excluded from the study, as the results of the prior treatment would be negated.

The thirty six subjects were randomly divided into two equal sized groups of 18 subjects each. (Only 30 subjects were required, but 36

numbers were drawn to allow for drop outs). Group one received McMannis traction and spinal manipulative therapy and group two received Intermittent traction and spinal manipulative therapy. Patients were not given the option of which treatment they would prefer as that could affect the results. The randomisation was done as follows: eighteen letters were inscribed with the letter M (representing the McMannis traction group) and eighteen were inscribed with the letter I (representing the Intermittent traction group). The identical labels were then folded and placed in a hat, which was then agitated to mix the labels. Each label was drawn out of the hat in the sequence counting from one to thirty six. The letter on the label was recorded next to the number counted as the label was drawn (Appendix 8.11).

On consultation patients were screened for the presence of lumbar facet syndrome, sacro-iliac syndrome or a combination of these two entities, and for any conditions delimiting the patient from the study. This was done by means of: a case history (Appendix 8.2), physical examination (Appendix 8.3) and regional low back examination (Appendix 8.4).

If clinically indicated the subjects underwent radiographic examination of the lumbar spine and sacro-iliac region to exclude any contraindications to therapy. (See literature review - Chapter 2).

Patients found eligible for inclusion in the study were required to complete an informed consent document (Appendix 8.1) and assigned to the Intermittent traction group or McMannis traction group, by the pre-established random sampling method. There was no patient blindness regarding treatment type as the treatment regime was explained to each patient as soon as they were integrated into the study.

Before treatment the symptomatic joints were identified by motion palpation (Schafer and Faye 1989:211-216, 256-259) and orthopaedic tests. The orthopaedic tests used specifically for the diagnosis of mechanical lower back pain were: Kemp's test (Gatterman 1990:141) and lumbar facet joint challenge for posterior facet syndrome, and Patrick Faber test (Magee 1992:343), Gaenslen's test (Magee 1992:319), Sacro-iliac compression (Magee 1992:315) and Pheasant's test (Magee 1992;274) for sacro-iliac syndrome.

The patient was then set up for a rotatory lumbar spinal manipulation which was directed to the affected spinal segment. These rotatory manipulations included either the lumbar roll technique (Szaraz 1990:9.1), spinous hook technique (Szaraz 1990:9.12), upper sacro-iliac joint technique (Szaraz 1990:9.2) or lower sacro-iliac joint technique

(Szaraz 1990:9.3). The lumbar roll and spinous hook techniques were used for manipulation of the lumbar spinal segments. The choice of lumbar spinal manipulation was based on the success of the manipulation on individual patients. The choice of sacro-iliac joint manipulation i.e. either upper or lower joint techniques, was based on the motion palpation findings of restricted motion.

The patient then received either McMannis traction or Intermittent traction.

(a) The Astro McMannis AH from the Lloyd Table Company, 101-102 W. Main Street, Lisbon, Iowa 52253-0899 was used for this study. This table consists of a head section, middle section, a lumbar cushion, a pelvic cushion and an ankle rest pad. The pelvic cushion is designed with the capability of rotation, lateral and anterior flexion. The ankle straps aid in holding the patient in position during traction. (Kretzmann 1995).

The general procedure for McMannis traction was as follows:

The subject was placed prone on the traction table and informed of what to expect. Their ankles were then fastened with the ankle straps and the swinging section of the table was extended until a reasonable stretch was felt by the subject. The tautening of the tissues was also palpable to the operator's hand by applying counter-pressure on the lumbar region. When the subject was under the desired amount of stretch, the operator's hand was placed on the upper spinous process of the two vertebrae involved or on the posterior superior iliac spine (upper sacro-iliac joint) or on the ischial tuberosity (lower sacro-iliac joint) on the side of the involved sacro-iliac joint.

(i) The table was then flexed straight downward to the tolerance level of the subject, and held in that position for five seconds and then returned to a neutral position. This procedure was repeated ten times in a rhythmical fashion and followed by a 30 second break.

(ii) Then the swinging section of the table was unlocked and moved across to one side, flexed downward to the tolerance level of the subject and held in that position for five seconds. The lateral flexion action was repeated five times and then returned to a neutral position for a thirty second break. The sequence was then repeated on the opposite side.

(iii) Once the swinging section of the table was locked the straight flexion procedure was then repeated.

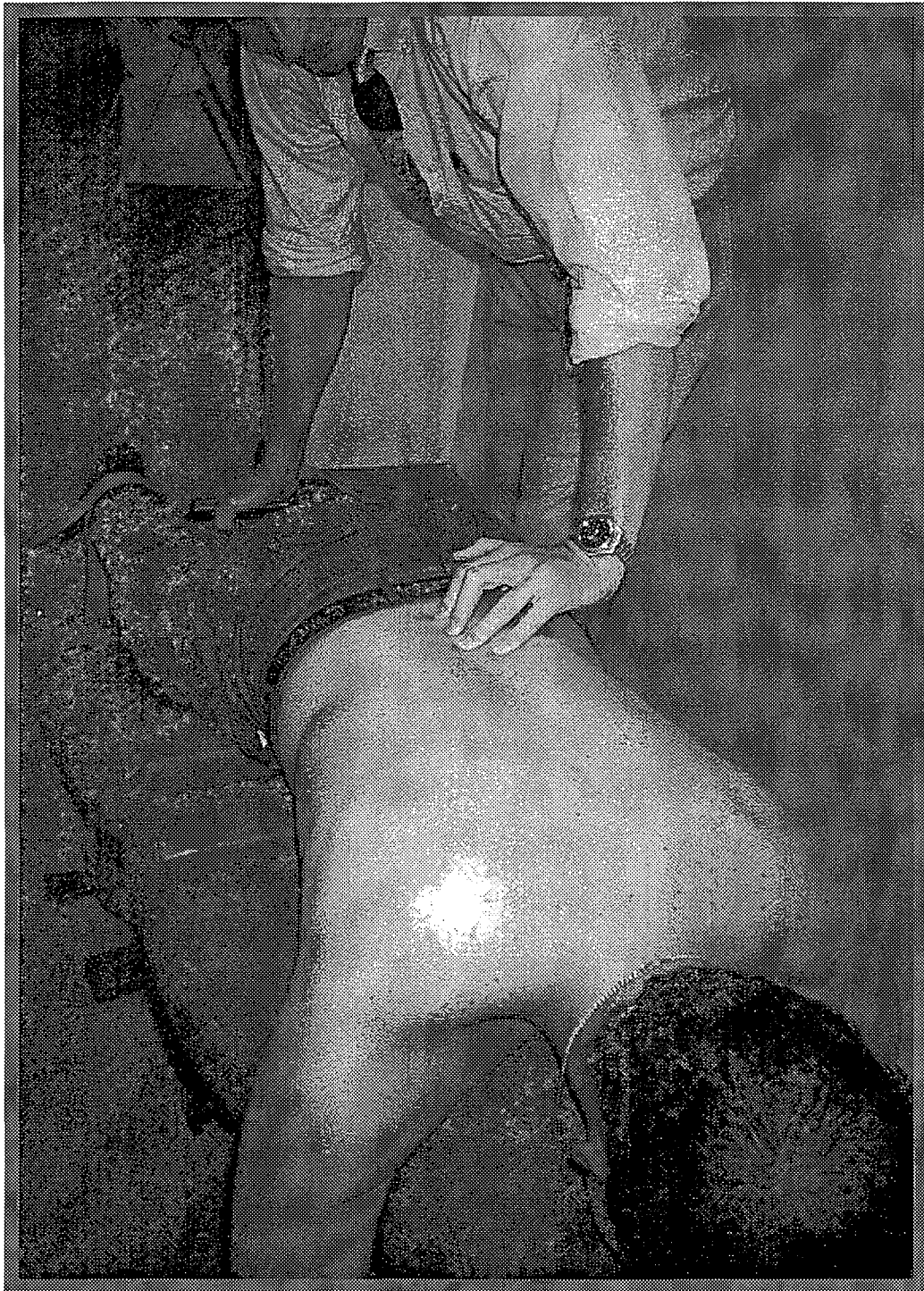
- (iv) Followed by another lateral flexion sequence to each side.
- (v) Then one more sequence of straight flexion was administered.

Rotation was not administered in this study as the Astro McMannis table is unable to produce rotatory movements. In addition Cox (1979) states that when using the McMannis table rotation of the lumbar spine should be used guardedly. He adds that it should only be used on a patient who has freedom of movement in their other ranges of motion.

Plate 4.1 Astro Mcmanus AH Table from Lloyd Table Company,  
101-102 W.Main Street, Lisbon, Iowa 52253-0899.



Plate 4.2 Astro Mcmanus AH Table from Lloyd Table Company,  
101-102 W.Main Street, Lisbon, Iowa 52253-0899.



(b) The Eltrac 471 traction unit, made by Enraf Nonius, and distributed by Physio Tritronics, 2 Belfast Rd, Bayhead, Durban was used for this study. This split traction table enables friction-free continuous or intermittent traction.

The general procedure for Intermittent traction was as follows:

The subject was placed comfortably in a supine position on the traction table, with the upper canvas belt firmly attached around the lower thoracic cage and the lower canvas belt around the iliac crests. The mid-position of the spinal segment to be treated was found, i.e. in a position mid-way between flexion and extension. The mid-point of the upper lumbar spine was achieved with slight knee flexion and the lower the lumbar problem the more the hips and knees were flexed. The thoracic straps and pelvic belts were then attached to the fixed upper and lower points respectively on the traction table. After unlocking the sliding table top, an intermittent traction force of twenty five percent of the subject's body weight was then applied for a six minute period. The force was applied for a ten second period, released for a ten second period, then reapplied for ten seconds, and so on.

Plate 4.3 Eltrac 471 traction unit made by Enraf Nonius and distributed by Physio Tritonics, 2 Belfast Road, Durban, 4001.

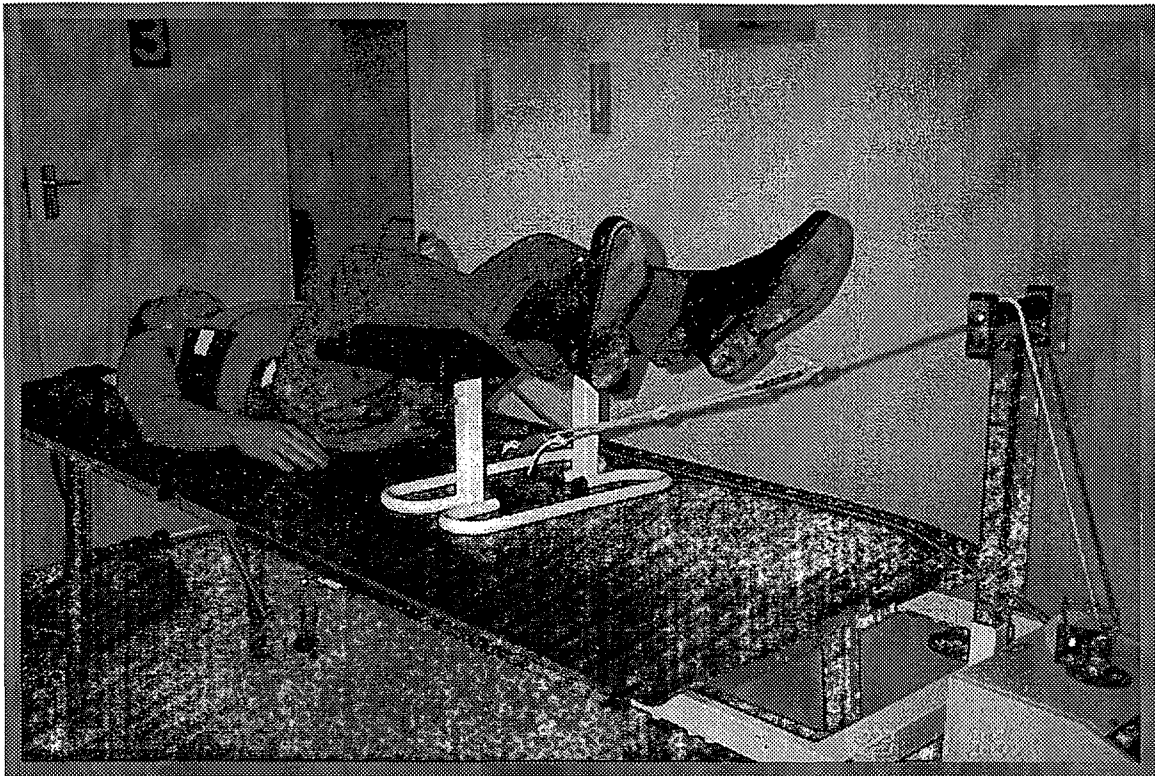


Plate 4.4 Eltrac 471 traction unit made by Enraf Nonius and distributed by Physio Tritonics, 2 Belfast Road, Durban, 4001.



Both experimental and questionnaire design were methods employed in the process of data collection.

The primary data was obtained directly from the patients using the communication and observation methods. The Numerical Pain Rating Scale 101 (Appendix 8.5), Pain Diagram's (Appendix 8.6), the Short-form McGill Pain Questionnaire (Appendix 8.7) and Owestry Back Disability Index (Appendix 8.8) were used to record the patients response to pain in a subjective manner. A goniometer was used to measure the subject's lumbar spine range of motion and an algometer was used to record the subjects pain sensitivity. These were used to record the response of the patients in an objective manner. It also included the case history, physical examination and lumbar spine regional examination forms which are used in the Technikon Natal Chiropractic Day Clinic.

This data was collected prior to the first and final treatments, in order to compare pre- and post-treatment results, which was either once the patient was free of signs and symptoms or at the eighth treatment. At the follow-up consultation one month after the final treatment it was again collected.

The secondary data included journal articles, published reports and books containing information relevant to the research being conducted.

The events that occurred at each consultation were as follows:

a) The initial consultation

The case history, physical examination and lumbar spine regional examination were completed. Radiographic examinations were taken where clinically indicated.

b) Treatment consultations

Prior to the first, and final treatments the patient was required to complete the following:

(i) Numerical Pain Rating Scale 101. (Jensen et al. 1986)

(ii) Pain Diagrams. (Ransford et al. 1976)

(iii) McGill Pain Questionnaire. (Melzack 1987)

(iv) Oswestry Back Disability Index. (Fairbank et al. 1980)

Subject's range of motion was measured using a goniometer and their sensitivity to pain was tested using an algometer. This was followed by treatment of the subject.

At the other five consultations patients received treatment.

c) The follow-up consultation

The Numerical Pain Rating Scale 101, Pain Diagrams, the Short-form McGill Pain Questionnaire and Oswestry Back Disability Index were completed. The goniometer and algometer readings were taken. This follow-up consultation was to determine how long the patient remained symptom free, giving an indication of the long-term effectiveness of the treatment.

If the patient was completely symptom free before the completion of their eight treatments they no longer received treatment and their follow-up consultation was brought forward. However, if the patient's symptoms subsequently returned before the end of the four week period, and the patient had not suffered any subsequent injury, their treatment was continued. Thus they still obtained their eight treatments but their treatment period was longer than four weeks.

The research involved experimental methodology by observation and descriptive survey methodology by questionnaires.

The descriptive survey design made use of the Numerical Pain Rating Scale 101 (Appendix 8.5), Short-form McGill Pain Questionnaire (Appendix 8.7) and the Oswestry Back Disability Index (Appendix 8.8).

(a) The Numerical Pain Rating Scale (Jensen et al. 1986) was used to measure the patient's subjective response to treatment in terms of their perception of pain intensity. This questionnaire instructed the patient to rate their pain at its worst and its least on a numerical scale ranging from zero, indicating "no pain at all", and ten, indicating "pain as bad as it could be". The data was collected and recorded. The average pain intensity was calculated by adding the values representing worst and least pain and then dividing this by two. The average pain intensity experienced by each patient over the treatment and follow-up periods were then used for statistical analysis.

(b) The Pain Drawings (Ransford et al. 1976) were not analysed statistically but they were used to aid the researcher to determine the location and nature of the pain felt by the patient. It provided a before and after comparison of the patients condition.

(c) The Short-form McGill Pain Questionnaire (Melzack 1987) is a subjective questionnaire that pertains specifically to the sensory and affective dimensions of pain experience. It was used to measure the extent of pain experienced by the patient. This questionnaire is divided into two sections. Questions 1 to 11 represent the sensory dimension of pain experience and questions 12 to 15 represent the affective

dimension, it assesses the behavioural and emotional aspects of pain. A minimum of zero for no symptoms and a maximum of three for the most severe symptoms in that particular category can be scored for each question. This data was collected and recorded. The sum of all the completed sections were calculated and given a percentage of the highest possible score. If all the sections were completed the highest possible score was forty-five and decreased by three for each section not completed.

(d) The Oswestry Back Disability Index provides information regarding the extent to which the patient's pain influences their normal daily activities. It consists of ten sections of six questions each. For each section the total possible score is 5 points, with the point distribution varying from zero if the first statement of the respective section was marked, and up to five if the sixth statement was chosen. The points obtained for each section were added, with the maximum possible score being fifty, and decreased by five for each section not completed. The final score was converted to a percentage score for each individual patient.

The Numerical Pain rating Scale 101, the McGill Pain Questionnaire and Oswestry Back Disability Index which were used in assessing the

subjective response to treatment, are accepted as being valid measurement criteria. (McDowell and Newell 1987:239-259).

The experimental design involved lumbar spine ranges of motion and pain sensitivity.

(1) Lumbar spine range of motion was measured in flexion, extension, left lateral flexion, right lateral flexion, left rotation and right rotation with a BROM II (Back Range Of Motion) instrument, (a product of Performance Attainment Associates, 3600 LaBore Road, Suite 6, St. Paul, MN 55110-4144).

(a) Flexion / Extension measurements - The patient stood erect with his feet shoulder width apart. S1 and T12 were palpated and marked. The BROM Flexion / Extension Unit was then placed on the sacrum with the pivot point on S1, and the Velcro straps stretched and attached around the patient's lower abdomen. The movable arm tip was placed on T12 and the initial reading on the outer scale was recorded. The patient was instructed to flex forward, trying to place his palms on the floor. The arm tip was replaced on T12 and the full flexion reading was recorded. The initial flexion reading was subtracted from the final flexion reading to obtain the true flexion reading.

With the patient erect, his arms were put across his chest with his hands on his shoulders. The movable arm tip was placed on T12 and the initial reading was recorded from the outer scale. The patient was then instructed to extend backwards, the arm tip was placed on T12 and the full extension reading was recorded. The initial extension reading was subtracted from the full extension recording to obtain the true extension reading.

(b) Rotation measurements - The belt was placed on S1 and T12 with the magnetic reference over the sacrum (The magnetic angle meter measures to the magnetic reference placed on the spine thus eliminating unwanted spine movement below that point). The Rotation / Lateral Unit was placed firmly against the patient's back in line with T12 and the magnetic meter was set to zero. The patient was instructed to rotate his shoulders to the right and the reading was recorded. The patient then rotated slowly to the left and a recording was made.

(c) Lateral flexion measurements - With the patient standing erect, the Rotation / Lateral Flexion Unit was placed in line with T12, and adjusted until the meter read zero. The patient was then instructed to lean to the right, with his legs kept straight, and the reading was recorded. The

procedure was then repeated on the left hand side and the reading recorded.

(2) Pain sensitivity was measured using an Algometer over the spinous processes of the lower five lumbar vertebrae and the posterior superior iliac spines. An algometer may be defined as an apparatus for determining sensitivity to pain caused by pressure. The algometer used in this study was the model "FDK 20 force dial", (made by Wagner Instruments and supplied by Activator Methods Inc). According to Fischer (1987) the reliability of the assessment of pain by the algometer has been documented and the reproducibility of results collected by those trained in pressure threshold measurement is sufficient for practical use.

The procedure of taking a reading was as follows: the algometer was set to zero and then pressed over the symptomatic lumbar spinous processes and/or posterior superior iliac spines to the pressure threshold of that patient i.e. The minimum pressure causing pain or discomfort. The reading, obtained in kilograms per square centimetre, indicated the sensitivity of the vertebrae and sacro-iliac joints.

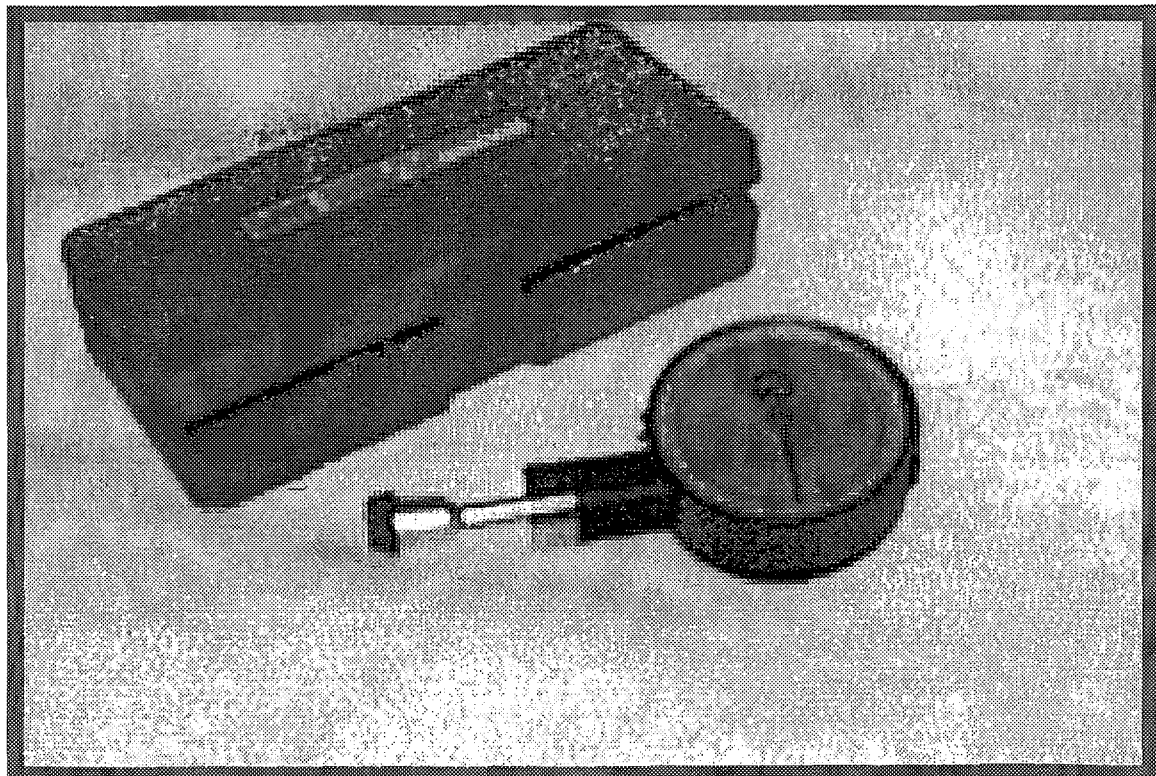
The readings produced by both the goniometer and algometer allowed for statistical analysis of the objective data. An increase of the numerical

values of the readings, indicated an increase range of motion as well as an increase pain tolerance of the affected area to pressure. Increases were interpreted as positive responses to treatment and therefore could be used to indicate the efficacy of traction in the chiropractic management of chronic mechanical lower back pain.

Plate 4.3 Eltrac 471 traction unit made by Enraf Nonius and distributed by Physio Tritonics, 2 Belfast Road, Durban, 4001.



Plate 4.4 Eltrac 471 traction unit made by Enraf Nonius and distributed by Physio Tritonics, 2 Belfast Road, Durban, 4001.



The data was analysed using the computer software programme STATAGRAPHS PLUS VERSION 6, supplied by Manugistics.

Descriptive statistics i.e. Mean and standard deviation were calculated. (Appendix 8.10).

The Wilcoxon Signed Rank test (intra-group analysis) was used to determine whether any significant change occurred between the initial and final treatments; and the final treatment and the follow-up visit, within each respective study group.

Mann-Whitney U-test (inter-group analysis) was used to determine whether there was any significant difference between the two groups at the time of initial consultation, final treatment given and at the follow-up visit one month later.

All confidence intervals were constructed at a 95% confidence interval, i.e.  $\alpha = 0.05$ .

The data obtained in Subproblem one and Subproblem two was analysed using the Wilcoxon Signed Rank test. It was a powerful test (less restrictive, yet very near equivalence in sensitivity to the T test) for non-parametric data with small sample sizes (Daniel 1978:31-36).

The null hypothesis for the above data was that within each group there was no improvement of the patients with regard to objective and subjective clinical features. The alternative hypothesis was that within each group there was significant improvement of the patients with regard to objective and subjective clinical features.

Once the results of subproblem one and subproblem two were processed, the results of subproblem three, namely finding out which of the two treatment types was more effective, could be determined. The Mann-Whitney U-test was chosen for this study because of its application to an inter-group statistical analysis as well as being held in high regard relating to power-efficiency. (Daniel 1978: 82-86).

The null hypothesis for subproblem three was that there was no statistically significant difference in the effects of McMannis traction and Intermittent traction in the management of chronic mechanical low back pain. The alternative hypothesis stated that McMannis traction would produce statistically significant results when compared to Intermittent traction in the management of chronic mechanical low back pain.

Statistical analyses using non-parametric test statistics were used i.e. Wilcoxon Signed Rank test and Mann-Whitney U-test.

Of the 36 patients found eligible for inclusion into the study four were non-compliant (two from the McMannis group and two from the Intermittent group) and did not show-up for their follow-up consultations. One patient from the McMannis group's pain was so severe that she had to go for medical intervention and was therefore excluded from the study and one patient, from the Intermittent group, was unable to complete the study as result of being involved in a severe motor vehicle accident.

## **CHAPTER 4**

To ensure that the data satisfied the criteria set out, all questionnaires had to be completed under the supervision of the researcher. Range of motion and pain sensitivity measurements taken by the researcher were used for statistical assessment. Treatments had to be conducted by the researcher or qualified staff clinician on duty at the Technikon Natal Chiropractic Day Clinic.

### **4. RESULTS**

This chapter covers the results obtained from the statistical analysis of the data collected from the:

- 1) Numerical Pain Rating Scale 101 (Appendix 8.5).
- 2) Short-form McGill Pain Questionnaire (Appendix 8.7)
- 3) Oswestry Back Disability Index (Appendix 8.8)
- 4) Lumbar spine range of motion (Appendix 8.10)
- 5) Algometer readings (Appendix 8.10)

The results obtained are tabulated to display the mean for each group, the exceedence probability value (p value ) and the large sample test statistic (z value). These values were compared to the level of significance set at 0.05 for all the tests.

## 4.1 PAIN INTENSITY

Pain intensity was measured with the Numerical Pain Rating Scale 101 and Short-form McGill Pain Questionnaire.

### 4.1.1 Numerical Pain Rating Scale 101

The following results were obtained:

Table 4.1 The mean values and results of the Wilcoxon's Signed Rank test for the Numerical Pain Rating Scale 101 (NRS 101) of the two groups during the period between the first treatment (1st tx) and final treatment (F tx).

	1st tx	F tx	z value	p value
McMannis Group	47.83	36.5	1.87083	0.0613685
Intermittent Group	41.73	26.17	1.6641	0.096092

The null hypothesis was accepted for both groups which indicated that at the 5% level of significance no statistical significant difference took place during this period.

Table 4.2 The mean values and results of the Wilcoxon's Signed Rank test for the NRS 101 of the two groups between the final treatment ( F tx) and the follow-up consultation (F/up C).

	F tx	F/up C	z value	p value
<b>McMannis Group</b>	36.5	33.17	0.579097	0.5547
<b>Intermittent Group</b>	26.17	25.35	1.33631	0.181449

The null hypothesis was accepted for both groups which indicated that at the 5% level of significance no statistically significant difference occurred during the follow-up period.

Figure 4.1 Mean values of the Numerical Pain Rating Scale 101 at the first treatment (1st tx), final treatment (F tx) and follow-up consultaion (F/up tx).

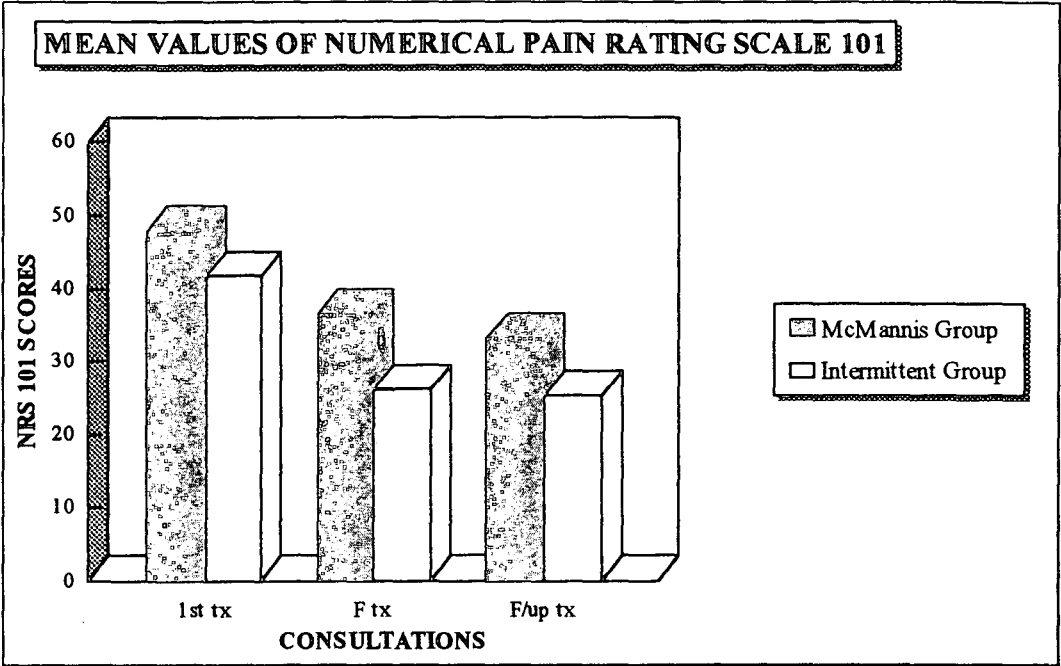


Table 4.3 The results of the Mann-Whitney U-test for the NRS 101 comparing the two groups at the first treatment(1st tx), final treatment (F tx) and follow-up consultation (F/up C).

	1st tx	F tx	F/up C
z value	-1.19252	-1.3934	-1.18822
p value	0.233058	0.1635	0.234746

The null hypothesis was accepted for all three consultations indicating that at the 5% significance level no statistically significant difference occurred between the two groups during the treatment period, or between the final treatment and the follow-up consultation.

#### 4.1.2 The Short-Form McGill Pain Questionnaire

The following results were recorded:

Table 4.4 The mean values and results of the Wilcoxon's Signed Rank test for the Short-form McGill Pain Questionnaire of the two groups during the period between the first (1st tx) and final treatments (F tx).

	1st tx	F tx	z value	p value
<b>McMannis Group</b>	21	17.87	2.06559	0.0388669
<b>Intermittent Group</b>	23.13	11.53	3.3282	0.0008742

The null hypothesis was rejected for both treatment groups which indicated that at the 5% level of significance a statistically significant change took place during the treatment period.

**Table 4.5 The mean values and results of the Wilcoxon's Signed Rank test for the Short-form McGill Pain Questionnaire of the two groups between the final treatment (F tx) and follow-up consultation (F/up C).**

	<b>F tx</b>	<b>F/up C</b>	<b>z value</b>	<b>p value</b>
<b>McMannis Group</b>	17.87	15.27	0.948683	0.34278
<b>Intermittent Group</b>	11.53	11.67	0.603023	0.546491

The null hypothesis was accepted for both groups which indicated that at the 5% level of significance no statistically significant change occurred between the final treatment and one month follow-up.

Figure 4.2 Mean values of the Short-form McGill Pain Questionnaire at the first treatment (1st tx), final treatment (F tx) and follow-up consultaion (F/up tx).

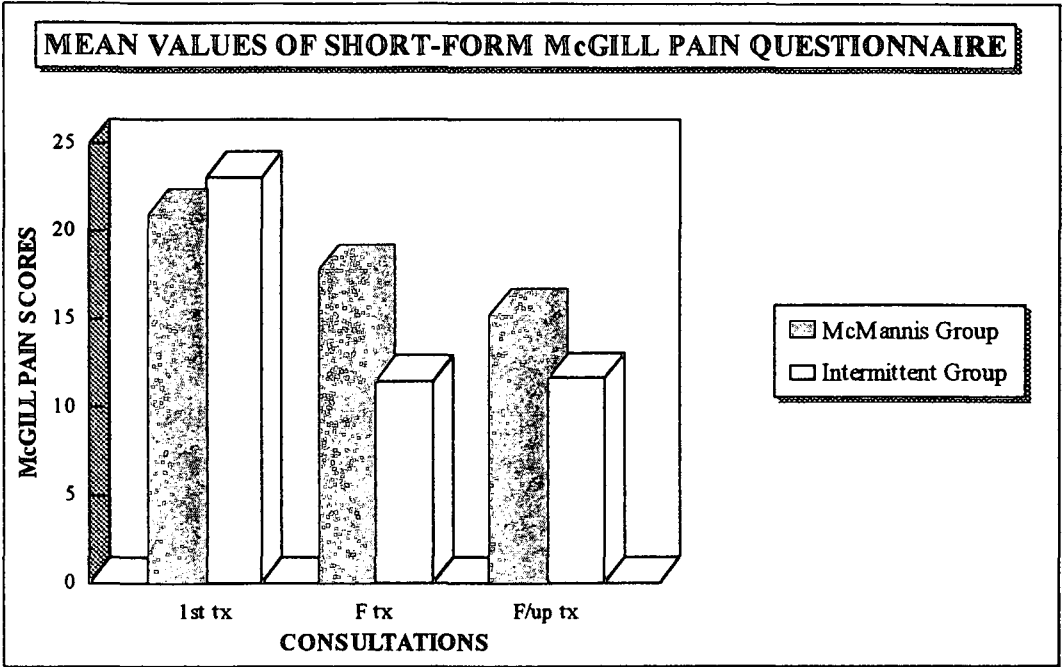


Table 4.6 The results of the Mann-Whitney U-test for the Short-form McGill Pain Questionnaire comparing the two groups at the first treatment (1st tx), final treatment (F tx) and follow-up consultation (F/up C).

	1st tx	F tx	F/up C
z value	0.68784	-0.523746	-0.272162
p value	0.491551	0.600452	0.785493

The null hypothesis was accepted at all three consultations which indicated that at the 5% level of significance no statistically significant difference occurred between the two groups during the treatment period or between the final treatment and follow-up consultation.

## 4.2 DISABILITY

### 4.2.1 Owestry Back Disability Index

The following results were recorded:

Table 4.7 The mean values and results of the Wilcoxon's Signed Rank test for the Owestry Back Disability Index of the two groups between the first (1st tx) and final treatments (F tx).

	1st tx	F tx	z value	p value
McMannis Group	18.07	12.33	2.0659	0.0388669
Intermittent Group	19	14.33	0.866025	0.386474

The null hypothesis was rejected for the McMannis group which indicated that at the 5% level of significance a statistically significant change took place during the treatment period. The null hypothesis was accepted for the Intermittent traction group which indicated that at a 5% level of

significance no statistically significant change took place during the treatment period.

**Table 4.8 The mean values and results of the Wilcoxon's Signed Rank test for the Owestry Back Disability Index of the two groups between the final treatment (F tx) and follow-up consultation (F/up C).**

	<b>F tx</b>	<b>F/up C</b>	<b>z value</b>	<b>p value</b>
<b>McMannis Group</b>	12.33	12.2	0	1
<b>Intermittent Group</b>	14.33	11.93	1.44338	0.148914

The null hypothesis was accepted in both treatment groups which indicated that at the 5% level of significance no statistically significant change took place during the final treatment and the one month follow-up consultation.

Figure 4.3 Mean values of the Owesstry Back Disability Index at the first treatment (1st tx), final treatment (F tx) and follow-up consultaion (F/up tx).

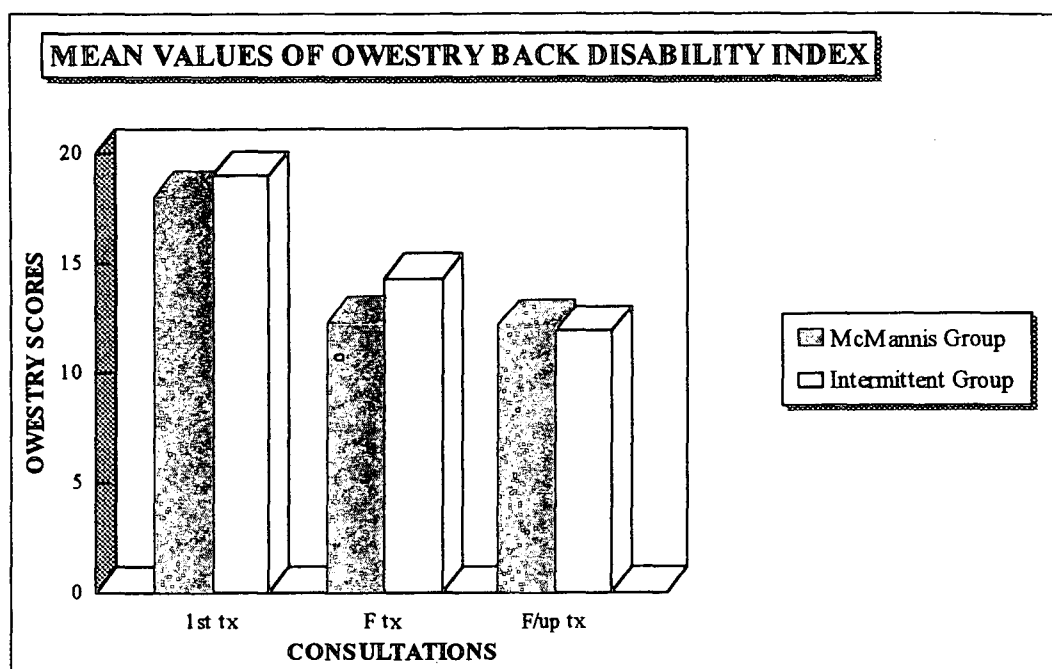


Table 4.9 The results of the Mann-Whitney U-test for the Owesstry Back Disability Index comparing the two groups at the first treatment (1st tx), final treatment (F tx) and follow-up consultation (F/up C).

	1st tx	F tx	F/up C
z value	0.0415521	0.855551	0.187466
p value	0.96685	0.392244	0.85129

The null hypothesis was accepted at all three consultations which indicated that at the 5% level of significance no statistically significant difference occurred between the two groups during the treatment period or between the final treatment and follow-up consultation.

### 4.3 LUMBAR SPINE RANGES OF MOTION

#### 4.3.1 Forward Flexion

Table 4.10 The mean values and results of the Wilcoxon's Signed Rank test for Flexion of the two groups between the first (1st tx) and final (F tx) treatments.

	1st tx	F tx	z value	p value
McMannis Group	32	34.6	0.866025	0.386474
Intermittent Group	29.47	30.6	1.1094	0.267256

The null hypothesis was accepted in both groups which indicated that at the 5% level of significance no statistically significant change took place during the treatment period.

Table 4.11 The mean values and results of the Wilcoxon's Signed Rank test for Flexion of the two groups between the final treatment (F tx) and the follow-up consultation (F/up C).

	F tx	F/up C	z value	p value
<b>McMannis Group</b>	34.6	36.4	1.1094	0.267256
<b>Intermittent Group</b>	30.6	33.13	2.7735	0.00554577

The null hypothesis was accepted in the McMannis group which indicated that at the 5% level of significance no statistically difference took place between the final treatment and the follow-up consultation. The null hypothesis was rejected for the Intermittent group which indicated that at the 5% level of significance a statistically significant place took place between the final treatment and follow-up consultation.

Figure 4.4 Mean values of Forward Flexion at the first treatment (1st tx), final treatment (F tx) and follow-up consultaion (F/up tx).

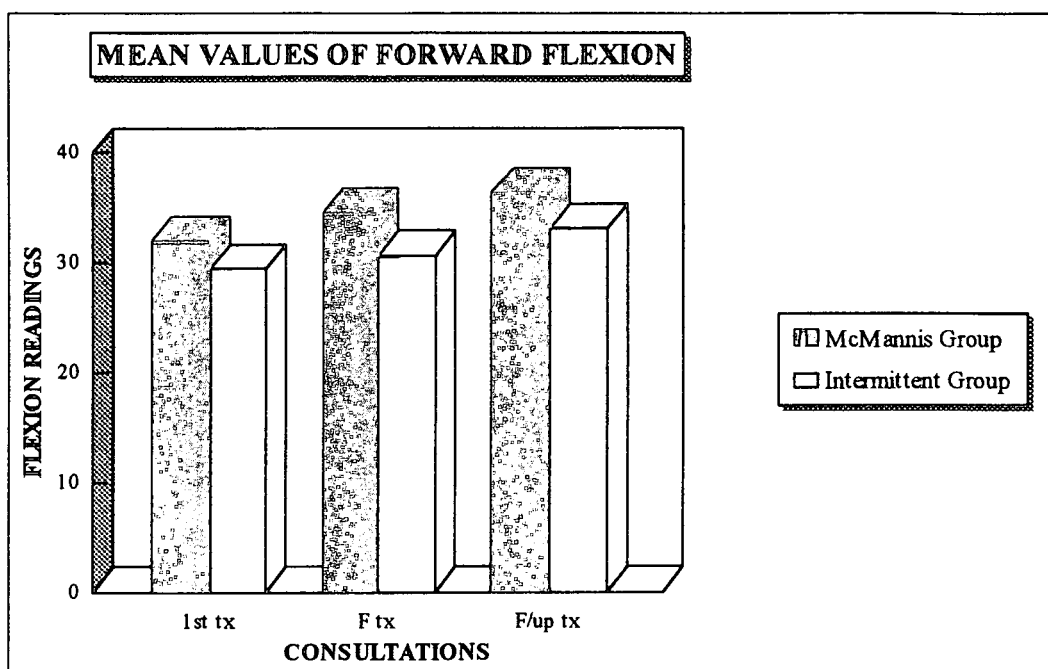


Table 4.12 The results of the Mann-Whitney U-test for Flexion comparing the two groups at the first treatment (1st tx), final treatment (F tx) and follow-up consultation (F/up C).

	1st tx	F tx	F/up C
z value	-1.41853	-2.14617	-1.62892
p value	0.156036	0.0318592	0.10333

The null hypothesis was accepted at all three consultations which indicated that at the 5% level of significance no statistically significant difference occurred between the two groups during the treatment period or between the final treatment and follow-up consultation.

4.3.2 Extension

Table 4.13 The mean values and results of the Wilcoxon's Signed Rank test for Extension of the two groups between the first (1st tx) and final (F tx) treatments.

	1st tx	F tx	z value	p value
McMannis Group	12.66	13.13	-0.288675	0.77826
Intermittent Group	12.53	13.13	0	1

The null hypothesis was accepted in both groups which indicated that at the 5% level of significance no statistically significant change took place during the treatment period.

Table 4.14 The mean values and results of the Wilcoxon's Signed Rank test for Extension of the two groups between the final treatment ( F tx) and the follow-up consultation (F/up C).

	F tx	F/up C	z value	p value
<b>McMannis Group</b>	13.13	13.67	0.755929	0.44969
<b>Intermittent Group</b>	13.13	12.73	0	1

The null hypothesis was accepted in both groups which indicated that at the 5% level of significance no statistically significant change took place between the final treatment and one month follow-up consultation.

Figure 4.5 Mean values of Extension at the first treatment (1st tx), final treatment (F tx) and follow-up consultaion (F/up tx).

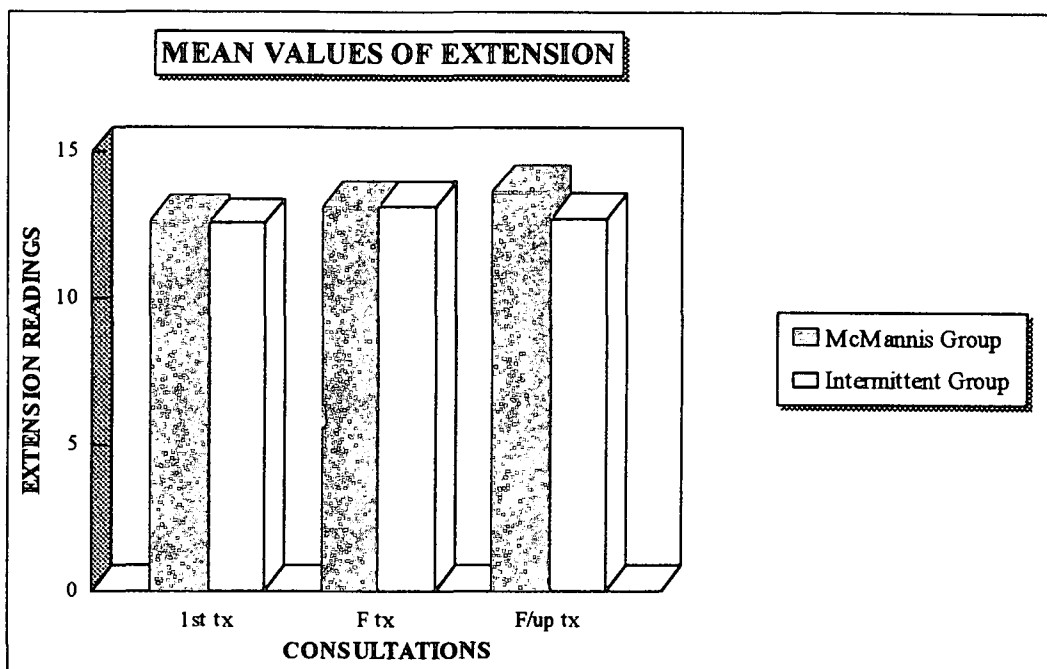


Table 4.15 The results of the Mann-Whitney U-test for Extension comparing the two groups at the first treatment (1st tx), final treatment (F tx) and follow-up consultation (F/up C).

	1st tx	F tx	F/up C
z value	-1.34201	-0.0836854	-0.984195
p value	0.179593	0.933301	0.325018

The null hypothesis was accepted at all three consultations which indicated that at the 5% level of significance no statistically significant difference occurred between the two groups during the treatment period or between the final treatment and follow-up consultation.

#### 4.3.3 Right lateral flexion

Table 4.16 The mean values and results of the Wilcoxon's Signed Rank test for Right Lateral Flexion of the two groups between the first (1st tx) and final (F tx) treatments.

	1st tx	F tx	z value	p value
<b>McMannis Group</b>	21.07	20.67	0	1
<b>Intermittent Group</b>	17.73	18	0.316228	0.751826

The null hypothesis was accepted in both groups which indicated that at the 5% level of significance no statistically significant change took place during the treatment period.

Table 4.17 The mean values and results of the Wilcoxon's Signed Rank test for Right Lateral Flexion of the two groups between the final treatment ( F tx) and the follow-up consultation (F/up C).

	F tx	F/up C	z value	p value
<b>McMannis Group</b>	20.67	20.67	0.288675	0.772826
<b>Intermittent Group</b>	18	19.27	0.603023	0.546491

The null hypothesis was accepted in both groups which indicated that at the 5% level of significance no statistically significant change took place between the final treatment and one month follow-up consultation.

Figure 4.6 Mean values of Right Lateral Flexion the first treatment (1st tx), final treatment (F tx) and follow-up consultaion (F/up tx).

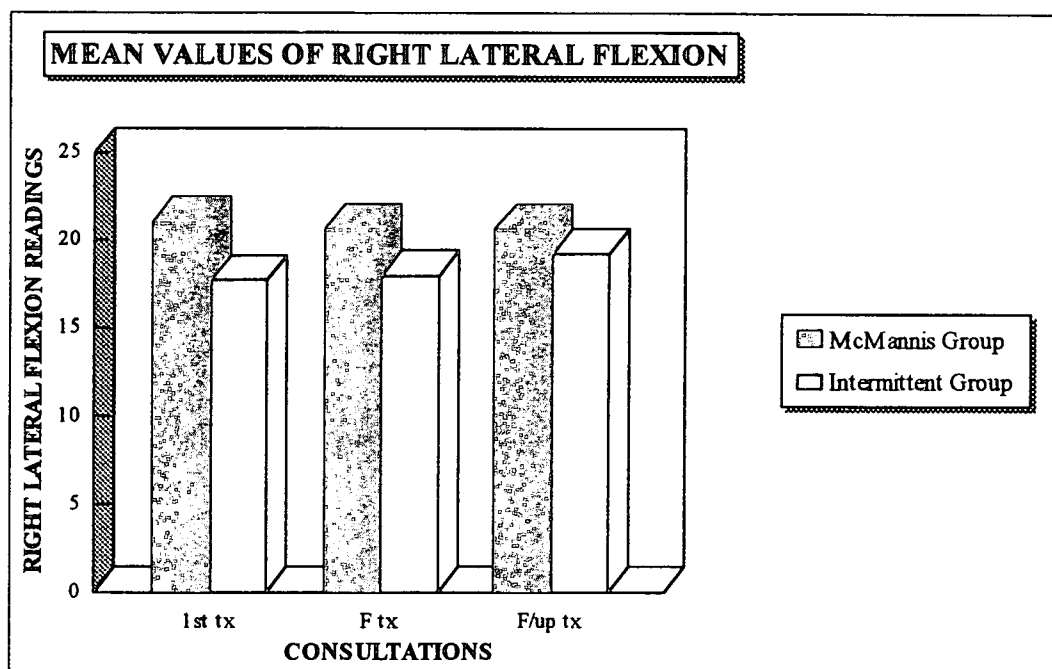


Table 4.18 The results of the Mann-Whitney U-test for Right Lateral Flexion comparing the two groups at the first treatment (1st tx), final treatment (F tx) and follow-up consultation (F/up C).

	1st tx	F tx	F/up C
z value	-1.65843	-1.52588	-0.944459
p value	0.0972307	0.12704	0.344934

The null hypothesis was accepted at all three consultations which indicated that at the 5% level of significance no statistically significant difference occurred between the two groups during the treatment period or between the final treatment and follow-up consultation.

#### 4.3.4 Left lateral flexion

Table 4.19 The mean values and results of the Wilcoxon's Signed Rank test for Left Lateral Flexion of the two groups between the first (1st tx) and final (F tx) treatments.

	1st tx	F tx	z value	p value
<b>McMannis Group</b>	21.33	20.93	0.288675	0.77826
<b>Intermittent Group</b>	18.47	17.27	0.866025	0.386474

The null hypothesis was accepted in both groups which indicated that at the 5% level of significance no statistically significant change took place during the treatment period.

**Table 4.20 The mean values and results of the Wilcoxon's Signed Rank test for Left Lateral Flexion of the two groups between the final treatment ( F tx) and the follow-up consultation (F/up C).**

	<b>F tx</b>	<b>F/up C</b>	<b>z value</b>	<b>p value</b>
<b>McMannis Group</b>	20.93	21.33	0.948683	0.34278
<b>Intermittent Group</b>	17.27	18.8	0.288675	0.772826

The null hypothesis was accepted in both groups which indicated that at the 5% level of significance no statistically significant change took place between the final treatment and one month follow-up consultation.

Figure 4.7 Mean values of Left Lateral Flexion at the first treatment (1st tx), final treatment (F tx) and follow-up consultaion (F/up tx).

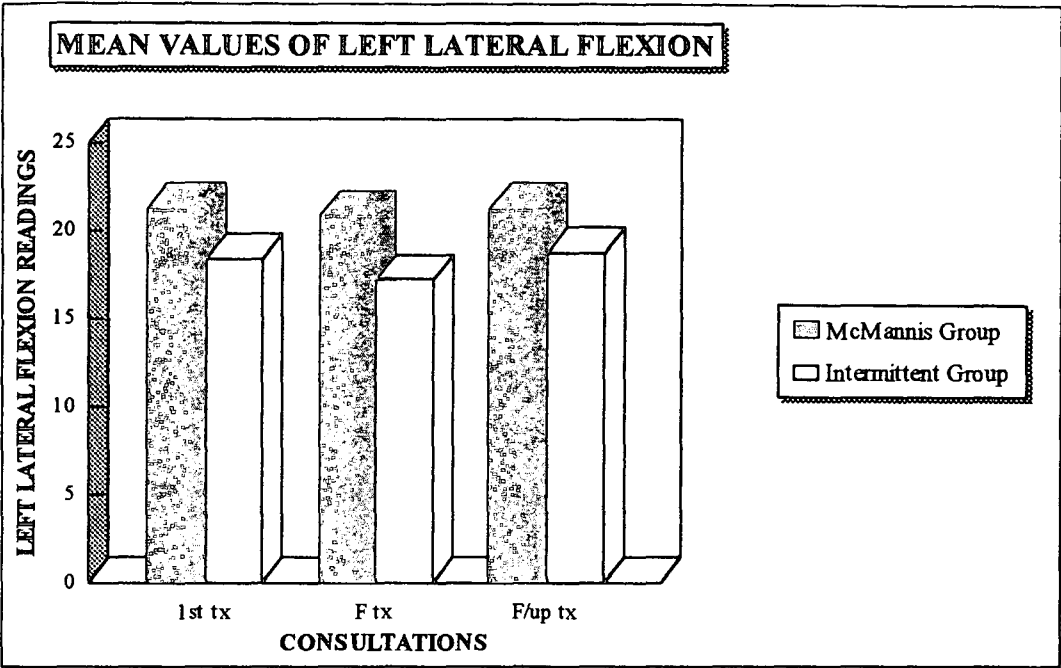


Table 4.21 The results of the Mann-Whitney U-test for Left Lateral Flexion comparing the two groups at the first treatment (1st tx), final treatment (F tx) and follow-up consultation (F/up C).

	1st tx	F tx	F/up C
z value	-1.62837	-1.88677	-1.46449
p value	0.103447	0.05191	0.143058

The null hypothesis was accepted at all three consultations which indicated that at the 5% level of significance no statistically significant difference occurred between the two groups during the treatment period or between the final treatment and follow-up consultation.

#### 4.3.5 Right Rotation

Table 4.22 The mean values and results of the Wilcoxon's Signed Rank test for Right Rotation of the two groups between the first (1st tx) and the final (F tx) treatments.

	1st tx	F tx	x value	p value
<b>McMannis Group</b>	20.13	21.07	0.666667	0.504983
<b>McMannis Group</b>	23	23.2	0	1

The null hypothesis was accepted in both groups which indicated that at the 5% level of significance no statistically significant change took place during the treatment period.

Table 4.23 The mean values and results of the Wilcoxon's Signed Rank test for Right Rotation of the two groups between the final (F tx) and the follow-up consultation (F/up C).

	1st tx	F tx	x value	p value
<b>McMannis Group</b>	21.07	21.6	0.755929	0.44969
<b>McMannis Group</b>	23.2	24.13	1.20605	0.227799

The null hypothesis was accepted in both groups which indicated that at the 5% level of significance no statistically significant change took place between the final treatment and one month follow-up consultation.

Figure 4.8 Mean values of Right Rotation at the first treatment (1st tx), final treatment (F tx) and follow-up consultaion (F/up tx).

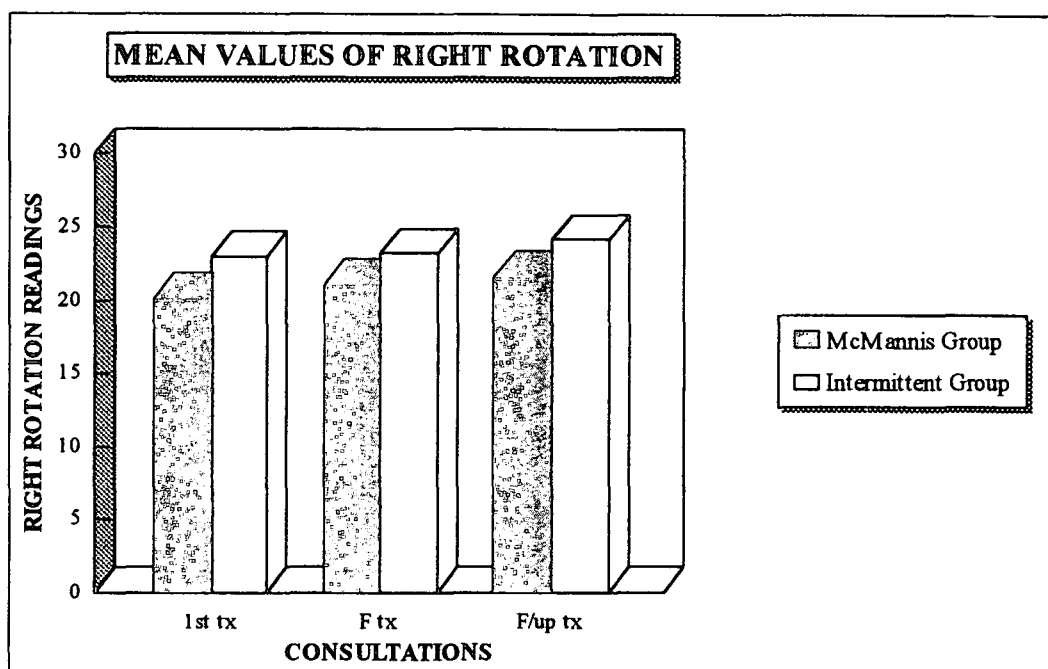


Table 4.24 The results of the Mann-Whitney U-test for Right Rotation comparing the two groups at the first treatment (1st tx), final treatment (F tx) and follow-up consultation (F/up C).

	1st tx	F tx	F/up C
<b>z value</b>	1.04347	0.733744	1.0512
<b>p value</b>	0.296729	0.463103	0.293167

The null hypothesis was accepted at all three consultations which indicated that at the 5% level of significance no statistically significant difference occurred between the two groups during the treatment period or between the final treatment and follow-up consultation.

#### 4.3.6 Left rotation

Table 4.25 The mean values and results of the Wilcoxon's Signed Rank test for Left Rotation of the two groups between the first (1st tx) and final (F tx) treatments.

	1st tx	F tx	z value	p value
<b>McMannis Group</b>	19.33	20.8	1.20605	0.227799
<b>Intermittent Group</b>	22.13	22.93	1.20605	0.227799

The null hypothesis was accepted in both groups which indicated that at the 5% level of significance no statistically significant change took place during the treatment period.

Table 4.26 The mean values and results of the Wilcoxon's Signed Rank test for Left Rotation of the two groups between the final treatment ( F tx) and the follow-up consultation (F/up C).

	F tx	F/up C	z value	p value
<b>McMannis Group</b>	20.8	21.87	1.51186	0.13057
<b>Intermittent Group</b>	22.93	23.73	0	1

The null hypothesis was accepted in both groups which indicated that at the 5% level of significance no statistically significant change took place between the final treatment and one month follow-up consultation.

Figure 4.9 Mean values of Left Rotation at the first treatment (1st tx), final treatment (F tx) and follow-up consultaion (F/up tx).

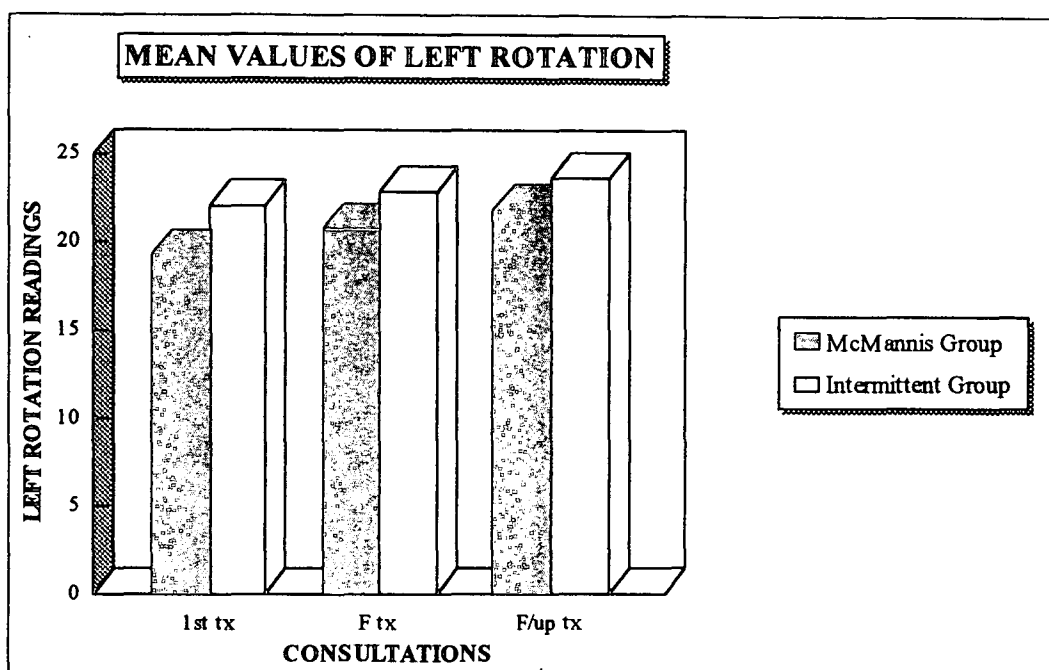


Table 4.27 The results of the Mann-Whitney U-test for Left Rotation comparing the two groups at the first treatment (1st tx), final treatment (F tx) and follow-up consultation (F/up C).

	1st tx	F tx	F/up C
z value	1.41135	0.670547	0.756257
p value	0.158141	0.502507	0.449493

The null hypothesis was accepted at all three consultations which indicated that at the 5% level of significance no statistically significant difference occurred between the two groups during the treatment period or between the final treatment and follow-up consultation.

#### 4.4 PAIN SENSITIVITY

##### 4.4.1 Algometer readings

Table 4.28 The mean values and results of the Wilcoxon's Signed Rank test for the Algometer readings of the two groups between the first (1st tx) and final (F tx) treatments.

	1st tx	F tx	z value	p value
<b>McMannis Group</b>	4.08	4.11	1.3028	0.301698
<b>Intermittent Group</b>	3.57	3.71	1.33631	0.181499

The null hypothesis was accepted in both groups which indicated that at the 5% level of significance no statistically significant change took place during the treatment period.

**Table 4.29 The mean values and results of the Wilcoxon's Signed Rank test for the Algometer readings of the two groups between the final treatment (F tx) and the follow-up consultation (F/up C).**

	<b>F tx</b>	<b>F/up C</b>	<b>z value</b>	<b>p value</b>
<b>McMannis Group</b>	4.11	4.29	-0.267261	0.789264
<b>Intermittent Group</b>	3.71	4.05	2.06559	0.0388669

The null hypothesis was accepted in the McMannis group which indicated that at the 5% level of significance no statistically significant change took place between the final treatment and one month follow-up consultation. The null hypothesis was rejected for the Intermittent group indicating that at the 5% level of significance a statistically significant change took place between the final treatment and one month follow-up consultation.

Figure 4.10 Mean values of the Algometer readings at the first treatment (1st tx), final treatment (F tx) and follow-up consultaion (F/up tx).

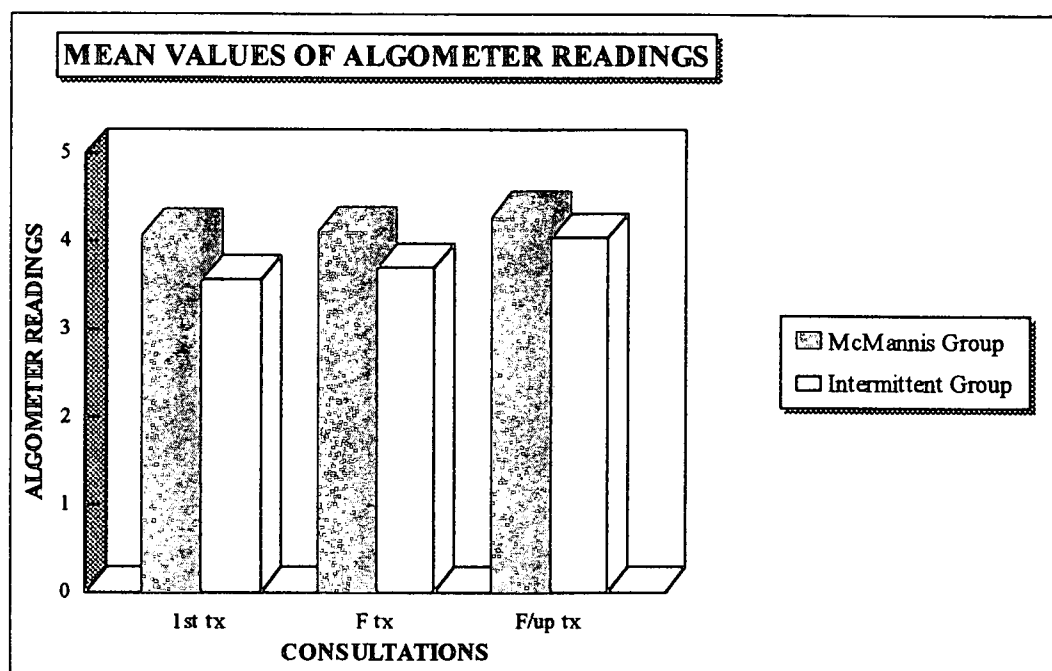


Table 4.30 The results of the Mann-Whitney U-test for the Algometer readings comparing the two groups at the first treatment (1st tx), final treatment (F tx) and follow-up consultation (F/up C).

	1st tx	F tx	F/up C
<b>z value</b>	-0.851913	-0.747687	-0.560453
<b>p value</b>	0.394261	0.454647	0.575168

The null hypothesis was accepted at all three consultations which indicated that at the 5% level of significance no statistically significant difference occurred between the two groups during the treatment period or between the final treatment and follow-up consultation.

#### 4.5 DEMOGRAPHICAL DATA

Table 4.31 Demographical data.

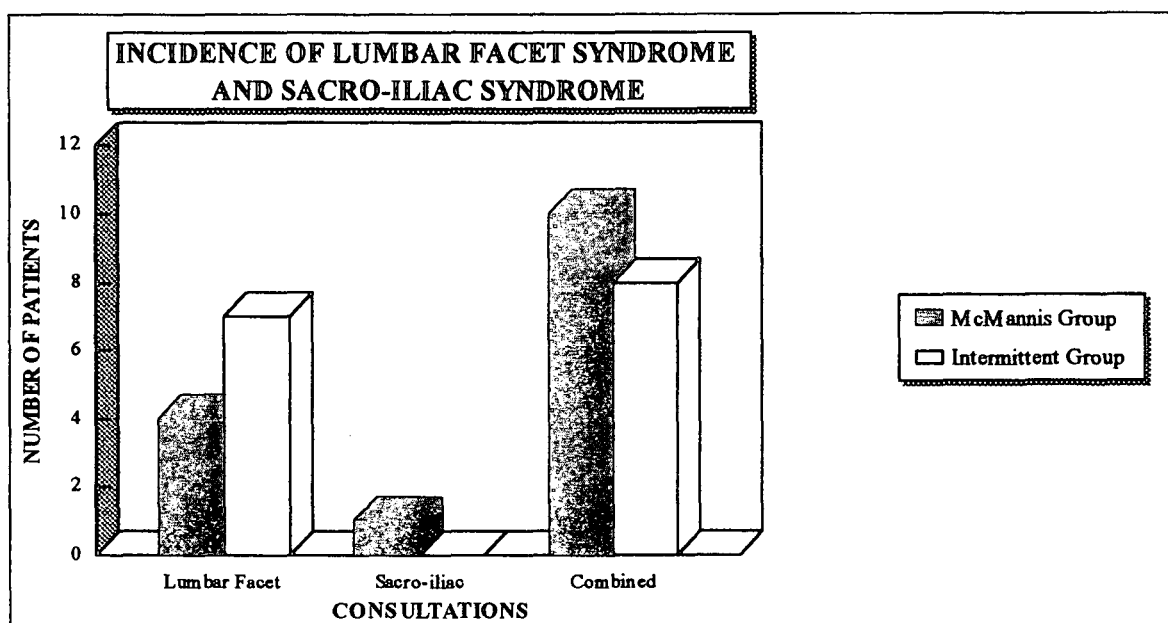
	<b>Mcmanis</b>	<b>Intermittent</b>	<b>Total</b>
<b>Age Distribution</b>			
Age Range	19 -- 67	18 -- 69	18 -- 69
Average Age	32.33	35.27	33.8
<b>Gender Distribution</b>			
Males	9	9	18
Females	6	6	12
<b>Racial Distribution</b>			
Black	2	0	2
White	10	6	16
Indian	2	8	10
Coloured	1	1	2
<b>Occupation</b>			
Housewife	0	1	1
Mechanic	0	1	1
Office clerk	5	2	7
Pensioner	1	2	3
Paramedic	0	1	1
Sales Executive	1	1	2
Scholar	1	0	1
Seamstress	0	1	1
Student	6	6	12
Waitress	1	0	1

#### 4.6 INCIDENCE OF LUMBAR FACET SYNDROME AND SACRO-ILIAC SYNDROME

Table 4.32 The incidence of Lumbar facet syndrome and Sacro-iliac syndrome.

	McMannis	Intermittent	Total
Lumbar Facet Syndrome	4	7	11
Sacro-iliac Syndrome	1	0	1
Combined lumbar facet and Sacro-iliac Syndrome	10	8	18

Figure 4.11 The incidence of Lumbar facet syndrome and Sacro-iliac syndrome.



#### 4.7 NUMBER OF TREATMENTS GIVEN

Table 4.33 Number of treatments given.

	McMannis	Intermittent
<b>3 Treatments</b>	0	1
<b>4 Treatments</b>	2	1
<b>5 Treatments</b>	0	1
<b>6 Treatments</b>	1	1
<b>7 Treatments</b>	3	4
<b>8 Treatments</b>	9	7

## **CHAPTER 5**

### **5. DISCUSSION**

This chapter covers the discussion of the results obtained from the Numerical Pain Rating Scale 101 (NRS 101), the Short-form McGill Pain Questionnaire, the Oswestry Back Disability Index, Lumbar spine ranges of motion and Algometer readings.

Wilcoxon Signed Rank test for the NRS 101 during the treatment period (Table 4.1) (p value for the M group=0.0613685 and the I group=0.096092) and follow-up period (Table 4.2) (p value for the M group=0.5547 and for the I group=0.181449) resulted in the acceptance of the null hypothesis for both groups, indicating that no statistically significant change took place during the treatment or follow-up periods.

When the results of the two groups were compared using the Mann-Whitney U-test it was found that there was no difference between the two groups before treatment was started (Table 4.3). (p value for the 1st tx=0.233058, for the F tx=0.1635 and for the F/up C=0.234746). Although both groups did not show statistically significant improvement during the treatment period, both groups mean scores of pain intensity did decrease during this time. This decrease in pain was by similar amounts, so one group did not out-perform the other. This did not support the alternate hypothesis, which

stated that McMannis traction would be the treatment of choice in the chiropractic management of low back pain.

Wilcoxon's Signed Rank test for the Short-form McGill Pain Questionnaire readings during the treatment period (Table 4.4) resulted in rejection of the null hypothesis for both groups, indicating that a statistically significant change occurred during the period. (p value for the M group=0.038869 and for the I group=0.0008742). This change was in the form of reduction of the mean scores during the treatment time, indicating that the patients perceived a decrease in the extent of pain as the treatment took effect.

Wilcoxon's Signed Rank test for the Short-form McGill Pain Questionnaire readings during the follow-up period (Table 4.5) resulted in acceptance of the null hypothesis in both groups, indicating that no statistically significant change occurred during the period. (p value for the M group=0.34278 and for the I group=0.546491). Thus the patients maintained the initial decrease in pain but did not improve further during the follow-up period.

The results of the Short-form McGill Pain Questionnaire were compared using the Mann-Whitney U-test and it was found that no statistically significant change occurred between the two groups before the treatment

was started (Table 4.6). (p value for the 1st tx=0.491551, for the F tx=0.600452 and for the F/up C=0.785493). Both groups perceived an improvement in their condition during the treatment period (Table 4.6) and although this improvement was maintained during the one month follow-up period (Table 4.6) neither improved further.

Wilcoxon's Signed Rank test for the Oswestry Back Disability Index readings during the treatment period (Table 4.7) resulted in the rejection of the null hypothesis for the McMannis traction indicating that a statistically significant change took place during this period. (p value for the M group=0.0388669 and for the I group=0.386474). This change was in the form of the reduction of the mean scores over the treatment period, which indicates that the patients perceived a reduction in the pain and the effect it had on their daily activities. The readings resulted in an acceptance of the null hypothesis for the Intermittent group during the treatment period (Table 4.7), indicating that no statistically significant change took place during the period.

Wilcoxon's Signed Rank test for the Oswestry Back Disability Index readings during the one month follow-up period (Table 4.8) resulted in the acceptance of the null hypothesis for both groups, which indicates that no

statistically significant change took place during the period. (p value for the M group=1 and for the I group=0.148914).

When the results of the two group were compared using the Mann-Whitney U-test it was found that no statistically significant difference existed between the two groups, in terms of the Oswestry Back Disability Index scores, at all times of data collection. (Table 4.9). (p value for the 1st tx= 0.96685, for the F tx=0.392244 and for the F/up C=0.85129).

In terms of the patients subjective response to treatment the results varied considerably. The McMannis group showed a statistically significant decrease in the disability associated with low back pain during the treatment period and both groups showed a statistically significant difference in their perception of the extent to which they felt pain. Although the remainder of the readings resulted in no statistically significant difference, they all demonstrated a decrease in the mean scores during the treatment period, thus indicating a clinically significant improvement. During the one month follow-up these mean scores improved slightly, indicating that the improvement was maintained.

The results of the subjective data did not show any statistically significant difference between the two groups at any time of data collection. This did

not support the alternate hypothesis, which stated that McMannis traction is the treatment of choice in the chiropractic management of low back pain.

Wilcoxon's Signed Rank test for the Forward Flexion during the treatment period (Table 4.10) resulted in the acceptance of the null hypothesis for both groups, indicating that no statistically significant change occurred during the period. (p value for the M group=0.386474 and for the I group=0.267256).

Wilcoxon's Signed Rank test for Forward Flexion during the follow-up period (Table 4.11) resulted in the acceptance of the null hypothesis for the McMannis group, indicating that no statistically significant change occurred and the rejection of the null hypothesis for the Intermittent group, indicating that a statistically significant change occurred during the period. (p value for the M group=0.267256 and for the I group=0.00554577).

When the results of the two groups were compared using the Mann-Whitney U-test it was found that no statistically significant difference existed between the two groups, in terms of Forward Flexion, at all times of data collection. (Table 4.12). (p value for the 1st tx=0.156036, for the F tx=0.0318592 and for the F/up C=0.10333).

Wilcoxon's Signed Rank test for Extension (Table 4.13) (p value for the M group=0.77826 and for the I group=1); Right Lateral Flexion (Table 4.16) (p value for the M group=1 and for the I group=0.751826); Left Lateral Flexion (Table 4.19) (p value for the M group=0.77826 and for the I group=0.386474); Right Rotation (Table 4.22) (p value for M group=0.504983 and for the I group=1) and Left Rotation (Table 4.25) (p value for the M group=0.227799 and for the I group=0.227799) during the treatment period all resulted in acceptance of the null hypothesis, indicating that no statistically significant change occurred during this period.

Wilcoxon's Signed Rank test for Extension (Table 4.14) (p value for the M group=0.44969 and for the I group=1); Right Lateral Flexion (Table 4.17) (p value for the M group=0.772826 and for the I group=0.546491); Left Lateral Flexion (Table 4.20) (p value for the M group=0.34278 and for the I group=0.772826); Right Rotation (Table 4.23) (p value for the M group=0.44969 and for the I group=0.227799) and Left Rotation (Table 4.26) (p value for the M group=0.13057 and for the I group=1) during the one month follow-up period all resulted in the acceptance of the null hypothesis, indicating that no significant change occurred during this period.

When the results of the two groups were compared in terms of Extension (Table 4.15) (p value for the 1st tx=0.179593, for the F tx=0.933301 and for

the F/up  $C=0.325018$ ); Right Lateral Flexion (Table 4.18) (p value for the 1st tx= $0.0972307$ , for the F tx= $0.12704$  and for the F/up  $C=0.344934$ ); Left Lateral Flexion (Table 4.21) (p value for the 1st tx= $0.103447$ , for the F tx= $0.05191$  and for the F/up  $C=0.143058$ ); Right Rotation (Table 4.24) (p value for the 1st tx= $0.296729$ , for the F tx= $0.463103$  and for the F/up  $C=0.293167$ ) and Left Rotation (Table 4.27) (p value for the 1st tx= $0.158141$ , for the F tx= $0.502507$  and for the F/up  $C=0.449493$ ) using the Mann-Whitney U-test it was found that no statistically significant difference existed between the two groups, at all times of data collection.

Wilcoxon's Signed Rank test for the Algometer readings during the treatment period (Table 4.28) resulted in the acceptance of the null hypothesis for both groups indicating that no statistically significant change occurred during this period. (p value for the M group= $0.301698$  and for the I group= $0.181499$ ).

Wilcoxon's Signed Rank test for the Algometer readings during the follow-up period (Table 4.29) (p value for the M group= $0.789264$  and for the I group= $0.0388669$ ) resulted in the acceptance of the null hypothesis for the McMannis group, which indicated that no statistically significant change occurred, and rejection of the null hypothesis for the Intermittent group, which indicated that a statistically significant change occurred during this

period. This change was in the form of an increase in the mean scores during the follow-up period, indicating that the patients perceived a decrease in the extent of pain felt over the affected spinous process or Sacro-iliac joints as the treatment took effect.

When the results of the two groups were compared using the Mann-Whitney U-test it was found that no statistically significant difference existed between the two groups, in terms of the Algometer readings, at all times of data collection. (Table 4.30). (p value for the 1st tx=0.394261, for the F tx=0.454647 and for the F/up C=0.575168).

Although no statistically significant changes occurred in the objective findings a clinically significant improvement occurred in both the Lumbar spine ranges of motion and the patients levels of pain felt over the affected spinous processes in both groups. The overall implications of the Mann-Whitney U-test are that the McMannis group showed no significantly better changes than the Intermittent group. These results once again indicated a rejection of the alternative hypothesis which stated that McMannis traction was the treatment of choice in the chiropractic management of low back pain.

When analysing the statistics obtained from the subjective and objective data, in this study, the results did not follow a particular pattern. Both groups showed statistically significant improvement during the treatment period in their perception of the extent of pain (Short-form McGill Pain Questionnaire) and the McMannis group showed a decrease in the disability (Owestry Back Disability Index) associated with low back pain. The Intermittent group showed statistically significant improvement in terms of the level of pain over the spinous processes and Forward Flexion during the one month follow-up period.

According to Pope et al. (1980) in Bolton (1994) although physical measures may be considered as objective they are almost certainly influenced by the patient's motivation, effort and psychological state. It has been reported by Hirsch et al. (1991) in Bolton (1994) that patients showing abnormal illness behaviour performed at a lower level than they were physically capable of. Furthermore, it was apparent that patients dealt with their back pain in different ways so that the severity of the pain and its attendant disability varied considerably from one person to the next. (Thus, biomechanical measures often described as objective may well reflect a varying degree of subjectiveness as well as physical capability (Bolton 1994) ).

Notwithstanding the appropriate pre-testing of outcome measures, it should be noted that all outcome data were gathered with some degree of measurement error, of which no measuring instrument is completely free (Bolton 1994). Careful scrutiny of the literature suggested that the reliability of measures of spinal mobility, muscle strength and lifting capacity, even when using relatively sophisticated equipment, was often poor to moderate, so that a cautionary approach should always be adopted when using them as clinical outcome measures (Waddell et al. 1982, Boline et al. 1992 and Hazard et al. 1993) (cited by Bolton 1994).

Both objective and subjective outcome measures were open to the criticism that they rely, to greater or lesser extent, on patient interpretation and this should always be taken into account when interpreting the data. This was, perhaps, the biggest limitation when measuring treatment efficacy. (Bolton 1994).

According to the results of Twomey's (1985) cadaveric study on sustained lumbar traction, they indicated that vertebral separation was greatest in those subjects with healthy intervertebral discs, and that residual deformation was largest in older subjects. Thus factors such as age, sex, occupation, as well as degeneration of the lumbar spine and intervertebral

discs might have had a bearing on the results of this study, but due to a very small sample size were not taken into account.

In a true clinical situation a chiropractor would not limit himself to two modalities but could also employ techniques such as cryotherapy, heat, massage and electrotherapy. In order to eliminate contamination of the effects of traction, additional physical modalities were not used in this study. However, according to Geiringer et al. 1988 whether or not paraspinal muscles were primarily involved in the condition being treated with traction, their relaxation was crucial during the procedure. Superficial heat was therefore often used prior to or concomitant with the application of traction to facilitate muscular relaxation. In addition the patients were not given a suitable exercise programme to maintain the effects of the spinal manipulation and traction. This could be another reason why the traction treatment was not as effective as anticipated.

In management studies where two or more treatment modalities are compared, the blinding of patients and therapists is difficult to achieve (Geiringer et al. 1995:b). Blinding could be ensured, in part, by selection of patients who have had no previous experience with the interventions. In this study neither the patient nor the therapist were blinded, in addition the therapist also played the role of assessor. Ideally pain sensitivity and

lumbar spine range of motion should have been measured by an assessor who was blind to the treatment allocation. Even the researcher who analyses the data should be blinded in future studies.

The RAND Health Insurance Experiment was designed to assess how varying the patient's share of costs for health services affected their use of services, the quality of their care, and the state of their health. Most private practices are run on a cash basis as opposed to this study which was set in a teaching clinic at which patients involved in research programmes were treated free of charge. As a result of the patients not having to pay for their treatment, I felt that they were not always compliant, as they had nothing to lose if they did not attend their treatment or follow-up consultations.

According to Bolton (1994) if there was a failure to demonstrate a beneficial effect of a treatment modality, consideration should be given to the possibility that this was not because the treatment was not efficacious, but that the outcome measures, for whatever reason, had failed to detect it. As with any practical procedure there is scope for much individual variation. Clearly, caution should be indicated in drawing broad conclusions on the values of mobilisation and or manipulation from any study (Sims-Williams et al. 1979).

It was difficult to compare these results to previous studies, as a majority of the previous works had been studies of manipulative therapy for the treatment of low back pain utilising medical, osteopathic or physiotherapy-trained practitioners of manipulation. Chiropractors specialise in the delivery of specific spinal adjustments and commonly utilise different manipulative techniques.

The sample size of this study was too small and did not represent a normal distribution of the population. I believe that this may have had an effect on the statistical results. To redesign this study I would increase the sample size of 15 patients per group to at least 30 patients for the sample to be assumed a normal distribution.

The Kirkaldy-Willis diagnostic model (Kirkaldy-Willis 1992:121) for classifying mechanical lower back pain includes several diagnoses. In this study patients with lumbar facet syndrome, sacro-iliac syndrome or a combination of these two were included, as these were found to be the most common condition within this classification system (Kirkaldy-Willis 1988:288). In order to improve the validity of future studies, the possibility of treating a specific syndrome such as posterior lumbar facet syndrome should be adopted.

Although the data did not produce statistically significant results, examination of the mean scores of both subjective and objective data revealed clinically significant differences over the treatment period and these improvements were maintained over the one month follow-up period.

Thus, on the basis of this study, the data is insufficient to support or refute the efficacy of McMannis traction or Intermittent traction in conjunction with spinal manipulation for patients with chronic low back pain. Statistical inquiry using a larger sample size might reveal more significant results.

## **CHAPTER 6**

### **6. CONCLUSIONS AND RECOMMENDATIONS**

Thirty subjects completed the study comparing the effects of McMannis and Intermittent traction in conjunction with chiropractic manipulation in the treatment of chronic mechanical low back pain. The results indicated that statistically significant subjective difference, in the form of decreased Short-form McGill Pain Questionnaire scores, occurred in both groups of patients during the treatment period. The McMannis group also showed an increase of functional activities that were previously affected by back pain. (indicated by the scores of the Oswestry Back Disability Index). However, these results of the Oswestry Back Disability Index showed no statistically significant difference compared to the Intermittent group. The Intermittent group showed statistically significant objective improvement in terms of Forward Flexion and pain sensitivity (Algometer readings) during the one month follow-up period. Thus the subjective and objective results of this study did not follow a consistent pattern.

According to a study performed by Waagen et al. (1986) one of the difficulties they encountered was the evaluation of the results of numerous objective tests of spinal mobility used to monitor the therapeutic progress.

Similar results, as well as contradictory and confusing findings have been reported by several investigators using similar standard objective function tests. (Waagen 1986).

They stated further that a possible solution to the problem presented by such contradictory results may be to use global indexes which combine the results of numerous objective tests as recommended by Lankhorst et al. (1982) and Million et al. (1982). This results in a reduction in both intra- and inter-observer error. (Cited by Waagen et al. 1986).

The results of this investigation are based on a small number of patients and require confirmation and modification using a larger sample size, so as to represent a normal distribution. Long-term trials in which patients are monitored for at least a year are also required.

Although the results of this study preclude the drawing of strong conclusions, chiropractic in conjunction with traction seemed to be an effective treatment of chronic low back pain in terms of clinical findings. However, studies with a better research methodology and larger sample size are clearly required.

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## **APPENDIX 8.1**

### **PATIENT INFORMED CONSENT FORM.**

I the undersigned, ....., have been explained the nature of this research project involving the treatment of lower back pain and therefore give my informed consent to be examined, treated and / or x-rayed at the Technikon Natal Chiropractic Day Clinic. I agree to comply with the instructions as stipulated by the intern in order for the successful completion of this research project.

Signature:.....

Date:.....

## APPENDIX 8.2

### 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

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

**Genital**

**Vascular**

**Musculoskeletal**

**Neurologic**

**Haematologic**

**Endocrine**

**Psychiatric.**

**TECHNIQUE 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.

**SEATED EXAMINATION**

**Spinal posture**

**Head**

scalp

skull

face

skin

**Eyes**

conjunctiva

sclera

eyebrows

eyelids

lacrimal gland

nasolacrimal duct

alignment

corneal reflex

ocular movement

L  
III IV VI

R  
III IV VI

visual fields

accommodation

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  
C1 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

dyadiadochokinesia

**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

7.  
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 hyperaesthesia  
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 reflexes**

patellar

Achilles

**plantar reflex**

**Rectal examination:**

**Inspection**

sacroccocygeal & perianal areas

**Palpation**

sphincter tone

tenderness

induration

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 :**

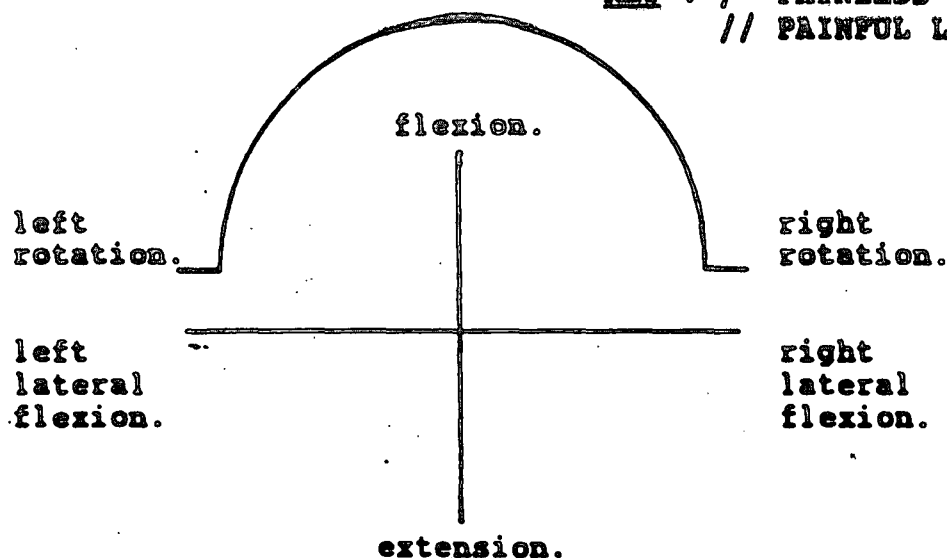
Posture  
 Minor's Sign  
 Skin  
 Scars  
 Discoloration  
 Muscle tone  
 Bony and soft tissue contours

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

**PRONE :**

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

Gluteus Maximus  
Active MP Trigger Points:

QL  
Glut. Med.  
Glut. Max.  
Glut. Min.  
Piriformis  
Hamstrings  
TFL

**NON-ORGANIC SIGNS :**

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

**GAIT :****Rhythm****On toes (standing)****On heels (standing)****Half-squat on one leg****Remarks :** \_\_\_\_\_**NEUROLOGICAL EXAMINATION :****DERMATOMES: Left, Right. MYOTOMES: Left, Right. REFLEXES: Left, Right**

T12	hip flex	C5
L1	hip int rot	C6
L2	hip ext rot	C7
L3	hip abd	
L4	hip add	
L5	knee flex	
S1	knee ext	
S2	dorsiflex	
S3	plantarflex	
	eversion	
	ext.hall.long	

**Tripod****Kemp's Test****COMMENTS:** \_\_\_\_\_

lay	Left						Right					Jt. play	
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 8.5

### NUMERICAL PAIN RATING SCALE 101.

Patient Name: \_\_\_\_\_

File number: \_\_\_\_\_ Date: \_\_\_\_\_

Please indicate on the line below the number between 0 and 100 that best describes the pain of your major problem at this point, when it is at its WORST. A zero (0) would mean "no pain at all" and one hundred (100) would mean "pain as bad as it could be".

Please write only one number.

0 \_\_\_\_\_ 100

Please indicate on the line below the number between 0 and 100 that best describes the pain of your major problem at this point, when it is at its LEAST. A zero (0) would mean "no pain at all" and one hundred (100) would mean "pain as bad as it could be".

Please write only one number.

0 \_\_\_\_\_ 100

# APPENDIX 8.6

- 3 -

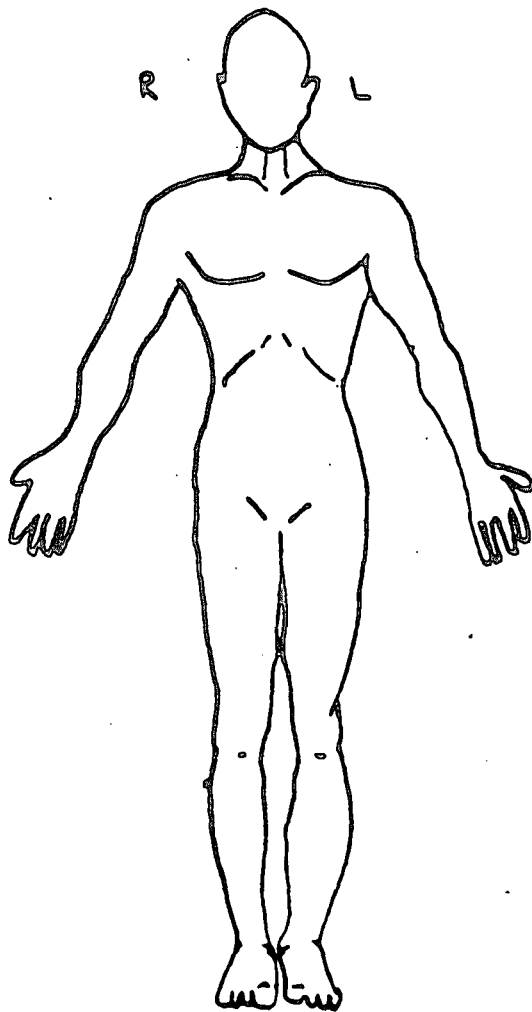
PATIENT NAME: \_\_\_\_\_ FILE # \_\_\_\_\_ DATE: \_\_\_\_\_

In the diagram provided below, please mark the areas on your body which you feel best represent the pain(s) or sensation(s) you are experiencing. Please include all areas. Use the symbols provided below.

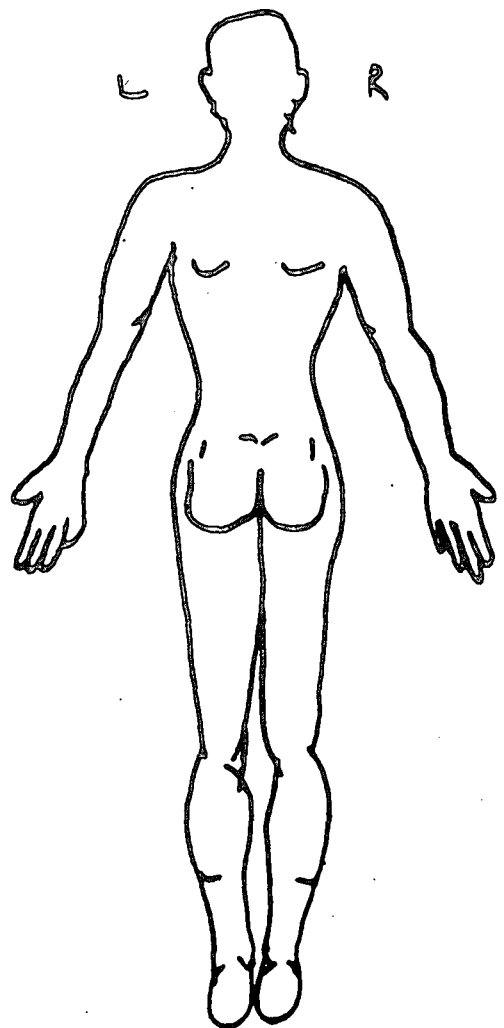
## SYMBOLS

numbness	==
	==
burning	XXX
	XXX
dull and aching	+++
	+++

pins and needles	.....
	.....
stabbing and sharp	////
	////
stiff and tight	ZZZ
	ZZZ



FRONT



BACK

P.T.O.

## APPENDIX 8.7

### THE SHORT-FORM MCGILL PAIN QUESTIONNAIRE

Patient Name: \_\_\_\_\_

File number: \_\_\_\_\_ Date: \_\_\_\_\_

	None	Mild	Moderate	Severe
Throbbing	0)	1)	2)	3)
Shooting	0)	1)	2)	3)
Stabbing	0)	1)	2)	3)
Sharp	0)	1)	2)	3)
Cramping	0)	1)	2)	3)
Gnawing	0)	1)	2)	3)
Hot-burning	0)	1)	2)	3)
Aching	0)	1)	2)	3)
Heavy	0)	1)	2)	3)
Tender	0)	1)	2)	3)
Splitting	0)	1)	2)	3)
Exhausting	0)	1)	2)	3)
Sickening	0)	1)	2)	3)
Fearful	0)	1)	2)	3)
Punishing-cruel	0)	1)	2)	3)

## APPENDIX 8.8

### OWESTRY BACK DISABILITY INDEX

Patient Name: \_\_\_\_\_

File Number: \_\_\_\_\_ Date: \_\_\_\_\_

This questionnaire has been designed to give the doctor information as to how your back pain has affected your ability to manage every day life. Please answer every section and mark in each section only the one box which applies to you.

#### 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

- ☐ 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
- ☐ I can lift very light weights
- ☐ I cannot lift or carry anything

### **Section 4-Walking**

- ☐ Pain does not prevent me from walking any distance
- ☐ Pain prevents me from walking more than 2.2 km
- ☐ Pain prevents me from walking more than 1.1 km
- ☐ Pain prevents me from walking more than 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 favourite chair as long as I like
- ☐ Pain prevents me from sitting more than 1 hour
- ☐ Pain prevents me from sitting more than half an 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 more than 1 hour
- ☐ Pain prevents me from standing more than 30 minutes
- ☐ Pain prevents me from standing 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 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 no extra pain
- ☐ My social life is normal but increases the degree of pain
- ☐ Pain has no significant effect on my social life except 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 using pills
- ☐ Even when I take pills I have less than 6 hours sleep
- ☐ Even when I take pills I have less than 4 hours sleep
- ☐ Even when I take pills I have less than 2 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 extra pain
- ☐ Pain is bad but I manage trips over 2 hours
- ☐ Pain restricts me to trips less than 1 hour
- ☐ Pain restricts me to trips less than 30 minutes
- ☐ Pain prevents me from travelling, except to the doctor or hospital

## APPENDIX 8.9

### Objective Data

Patients Name: \_\_\_\_\_

File Number: \_\_\_\_\_

#### 1. INITIAL CONSULTATION

Date: \_\_\_\_\_

(1) Goniometer:	Flexion	_____
	Extension	_____
	R-lateral flexion	_____
	L-lateral flexion	_____
	R rotation	_____
	L rotation	_____

(2) Algometer:	L1	_____
	L2	_____
	L3	_____
	L4	_____
	L5	_____
	R SI joint	_____
	L SI joint	_____

#### 2. FINAL TREATMENT

Date: \_\_\_\_\_

(1) Goniometer:	Flexion	_____
	Extension	_____
	R-lateral flexion	_____
	L-lateral flexion	_____
	R rotation	_____
	L rotation	_____

(2) Algometer:	L1	_____
	L2	_____
	L3	_____
	L4	_____
	L5	_____
	R SI joint	_____
	L SI joint	_____

### 3. ONE MONTH FOLLOW-UP CONSULTATION

Date: \_\_\_\_\_

(1) Goniometer:	Flexion	_____
	Extension	_____
	R-lateral flexion	_____
	L-lateral flexion	_____
	R rotation	_____
	L rotation	_____

(2) Algometer:	L1	_____
	L2	_____
	L3	_____
	L4	_____
	L5	_____
	R SI joint	_____
	L SI joint	_____

## APPENDIX 8.10

Table A McMannis Group - Subjective Data

	Numerical Pain Rating Scale			McGill Short-Form			Owestry Index			Algometer Readings		
	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>
	50	77.5	55	84	64	64	28	24	24	1.8	2.6	2.5
	75	52.5	60	11	16	20	27	20	31	7	4.7	4.2
	50	55	45	20	9	4	22	29	31	5.8	4.8	4.4
	35	15	0	16	4	0	23	6	0	4.5	4.6	5.9
	10	65	65	11	73	62	18	26	20	2.6	4	2.7
	50	45	45	29	22	22	10	8	8	1.9	2.6	3.8
	50	50	55	2	9	9	16	20	20	4.4	3.6	2.5
	50	5	20	20	4	0	20	2	0	3.6	5	5.4
	65	10	0	20	0	0	8	0	0	2.3	2.8	4.1
	30	25	40	9	7	9	10	6	8	3.8	4.2	2.8
	30	12.5	10	9	2	2	1	6	6	5.2	3	5.2
	60	30	15	18	9	2	28	22	20	4.8	4.3	5.5
	47.5	45	22.5	40	38	24	8	2	3	4.8	5.2	5.9
	65	30	25	13	2	7	18	6	4	2.5	3.9	3.9
	50	30	40	13	9	4	24	8	8	6.2	6.3	5.6
Mean	47.83	36.5	33.17	21	17.87	15.27	18.07	12.33	12.2	4.08	4.11	4.29
Median	50	30	40	16	9	7	18	8	8	4.4	4.2	4.2
Std.	16.335398	21.397597	21.515498	19.654153	22.730931	20.967549	7.284687	9.911513	11.078938	1.618288	1.05929	1.254402
Coeff.	34.150658	58.623552	64.870849	93.591203	127.225362	137.342022	40.321147	80.363621	90.810963	39.66393	25.794399	29.217433

# APPENDIX 8.10 (Continued)

Table B Intermittent Group - Subjective Data

	Numerical Pain Rating Scale			McGill Short-Form			Owestry Index			Algometer Readings		
	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>
	20	20	10	9	4	2	17	11	10	2.6	2.9	3.3
	40	0	40	2	2	2	6	8	10	4.5	3.5	4.6
	0	20	10	13	2	7	16	16	13	4.7	4.7	4.9
	90	85	80	87	69	73	36	38	24	4.5	5.3	5.4
	37.5	0	0	9	0	0	31	15	17	2.6	3.3	3.1
	35	35	40	20	16	16	8	8	12	3.6	4.3	4.7
	50	40	30	22	9	2	25	6	6	3.3	3.2	3.3
	32.5	50	35	31	18	9	16	20	17	4.3	4.4	3.4
	40	60	50	22	9	27	26	34	30	2.8	3.7	3.5
	35	30	10	20	4	2	13	10	8	4.4	4.9	5.4
	35	10	0	29	11	2	20	2	2	4.8	5.9	6.4
	40	0	5	36	11	4	20	10	4	4.4	2.6	3
	51	12.5	10	29	7	7	6	6	6	3.9	3.2	4.2
	40	20	15	16	9	4	15	9	0	1.1	1.2	2.3
	80	10	45	2	2	18	30	22	20	2	2.6	3.2
Mean	41.73	26.17	25.33	23.11	11.53	11.67	19	14.33	11.93	3.57	3.71	4.05
Median	40	20	15	20	9	4	17	10	10	3.9	3.5	3.5
Std.	21.403326	24.401161	22.793065	20.430603	16.741167	18.569047	9.157355	10.314114	8.396144	1.122921	1.215887	1.142595
Coeff.	51.285926	93.252845	89.972625	88.316726	145.154626	159.163264	48.196603	71.958936	70.358751	31.483776	32.743812	28.235466

# APPENDIX 8.10 (Continued)

Table C McMannis Group - Objective Data

	Forward Flexion			Right Lateral Flexion			Left Lateral Flexion		
	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>
	26	30	30	20	14	12	18	12	12
	30	38	36	20	22	22	26	26	26
	30	18	24	16	14	16	18	14	18
	34	40	42	24	24	20	24	22	24
	30	35	34	16	18	20	14	20	22
	34	38	38	26	24	28	24	26	28
	36	32	30	20	18	18	20	20	22
	30	36	38	18	26	26	20	26	26
	36	37	40	20	22	24	22	20	24
	40	40	39	18	18	20	16	18	18
	30	30	35	26	26	28	28	26	26
	34	34	36	26	26	22	28	26	20
	30	29	34	24	26	20	24	26	20
	30	27	30	30	22	20	28	22	20
	30	35	40	12	10	14	10	10	14
Mean	32	34.6	36.4	21.07	20.67	20.67	21.33	20.93	21.33
Median	30	35	36	20	22	20	22	22	22
Std.	3.545621	7.169379	5.997619	4.83243	5.10835	4.639376	5.433582	5.444088	4.577377
Coeff.	11.080066	20.72075	16.476974	22.938751	24.717822	22.448593	25.469914	26.00679	21.456455

# APPENDIX 8.10 (Continued)

Table D McMannis Group - Objective Data

	Extension			Right Rotation			Left Rotation		
	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>
	15	18	18	20	20	20	18	18	20
	15	10	13	20	18	20	20	18	18
	12	8	8	12	12	12	10	12	12
	11	15	17	22	20	24	20	20	24
	10	14	15	16	20	20	18	22	24
	15	16	14	12	12	18	12	12	16
	6	10	10	30	30	28	26	28	28
	15	15	15	10	12	12	12	16	16
	14	14	14	28	28	30	24	22	28
	14	15	15	26	26	20	26	26	22
	11	11	10	28	30	30	26	30	30
	15	14	17	24	28	30	26	28	30
	13	12	12	20	18	18	20	18	12
	11	9	11	20	22	22	20	22	22
	13	16	16	14	20	20	12	20	20
Mean	12.66	13.13	13.67	20.13	21.07	21.6	19.33	20.8	21.87
Median	13	14	14	20	20	20	20	20	22
Std.	2.218966	2.948769	2.94392	6.345602	6.273148	5.865151	5.690426	5.492852	5.475486
Coeff.	23.276932	22.452555	21.54088	31.517891	29.777599	27.153478	29.43324	26.407945	25.040335

# APPENDIX 8.10 (Continued)

Table E. Intermittent Group - Objective Data

	Forward Flexion			Right Lateral Flexion			Left Lateral Flexion		
	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>	<i>First Tx</i>	<i>Final Tx</i>	<i>Follow-up</i>
	26	32	35	17	12	19	20	14	20
	30	32	34	21	26	26	23	22	24
	24	28	35	12	12	10	6	10	12
	35	28	32	22	18	18	20	20	18
	23	25	27	28	30	32	26	31	30
	32	35	35	20	14	18	22	14	24
	34	35	40	16	12	16	18	10	16
	35	30	37	12	20	20	14	20	20
	38	38	40	18	18	12	20	20	12
	25	26	28	20	20	28	18	16	20
	24	32	35	20	22	28	22	24	26
	31	28	13	12	16	20	12	16	16
	26	35	35	20	20	20	18	18	18
	29	29	30	14	16	12	16	14	14
	30	26	24	14	14	10	12	10	12
Mean	29.47	30.6	33.13	17.73	18	19.27	18.47	17.27	18.8
Median	30	30	35	18	18	19	18	16	18
Std.	4.703595	3.924283	4.596065	4.511361	5.237229	6.829209	4.015446	5.812138	5.440588
Coeff.	15.962428	12.824455	13.871422	25.440007	29.095719	35.445723	21.744294	33.661033	28.939299

# APPENDIX 8.10 (Continued)

Table F Intermittent Group - Objective Data

	Extension			Right Rotation			Left Rotation		
	First Tx	Final Tx	Follow-up	First Tx	Final Tx	Follow-up	First Tx	Final Tx	Follow-up
	9	16	11	19	20	16	20	18	18
	10	12	12	10	18	18	10	16	16
	17	12	16	28	24	28	28	28	30
	14	11	12	28	28	30	28	28	30
	10	13	10	30	34	32	28	36	30
	17	14	14	26	24	26	26	18	28
	14	11	15	14	18	22	14	18	20
	10	16	12	34	24	30	30	20	32
	18	18	15	26	26	30	20	26	30
	12	12	14	26	28	30	26	28	22
	11	15	15	28	32	32	28	30	30
	11	11	11	20	20	20	20	22	18
	10	14	14	16	14	14	16	16	16
	14	14	12	18	18	20	18	20	18
	11	8	8	22	20	14	20	20	18
Mean	12.53	13.13	12.73	23	23.2	24.13	22.13	22.93	23.73
Median	11	13	12	26	24	26	20	20	22
Std.	2.948769	2.531704	2.218966	6.663476	5.645744	6.696125	6.059439	5.993647	6.273148
Coeff.	23.527412	19.276932	17.426434	28.980331	24.339412	27.746376	27.422166	26.135091	26.431802

## APPENDIX 8.11

### Randomisation

1. M  
2. I  
3. I  
4. M  
5. I  
6. I  
7. I  
8. I  
9. I  
10. I  
11. I  
12. M  
13. I  
14. M  
15. M  
16. M  
17. M  
18. M

19. I  
20. M  
21. M  
22. I  
23. M  
24. M  
25. M  
26. M  
27. I  
28. M  
29. M  
30. I  
31. I  
32. M  
33. I  
34. I  
35. I  
36. M