

THE RELATIVE EFFECTIVENESS OF SPECIFIC PASSIVE  
MOBILIZATION VERSUS SPINAL MANIPULATION  
IN THE TREATMENT OF  
MECHANICAL LOW BACK PAIN

By

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## Dedication

This work is dedicated to my Creator from whom I received the strength and courage to complete this work and to my family and friends who encouraged and believed in me always.

I would like to extend a special mention to my friends Michael Bruce and Mark Atkinson for being constant fountains of objective wisdom and inspiration.

To Kari: "You knew..."

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## Abstract

The absence of tested theory has resulted in the continued variation of treatment protocols in the treatment of mechanical low back pain. This study was designed to determine the relative effectiveness of specific passive mobilization versus spinal manipulation in the treatment of uncomplicated mechanical low back pain. It was hypothesized that both spinal manipulative therapy and specific passive mobilization would be effective, but that manipulation would be significantly more effective in terms of objective and subjective findings, over the same two week treatment period.

This randomized clinical trial consisted of a sample population of thirty voluntary subjects, diagnosed as suffering from a Posterior facet syndrome of the lumbar spine, a Sacro-iliac syndrome or a combination of the two conditions. According to their diagnosis each group of fifteen patients received the appropriate spinal manipulation or mobilization, with a frequency of three treatments per week for two weeks. The patient then returned for a one month follow up consultation.

The outcome measurements included the response of patients to the NRS-101 pain intensity scale and the Oswestry Back Disability Index. This information was collected before the onset of treatment, at the final treatment and at the one month follow-up consultation. Objective data was gathered from goniometric and pressure algometer measurements. These were taken at the initial consultation, before every treatment and at the one month follow-up consultation.

Intra-group comparison of the results indicated that only the manipulation group showed a significant ( $p < 0.025$ ) improvement between the initial visit and the 1 month follow-up consultation with respect to the subjective data. For the objective data, over the same time period, the mobilization group showed significant changes in flexion and right rotation values as well as pressure algometry measurements. The manipulation group showed significant changes in all ranges of motion tested as well as pressure algometry measurements.

The inter-group comparison revealed no statistically significant results, but due to the low power of the study the chance of a type II error was high, thus making the incorrect acceptance of the null hypothesis a possibility.

It was therefore concluded that both treatment groups responded equally well to the treatment protocol given. It would seem from this pilot study that both spinal mobilization and spinal manipulation have a positive effect in increasing ranges of motion as well as decreasing pain and disability in patients suffering from uncomplicated mechanical low back pain originating from the lumbar facet joints, the sacro-iliac joints or both.

Further studies with larger sample sizes and greater specificity, utilizing these interventions are warranted.

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## **Definition of Terms**

**Dysfunction** refers to any joint where there is a decreased or aberrant mobility for which manipulation is indicated. In this context the state excludes hypermobility or instability (Haldeman et al. 1993)

**Manipulation** is a passive movement of short amplitude and high velocity which moves a joint into the paraphysiological range. This is accompanied by cavitation or gapping of the joint which is thought to involve gas separating from fluid. Usually accompanied by an audible pop or click, manipulation has been shown to result in increased joint motion compared to mobilization alone. This increase in motion lasts for a 20-30 minute refractory period during which an additional cavitation of the same joint will not occur. Manipulation is a passive dynamic thrust that causes cavitation and attempts to increase the manipulated joint's range of motion (Haldeman et al. 1993: 103).

**The diversified method** of manipulation, for the purposes of this study, refers to manipulation as defined above, but is applied after a detailed consultation documenting symptomatology and taking into account age, sex, lifestyle, occupation, and nature of the injury, and with the appreciation of the fact that the patient is in the midst of an ongoing process; therefore, it attempts to apply the most ideal technique within the context of the reality of the clinical picture. (Gitelman and Fligg: 483.)

**Mechanical low back pain** is defined as pain resulting from the inherent susceptibility of the spine to static loads due to muscle and gravity forces and to kinetic deviation from normal function (Gatterman 1990: 129).

Uncomplicated mechanical lower back pain refers to low back pain within the dysfunction stage, according to Kirkaldy-Willis classification and specifically to the posterior facet syndrome and sacro-iliac syndrome (Kirkaldy-Willis 1988:133-135).

**Mobilization** is a passive movement within the paraphysiological joint space administered by a clinician for the purpose of increasing overall range of motion.

(Haldeman et al. 1993: 103). Mobilization is a passive movement performed in such a manner (particularly in relation to the speed of the movements) that it is, at all times, within the ability of the patient to prevent the movement if he so chooses.

Passive oscillatory mobilizations are movements performed slowly (one in 2 seconds), or quickly (3 per second), smoothly or staccato, with small or large amplitude, and applied in any part of the total range of movement. These movements may be performed while the joint surfaces are distracted or compressed (Maitland 1986: 4).

## Chapter 1

### 1.0 Introduction

#### 1.1 The problem and its setting:

It is now generally accepted that between 60 and 80% of the general population will suffer from low back pain some day (Kirkaldy-Willis 1992: 2).

Besides health, the substantial financial implications associated with back pain are well documented and an ongoing concern to industry (Frymoyer 1991: 137).

Even though a well established model describing the patho-anatomy and patho-physiology of mechanical low back pain exists (Kirkaldy-Willis 1988: 134), a standardized and effectively proven treatment protocol has not been agreed upon to treat even the least complicated of mechanical back pain syndromes, namely that of simple spinal dysfunction (Van Tulder et al. 1997).

Manual therapy, in various forms, has been widely used to treat somatic pain syndromes and associated disorders of the back (Di Fabio 1992). In the dysfunctional phase of low back pain the phenomena of facet subluxation, synovitis and segmental muscle spasm, which constitute the representative patho-anatomy and patho-physiology are countered by increasing ranges of motion, whilst at the same time decreasing pain and muscle spasm (Kirkaldy-Willis 1988:133-135).

With this in mind, manual therapists have traditionally followed two main routes to reach this goal, namely that of spinal mobilization (Frost and Klaber Moffett 1992) or that of spinal manipulation (Haldeman et al. 1993).

Over a number of years various studies have contra-dicted each other as to the true efficacy of either spinal mobilization or manipulation on their own or in combination, with a resultant "stale mate" occurring (Di Fabio 1992). However, various authors agree that enough evidence exists, indicating the potentially important role of spinal mobilization and manipulation as

treatments for low back pain and subsequently for research in this field to be continued (Assendelft 1992).

It is also currently felt that spinal manipulation is of greater benefit in the treatment of mechanical low back pain than mobilization, largely because it has been more extensively studied and has often yielded significant results when pitted against some type of spinal mobilization in a clinical trial setting (Di Fabio 1992).

However, the analysis of valid trials still cannot make definite suggestions as to which type of manual therapy is most beneficial (Koes *et al.* 1995).

The reservations expressed by the scientific community are largely based on the methodological errors committed by researchers in the race to establish one therapy as superior to another (van Tulder *et al.* 1997).

It therefore stands to reason, that we should concern ourselves with simple questions regarding low back pain and try and answer them completely, before moving on to more complex, combination protocols.

This study will attempt to address some of the major research method shortcomings, whilst attempting to establish whether it is of greater benefit to manipulate the spine than to mobilize it passively in patients suffering from uncomplicated acute low back pain of mechanical origin.

## 1.2 Aims and Objectives of the study:

The aim of this investigation is to evaluate the relative effectiveness of spinal manipulation to specific passive mobilization, using subjective and objective measures, in order to determine which therapy method is more beneficial in treating mechanical low back pain.

Objective one will be to determine the effectiveness of spinal manipulation and also the effectiveness of specific passive mobilization, using objective measures.

Objective two will be to determine the effectiveness of spinal manipulation and also the effectiveness of specific passive mobilization, using subjective measures.

Objective three will be to evaluate the data from objectives one and two in order to determine whether one of these therapy methods is more beneficial in treating mechanical low back pain.

### 1.3 Benefits of the study:

This pilot study should add to the pool of knowledge on the topic of mechanical lower back pain by confirming the established trends as found by authors such as Di Fabio (1992) and it should accomplish this by using as many of the research method outlines suggested by authors such as Koes et al. (1996) and van Tulder et al. (1997).

A well-designed randomized clinical trial could serve as a “blue print” from which a larger study can be fashioned, taking into account the methodological principles proposed by the author, to attain results that are both conclusive as well as repeatable.

The author hopes that this investigation will serve to fuel the debate once again and inspire those affected to search for answers to the many questions which still elude us regarding mechanical lower back pain.

## Chapter 2

### 2.0 Review of the related literature

#### 2.1 Introduction:

The following is an overview of the related literature concerned with clinical trials on the topic of manipulation and mobilization in the treatment of mechanical low back pain. The theoretic basis for the action and effects of spinal manipulation and spinal mobilization as well as the basic clinical, etiological and epidemiological aspects of each are presented.

#### 2.2 Spinal degeneration and the need for effective treatment:

This study utilised the classification of low back pain as set out by Kirkaldy-Willis (1988: 117-131), which categorizes low back pain into three separate stages namely: **Dysfunction, instability and stabilization.**

##### Stage1 Dysfunction:

The cause of pathology in this phase may be due to rotational sprains, synovitis and associated nipping of the facet joint synovial fringe, para-spinal muscle spasm resulting in joint dysfunction and entrapment of the facet joint meniscoids. The aforementioned result in slight degeneration of the articular cartilage and intra-articular adhesions. The intervertebral disc is affected as it develops circumferential tears within the substance of the annulus fibrosis, which when they become more numerous, coalesce to form radial tears. These weaken the disc and predispose it to bulging and even herniation of the inner nucleus pulposus.

Symptoms associated with this type of pathophysiology are as follows:

- 1) Facet joint inflammation resulting in the production of inflammatory metabolites which stimulate pain sensitive nociceptors,
- 2) muscle spasm resulting in ischemia and pooling of metabolites, the associated chemical irritation may then also stimulate the pain sensitive nerve endings,
- 3) joint dysfunction which results in disturbed proprioception and gate control which then augments the perception of pain, this is a sclerotogenous pain and may therefor be referred or localized, and



4) the effect of disc pathology, if severe enough, may result in nerve root irritation following radicular pain characteristics.

#### Stage 2 Instability:

If degeneration continues from stage 1 the result is gross disc disruption, which is characterised by a decrease in discal water, proteoglycans and a coalescence of radial annular tears. A loss of disc height and circumferential bulging of the annulus, hyperlaxity of the facet joint capsule and increased degeneration of the facet cartilage, osseous erosion and ultimately osteophyte formation soon follow. The final outcome is excessive intersegmental motion leading to subluxation and lateral canal entrapment.

The symptoms associated with this phase include:

- 1) Coalescence of radial tears resulting in disc herniation which causes nerve root compression and consequently muscle weakness, reduced tendon reflexes and dermatomal hypoaesthesia,
- 2) inflammation causing muscle spasm and consequent antalgia, and
- 3) excessive movement results in intermittent lateral nerve root entrapments at one level with radicular patterns of pain referral which are aggravated by flexion, extension and rotational movements.

#### Stage 3 Stabilization:

Advanced pathology results in enlargement of the superior and inferior facets, osteophyte formation, loss of articular cartilage and periarticular fibrosis. Most of the disc is replaced by fibrous tissue, causing a substantial loss of disc height. Radiological studies show signs of subchondral sclerosis, peripheral osteophytes and some degree of ankylosis.

Symptoms included in this phase are:

- 1) Fixed lateral canal entrapment due to subluxation, osteophytes and disc fibrosis which results in continuous signs of muscle weakness, reduced tendon reflexes, and dermatomal hypoaesthesia, and
- 2) central canal stenosis due to enlarged inferior articular facets and osteophyte formation.

The symptoms related to this condition are partly due to impaired blood circulation and partly due to nerve compression. The consequences may include neurogenic claudication and cauda equina syndrome.

### 2.2.1 Clinical considerations:

Kirkaldy-Willis (1988: 134) further elaborated on his model by grouping the clinical lesions together that are likely to occur within each phase of spinal degeneration. This enables the examiner to correlate the clinical lesion with any particular phase, enabling him/her to have a better understanding of the pathological processes and consequently the possible effects they may have.

In the phase of dysfunction we include the following conditions:

- Posterior facet syndrome

- Sacroiliac syndrome

- Maigne's syndrome

Myofascial dysfunction syndromes of the following muscles: gluteus maximus, gluteus medius, gluteus minimus, quadratus lumborum, piriformis, tensor Fasciae latae and the hamstring group.

In the phase of instability we include:

- Disc herniation

- Facet and disc degeneration

- Lateral stenosis

- Central stenosis

In the phase of stabilization we include:

- Lateral stenosis

- Central stenosis

- Multilevel stenosis

- Disc herniation

### 2.2.2 Diagnostic criteria:

As this study elaborates solely on the dysfunction phase, and even more specifically on the Posterior facet syndrome and Sacroiliac syndrome, the diagnostic criteria governing these two conditions become pertinent.

The Posterior facet syndrome exhibits itself in the form of localized pain over the involved area and is usually unilateral. Referred pain to the buttock, posterior and lateral thigh, and

rarely below the knee.

The pain is sclerotogenous i.e. dull, deep and poorly defined. The severity of pain may vary from mild to severe and is aggravated by movement, whilst relieved by rest. Associated clinical *signs* include local tenderness on palpation of the affected areas, hypertonic paraspinal musculature, and reduced lumbar spine range of motion, especially in extension that aggravates the condition due to facet joint compression. Kemp's test and lumbar facet joint challenge are usually positive (Kirkaldy-Willis 1988: 133-135).

The Sacroiliac joint syndrome exhibits as pain in varying degrees over the back of the joint, referred pain to the groin, over the greater trochanter, down the back of the thigh to the knee and occasionally down the lateral or posterior leg to the ankle, foot and toes. Associated clinical signs include tenderness on application of pressure over the posterior superior iliac spine and in the region of the sacroiliac joint or buttock. Motion palpation findings of the joint as it moves in the sagittal plane may indicate reduced motion. Orthopaedically, the Patrick Faber, Gaenslen's, Erichsen's and lateral recumbent sacroiliac compression tests are normally positive (Kirkaldy-Willis 1988: 135-137).

These two conditions may be complicated by the subsequent development of the other at a later stage (Kirkaldy-Willis 1988: 133)

### 2.2.3 The impact of simple back pain:

It is evident from the above that the relatively "benign" phase of dysfunction has the ability to progress into the major disability associated with both the instability and stabilization phase, if not dealt with effectively from its onset. This seems to hold true when we consider the natural history of low back complaints.

A controlled prospective study by Bergquist-Ullman and Larson (1977), involving 217 patients suffering from acute- and subacute low back pain found that out of the 184 compliant patients, the mean duration of sick leave was 21 days. Interestingly though, it was found that 151 of the compliant patients suffered a recurrence within 1 year, causing them a further mean value of 16 days work absenteeism. This study indicated that for the 82% of patients suffering a recurrence, the absenteeism figure almost doubled. It could thus be extrapolated that the effect of treatment strategies was not adequate to sustain long-term health in the majority of patients.

Even though Hadler *et al.* (1987) suggests a spontaneous recovery rate of 80% for patients suffering with mechanical low back pain of less than four weeks duration, it is held by Kirkaldy-Willis (1988: 8) that of those patients, sixty percent have a chance of a recurrence in their low back pain over the following two years.

The above studies also indirectly point to the great costs incurred. These costs are directly incurred as a result of the amount of treatment required and indirectly, yet probably more importantly due to workman's compensation and loss of productivity from the complications encountered after the initial treatment of low back pain.

This is confirmed by the work of Frymoyer (1991: 10-19), who stated the following in an attempt to describe the magnitude of the costs involved in the treatment of low back pain disorders:

1. In subjects between the age of 25 and 44 years of age, the average days of work lost per 100 workers were calculated at 28.6 days per year,
2. for the 50 million working males in the U.S.A. between the ages of 18 and 55 years, it was calculated that low back pain resulted in a total 17 million work days lost each year, and
3. the total cost of low back disorders is estimated to range between 16 and 60 billion dollars a year in the U.S.A.

### 2.3 Manual Treatment:

Manual therapy has proven to be one of the most effective treatments for non-specific neck pain according to Koes *et al.* (1992). The authors conducted a randomized clinical trial on the effectiveness of manual therapy, physiotherapy and treatment by a general practitioner on chronic non-specific back and neck complaints of greater than six weeks duration. The physiotherapy group received exercises, massage and physical therapeutic modalities including electrotherapy, heat, ultrasound and diathermy. The manual therapy group received manipulation or mobilization according to the directives of the Dutch Society of Manual Therapy. The patients treated by the general practitioner received medication and advice regarding posture and exercise, while a fourth group acted as a control group and received de-tuned ultrasound or diathermy. The treatments were performed for a maximum period of 3-

months and follow-up measurements were taken at three, six and twelve weeks.

The results indicated that at three and six weeks the manual therapy group and physiotherapy group had a much greater improvement in their main complaints and the global perceived effect compared to the general practitioner and control groups. At twelve weeks the manual therapy had the highest mean improvement in the main complaint, but this was not statistically significant. Furthermore, no statistically significant difference within the groups was evident with regards to pain severity or daily functioning, and all groups tended to improve equally.

Spinal mobility did not seem to change significantly in any of the groups, and its suitability for measuring progress in patients with chronic neck and low back pain was questioned.

It is of interest to note that the manual therapy group received the least amount of treatments (5,4) as compared to the physiotherapy group (14,7), but no other significant differences were noted between the manual therapy and physiotherapy groups at any of the follow-up measurements.

A one-year follow-up indicated the manual therapy group to be slightly more effective than physiotherapy. Unfortunately, no clear distinction was made between the neck pain and back pain patient.

It was stated by the authors in their conclusion, that even though the results gained through manual therapy and physiotherapy were better than the placebo and general practitioner groups, that the differences found may have been due to non-specific (placebo) effects.

As can be seen from the above a lack of protocollization and description of interventions as well as a high number of variables made the drawing of precise conclusions from a potentially strong study difficult (Assendelft *et al.* 1992). It can be reasoned that by minimizing the number of co-interventions and by treating a specifically diagnosed condition, the relative worth of a treatment modality can be brought to the fore more effectively.

As stated previously, lesions found within the stage of dysfunction are usually initiated by trauma and show facet subluxation, synovitis and segmental muscle spasm as the representative patho-anatomy and patho-physiology (Kirkaldy-Willis 1988: 134).

The treatment goals of the dysfunction phase when considering the pathology found, should be geared at reducing pain and increasing segmental mobility to restore normal functioning. Different schools of thought, utilizing manual therapy, have developed their own theories regarding and accordingly, separate approaches to the treatment of low back pain. They have given preference to one of, or a combination of the body's ranges of motion to restore lost mobility. This meant that either manipulative approach or mobilization approach was favoured (Di Fabio 1992).

By understanding the effects of mobilizing or manipulating a joint, the reason for the disparity regarding the use of either treatment can be understood.

### 2.3.1 Manipulation:

During spinal manipulation the joint is carried deep into the para-physiological range for a very short time, the process of which can often be identified by a cracking sound within the joint (Sandoz 1976). The result is an increase in passive motion of the joint in all directions.

The possible effects of manipulation according to Calliet (1981: 129-130) are as follows:

1. A facet joint is immobilized by an acute synovial reaction and adherence of the joint surfaces of the facets takes place. The passive movement of the manipulation separates these surfaces,
2. manipulation allows an entrapped meniscus to exit the facet joint in which it became entrapped,
3. the capsule of the facet joint becomes lodged between two adjacent articular surfaces and the manipulative process allows this capsule to be freed,
4. the mechano-receptors of the joint are desensitised by the abrupt movement of the joint (manipulation), and reflex protective spasm is eliminated and allows the joint to move again,
5. the spindle systems of the adjacent muscles are reflexly stimulated by the dynamic thrust of the manipulation and reciprocally relax the extrafusal muscle fibres, and
6. the mal-aligned spinal segments are realigned to conform to the centre of gravity.

Wyke (1985: 75) suggests that the mechanoreceptor system has collateral branches of innervation which synapse on the nociceptor system, and that these synapses are inhibitory because of the type of neurotransmitter substance they release. Therefore, stimulation of the peripheral mechanoreceptor system through the manipulation will cause a presynaptic inhibition of nociceptive activity before it can be transmitted up into the central nervous system and be perceived as pain.

However, Bergmann *et al.* (1993: 139) reports that the specific mechanical and physiological changes that take place to relieve the signs and symptoms of joint dysfunction have not been accurately determined.

Mierau *et al.* (1988) confirms the hypothesized differences between the two approaches by stating that manipulation and mobilization are two distinctive therapies with different effects on joint function.

#### *Contra-indications to spinal manipulation:*

As previously discussed the selection criteria for subjects were aimed at admitting only those suffering from simple mechanical low back pain, however manipulation has been thought to be contra-indicated in more ominous conditions where the indiscriminate application of dynamic thrust may lead to adverse effects on the patient (Haldeman *et al.* 1993: 170-172).

Gatterman (1990: 67) lists the contra-indications to manipulation of the lumbar spine as follows:

Athero-sclerosis of major blood vessels, abdominal aneurism, prostate and bone tumours, bone infections (e.g. T.B., osteomyelitis), traumatic injuries (e.g. fractures, instability), arthritis (e.g. ankylosing spondylitis), psychological disorders (e.g. malingering), metabolic disorders (e.g. clotting disorders) and neurological disorders (e.g. space occupying lesions).

#### 2.3.2 Mobilization:

Active motion normally ranges between the neutral position and the point of tissue resistance, while passive motion extends past this up to the elastic barrier of the joint (Sandoz 1976).

The usual objective of mobilization techniques is to restore the normal ranges of passive motion from the neutral position to the elastic barrier (Schafer and Faye 1989: 12).

According to Boyling and Palastanga (1994: 646) the effects of mobilization due to the repetitive rhythmical movement will:

- 1) Affect the hydrostatics of the disc and the vertebral bodies,
- 2) activate the type I and II mechanoreceptors in the capsule of the facet joint influencing the spinal gating mechanism,
- 3) alter the activity of the neuromuscular spindle in the intrinsic muscles of the segment subsequently affecting bias in the grey matter cells,
- 4) and assist the pumping effect on the venous plexus of the vertebral segment.

Mayer *et al.* (1991: 90) suggests that continuous passive mobilization facilitates the transport of intrasynovial contents and thereby enhances the healing process.

#### *Contra-indications to spinal mobilization:*

The contra-indications for mobilization are potentially the same as for manipulation, however according to Maitland (1986: 110), some conditions may be contra-indicated for manipulation yet may not be contra-indicated to mobilizations as described in his text i.e. active arthritic, vascular as well as metabolic conditions. This statement is made due to the gentle nature of the technique and use of the physiological range, which the patient may resist at any stage, which allows it to be applied more widely.

The previously discussed concepts present an obvious question, when the goal of treatment is to increase the range of motion in a dysfunctional joint, which approach is better, passive mobilization within the physiological range or manipulation into the para-physiological range?

## 2.4 Efficacy Studies:

### 2.4.1 The efficacy of spinal manipulation:

Several valid efficacy studies have been conducted indicating manipulation on the low back to be an effective treatment when compared to a placebo-control group (Di Fabio 1992).



Sanders *et al.* (1990) illustrated the immediate effect of manipulation on low back symptoms. 18 manipulatively “naive” patients suffering from acute low back pain of less than 2 weeks duration were used in the study, ranging between the ages of 22 and 56 years. These patients agreed to stop the use of medications 48 hours prior to the study. Patients were divided into 3 groups of 6, with an experimental group receiving spinal manipulation, a control group receiving no treatment and a “sham” group receiving only light touch without manipulation. A five point visual-analog scale indicated a small, but significant reduction in pain scores in the experimental group, after a manipulation focused at the L4/5 to S1 segments.

The immediate reduction in pain symptoms in the low back following manipulation was also noted by Glover *et al.* (1974) as well as by Fisk (1979).

Hoehler *et al.* (1981) studied 95 patients with restricted or painful spinal ranges of motion who had no previous experience with manipulative therapy. Further inclusion criteria were that subjects were not receiving disability income, were not involved in any litigation, had no previous back surgery, were not obese and did not report drug abuse.

Manipulation versus a placebo treatment of soft tissue massage provided immediate alleviation of low back pain. However, no difference was found at the termination of treatment, and after a 3 week follow-up period even though a variable amount of treatments were given to a specific patient during the course of the study.

Evans *et al.* (1978) reported manipulation to have a somewhat transient effect on ranges of motion, in patients with mechanical back pain. The authors conducted a simple “cross-over” design on two groups of patients over two consecutive 3- week intervals. This design ensured patient exposure to both the experimental and control regimen. The group receiving manipulation during the first 3 weeks, received no treatment and no analgesics during the second 3-week period. The group receiving no treatment during the first three weeks then “crossed over” and received manipulation for the last three weeks of the study. Spinal mobility was increased significantly during the three weeks of spinal manipulation, however this gain was then lost over the following three weeks of control treatment.

Koes *et al.* (1991) reviewed 35 randomized control trials comparing spinal manipulative techniques with other forms of conservative therapy. The objective of the study was to assess the efficacy of spinal manipulation for patients with back and neck problems on a scoring system with a maximum rating of 100 points. The papers assessed included physiotherapists, osteopaths and chiropractors. Each paper was scored for the quality of methodology. No study scored higher than 60, thus the authors subsequently concluded that the efficacy of manipulative treatment for patients with back and neck pain had not been convincingly demonstrated in the literature reviewed.

This study was not devised to discredit previous research studies, but was aimed at making researchers aware of improvements that needed to be made in their research design so, as to render results achieved in future studies less vulnerable to technical error criticism.

#### 2.4.2 The efficacy of spinal mobilization:

Di Fabio (1992) stated in a review of relevant clinical studies that the only acceptable low back pain study establishing mobilization as an effective treatment when compared to a control treatment, was that of Nwuga (1982). This author utilized a lumbar oscillatory mobilization combined with a "push-relax" technique as an experimental procedure in a clinical trial for patients diagnosed with a lumbar disc protrusion. Patients ranged between 20 and 40 years old and were excluded if neurological disturbances were of greater than two weeks duration. The author found that the mobilization group showed significant increases in lumbar motion and straight leg raising when compared to the controls, which received short-wave diathermy and lumbar flexion exercises. The functional significance of improvement in the straight leg raise was not described.

A 1990 study conducted by MacDonald *et al.*, questioned the efficacy of mobilization. This study reported that for patients suffering from non-specific low back pain, osteopathic manual therapy techniques, which were classified as mobilizations by Di Fabio (1992), showed no statistically significant improvement in patients with a complaint duration of less than two weeks. This open-controlled assessment indicated from disability index measurements that for a 0-13 day complaint duration, the experimental protocol actually delayed recovery when compared to the control group, who received only postural advice as management ( $p = 0.16$ ).

Brodin (1984) conducted a randomized control trial on 63 patients suffering from mechanical neck pain. Three groups were created within the study namely a control group receiving no treatment, an experimental group receiving passive mobilization without thrusting and a third group receiving massage, gentle traction and electrical stimulation. All treatments were performed three times a week for three weeks and all three groups were advised to take a salicylate preparation during this period. Cervical ranges of motion and pain intensity were measured before the treatment, weekly during the treatment period and after a one-week follow-up period.

Results indicated that one week after the treatment had ended 48% of the mobilization group, 22% of the control group and 12% of the massage group had no neck pain. Overall 78% of the mobilization group experienced a decrease in pain as compared to 39% of the control group and 35% in the massage group. The difference was found to be statistically significant ( $p < 0.05$ ).

A significant increase in the range of motion was evident in the mobilized group as compared to the other groups after the third week of treatment ( $p < 0.001$ ), but this difference was not as significant after the fourth week ( $p < 0.1$ ).

Brodin (1984) concluded that mobilization was an effective form of treatment for mechanical neck pain, and although cervical range of motion increased initially, it tended to decrease once treatment had ended. He further remarked that a relationship between increased mobility of the cervical spine and a decrease in pain could not be made in the outcome of patients suffering from mechanical neck pain.

It could therefore be deduced from the above that passive mobilization, when applied to the lumbar spine, could be effective in relieving pain and increasing mobility in patients suffering from mechanical low back pain, but that a direct correlation between two does not necessarily exist.

#### 2.4.3 The efficacy of manipulation and mobilization:

Farrell and Twomey (1982) studied two groups of patients ( $n=24/\text{group}$ ) suffering from low back pain with a duration of less than three weeks. The experimental group received a

combination spinal manipulation and passive mobilization, whereas the control group received microwave diathermy, abdominal exercises and ergonomic instruction. Patients were considered asymptomatic when functional activities could be performed essentially without pain and when measurements of lumbar movement and SLR(straight leg raise) could be made without a report of pain.

The manual therapy group achieved symptom-free status approximately 1 week sooner than the control group, however 91% of all the subjects were asymptomatic within 4 weeks.

#### 2.4.4 Studies comparing manipulation and mobilization:

In a review of relevant studies by Haldeman and Phillips (1991 2: 1582-1583) it was suggested that spinal manipulative therapy is a significantly more effective treatment than bedrest and analgesia, analgesia alone, short wave therapy, heat, exercise and massage, or mobilization, in the treatment of low back pain.

Hadler et al. (1987) conducted a control trial comparing manipulation and mobilization as treatments for acute low back pain. They found that in the first week following treatment, manipulation subjects improved to a greater degree ( $P = 0.009$ , t-test) following treatment and did so more rapidly ( $p < 0.025$  Wilcoxin rank-sum test). However, this study was not adequately randomized, which prohibits the drawing of strong conclusions from the gathered results.

Meade et al. (1990) compared chiropractic and outpatient treatment of low back pain. In the study standardized chiropractic manipulative techniques were compared to an array of accepted conservative medical interventions, among these were the physiotherapy techniques of Maitland manipulation/ mobilization and Cyriax manipulation as well as traction and exercise therapies. Using the Oswestry Low Back Disability Index, the straight leg raise test and lumbar flexion as criteria, they found chiropractic spinal manipulation to be significantly more effective i.t.o. disability after a two year follow up period. The results of the study led the authors to conclude that for patients in whom manipulation is not contra-indicated chiropractic treatment almost certainly offers worthwhile, long-term benefit in comparison with out patient management.

From these results suggestions were also aired by the authors that chiropractic treatment should form part of the British National Health Service practice.

In a subsequent review of randomized clinical trials Assendelft *et al.* (1992) heralded this study as methodologically the "best" randomized clinical trial ever devised on the topic of spinal manipulation as a treatment for low back pain.

In a review of relevant studies concerned with the manual treatment of somatic pain syndromes Di Fabio *et al.* (1992) states that manual therapy can be an effective modality when used to treat patients with somatic pain syndromes. However, the author further states that there may be a difference in the efficacy between manipulation and mobilization. His doubt stems from the lack of studies using mobilization as a primary intervention.

In his study the author could only identify one acceptable efficacy study in favour of mobilization as a primary intervention versus three studies with a negative result.

In contrast, Cote *et al.* (1994) found no significant difference when manipulation was compared to a mobilizing technique for mechanical low back pain. The methodology of this study incorporated three pressure algometry measurements per patient, within a 30-minute period, after one intervention, on a sample of thirty patients.

This study was unable to show any statistically significant difference in algometry measurements between the two groups. The authors stated that in the studies where results indicated manipulation to be effective, especially those dealing with chronic low back pain, a therapy regimen of 10-12 treatments were given, consequently the authors suggested that their lack conclusive findings may have been due the single intervention given. The Cote *et al.* (1994) study also relied on a single objective measurement taken from a small sample group (thirty patients). According to the authors a larger sample size would create more homogenous groups and help to detect true changes of smaller magnitude. The authors suggested that to measure the true effect of an experimental procedure with the algometer, it would be more advisable to localize the areas of maximal tenderness specific to individual patient, rather than using a pre-set point of measurement.

In the search for specific treatment protocols, clinical trials attempting to show the value of spinal manipulation have often used mobilization techniques as controls, against which was pitted some type manipulative experimental procedure (Di Fabio *et al.* 1992).

The majority of valid efficacy studies have indicated that spinal manipulation seems to be a more effective treatment for mechanically based low back pain (Di Fabio *et al.* 1992).

However, these studies have fallen short in a number of different areas, so as to leave doubts, as to the true value of the results gained and thus the treatments suggested (Koes *et al.* 1995).

## 2.5 Clinical Trials and Research Methodology:

In a blinded review of relevant randomized clinical trials relating to chiropractic manipulation for back pain, Assendelft *et al.* (1992), identified five studies involving chiropractors as therapists. Using a list of methodological criteria (each of which carried a certain point value), the authors gave each study a score out of a maximum 100 points. Not one study ranked higher than 50 points for its method quality. A summary of the major criteria against the studies is as follows:

- a) The lack of proper description of dropouts.
- b) An inadequate protocollization and descriptions of the intervention.
- c) The lack of blinded or naive patients.
- d) Improper data analysis.

In their discussion the authors were unable to draw any strong conclusions due to the small number of chiropractic randomized clinical trials identified with generally poor study methodologies, but their opinion was that chiropractic seems to be an effective treatment for back pain.

Koes *et al.* (1995) conducted a computer-based meta-analyses to assess the methodological quality of published randomized clinical trials on the efficacy of commonly used interventions in low back pain. The authors restricted themselves to randomized clinical trials that studied the effect of spinal manipulation and mobilization, exercise therapy, back schools, bed rest, orthoses, and traction therapy. This review also employed a scoring system, with each study having a potential maximum of 100 points.

Thirty studies were identified as ones relating to manipulation or mobilization and received scores ranging between 20 and 56 points. The highest overall value for any reviewed study was 82. In their conclusion the authors stressed that no one intervention has proven to be clearly superior to others and therefore the need for more carefully designed clinical trials in this field was still urgent.

Randomized clinical trials of low standing method quality will fail to show small, but significant clinical and socio-economic differences between treatment protocols and if method quality is ignored, the true efficacy of treatments may be obscured as falsely negative or positive results could be obtained. Specific areas of concern were the small sample sizes, lack of description of randomized procedure, no description of drop-outs, no placebo-control groups and a lack of blinded outcome assessment.

For a pragmatic-type study, the authors suggested that the following procedures be included to strengthen the method quality:

- a) By ensuring the maximum amount of patient naiveté e.g. no manipulation/mobilization for the six months preceding the study.
- b) A well described randomized procedure.
- c) By comparing only two treatment interventions and using no co-interventions.
- d) By not only noting drop-out patients, but also stating the reason why patients drop out.
- e) An intention-to-treat analysis when the dropout is less than 10%.

Koes *et al.* (1996) further stated in an updated systematic review of randomized clinical trials concerned with spinal manipulation as a treatment of acute low back pain, that of the thirty six studies reviewed in the study, 53% showed favourable results for manipulation.

However, most of the studies were of poor quality, due to the fact that none scored higher than 60 out of a possible 100 marks when critiqued for methodological quality. Of the eight trials comparing manipulation with some other conservative modality, five reported positive results, two reported negative results and one study reached no conclusion.

As a final comment the authors stated that the efficacy of spinal manipulation has not been

demonstrated with sound randomized clinical trials, but the positive indications justify additional research efforts on this topic.

Van Tulder *et al.* (1997) titled their paper: "Conservative treatment of acute and chronic non-specific low back pain. A systematic review of randomized controlled trials of the most common interventions." On their 100 point method criteria scale no study scored higher than 79 points, indicating the general lack in the method quality of study design. There appeared however, to be strong evidence for the effectiveness of manipulation, back schools, and exercise therapy, especially for short-term effects. The authors echoed Koes *et al.* (1995), by stating that research methodology would be the key to establishing the efficacy of any one treatment protocol in the treatment of low back pain.

The above authors cautiously lend their support to manipulation as an effective treatment and give some simple guidelines by which the quality of a study may be bolstered so as to strengthen the results ascertained. The "perfect" environment for conducting trials can rarely be created, but what is of importance is striving towards pure research methods, enabling results gained to be independently repeated or for further studies to be conducted from a strong basis.

It seems that randomized clinical trials have, up until now, fallen short in their design to such an extent, that they prohibit research from moving on to newer and more complex studies.

## 2.6 Conclusion:

An optimum treatment regimen has yet to be found for the treatment of simple mechanical back pain (van Tulder *et al.* 1997). The overwhelming majority of research articles published use spinal manipulation as the main treatment protocol (Di Fabio 1992). However, mobilization is a widely utilized method of treatment and thus, must be tested for its possible value (Frost and Klaber Moffett 1992). By running a pilot, randomized clinical trial and adhering to as many of the research method guidelines possible, substantiated suggestions can be made as to the relative effectiveness of these two treatments. This will then enable the construction of further trials proposing not one, but a combination of statistically significant



treatments that may lead to an optimum treatment strategy.

## 2.7 Summary:

The literature review was started by giving the reader an insight into the current model for the approach to low back pain as set out by Kirkaldy-Willis (1988:117-131). As part of this model the criteria enabling the diagnosis of the facet syndrome and sacro-iliac syndrome were discussed, which were to be the particular focus of this study.

The unique problem surrounding low back pain was then highlighted to illustrate that a short natural history and favourable prognosis were often followed by further and often costly, reoccurrences (Bergquist-Ullman and Larson 1977 and Frymoyer 1991:10-19). It was then reasoned that the current treatment protocols were not adequately managing the problem.

A short review discussing manual therapy as an effective treatment of low back pain, then illustrated that two types of approaches have been used, namely manipulation and mobilization, both claiming good results during clinical trials (Koes et al. 1992).

On closer review it seemed that spinal manipulation had a greater amount of research backing its effectiveness (Di Fabio 1992) , but that the studies done have not shown satisfactory results to make clear judgements (Koes et al. 1991).

The review was concluded with a critical review of clinical trials concerning mechanical low back pain. It was stated that only by following a stringent protocollization within research studies can results be gained that can be accepted completely, so that more complex studies could be completed (van Tulder et al. 1997).

It was then suggested by the author that these complex studies would be able to propose entire treatment strategies, utilizing statistically proven single treatment components, to effectively ameliorate the epidemic proportions of painful ailments associated with the low back.

## Chapter 3

### 3.0 Methodology

The objective of this study was to compare specific spinal manipulative therapy and specific passive spinal mobilization, in terms of objective and subjective findings, in order to determine the more effective approach in the management of mechanical low back pain.

Radio and newspaper advertising was used to attract prospective subjects suffering from low back pain in the dysfunctional stage according to the Kirkaldy-Willis classification (Kirkaldy-Willis 1988: 134). The advertisement called on patients having low back pain for a period of 4 weeks or less (Kirkaldy-Willis 1988: 8).

Upon reply, each subject was telephonically interviewed so as to explain the conditions of the study and as an initial screening process to eliminate those patients obviously falling outside the range of the study. Patients were excluded immediately for the following reasons:

If they were younger than 18 or older than 65 years of age.

Any female applicant if pregnant.

If their condition exhibited neurological deficit or a vascular deficiency involving the lower limb and was so diagnosed before applying to enter the study.

If their symptoms had a duration of longer than one month.

After agreeing to participate an initial consultation was scheduled for the prospective participant.

At the initial consultation the candidate underwent a full case history (Appendix A), Physical examination (Appendix B) and regional low back examination (Appendix C).

During this process the participant was screened for a posterior facet syndrome of the lumbar spine, a sacro-iliac syndrome, or a combination of both (Kirkaldy-Willis 1988: 133-148).

When clinically indicated, patients underwent the relevant radiographic evaluation (lumbar spine and pelvis) for possible pathology contra-indicating manipulation or mobilization.

Following examination, a diagnosis was determined and patients with the appropriate

diagnosis were included into the study.

Patients suffering from an associated myofascial pain dysfunction syndrome (Travel and Simon 1983: 1:1) were included, but the myofascial component was not treated. Patients were not excluded due to the use of any medication.

The orthopaedic procedures used to specifically diagnose the lumbar facet syndrome were: Kemp's (axial compression) test and lumbar facet joint challenge (joint 'springing').

**Kemp's test** is conducted whilst the patient is seated with the examiner standing behind the patient. The examiner reaches around the patient's shoulders and upper chest from behind so as to support and control the patient. The patient is directed to lean forward to one side and then to bend obliquely backward as far as possible, at this point the examiner applies axial pressure so as to compress the side of rotation. If this manoeuvre produces or aggravates local pain over the affected spinal segment(s) it may be indicative of a lumbar facet syndrome (Schafer and Faye 1989:208-209).

**Lumbar facet joint challenge** is carried out with the patient in the prone position. The examiner places a thumb on the spinous process tip and pushes laterally, varying the force. The joint may be bounced with a little more vigour if there is no pain response. This produces end-feel, which is never reached abruptly in a normal joint. A joint with restricted mobility has lost the springiness at the end position. It is this springiness that one palpates for when performing facet joint challenge (Gatterman 1990: 49, 84). Kenna and Murtagh (1989: 104) describe the test as an application of transverse pressure to the spinous processes with local pain aggravated or produced by this procedure indicating to a lumbar spinal facet syndrome. They also state that this is a very sensitive movement for detecting pain in an affected spinal segment.

The orthopaedic tests used to specifically diagnose the sacro-iliac syndrome were: Patrick Faber's test, Gaenslen's test, Erichson's test and lateral recumbent sacroiliac compression.

**Patrick Faber's test** is done with the patient lying supine, the affected side's hip joint is flexed, abducted and externally rotated with downward pressure applied by the examiner on the patient's knee. The eliciting or aggravation of pain over the sacro-iliac joints may be indicative of a sacro-iliac syndrome (Schafer and Faye 1989: 276).

For **Gaenslen's test** the patient once again lies supine, but is positioned so that the involved hip extends over the side of the examination table. The patient is asked to draw both legs up to the chest and then to let the leg under examination drop slowly. A positive test is constituted by pain in the ipsilateral sacroiliac joint (Gatterman 1992: 319).

**Erichsen's test** requires the patient to remain supine, the examiner places his/her hands on the patient's iliac crests and anterior superior iliac spines. The pelvis is then forcibly compressed towards the midline, which tends to separate the sacroiliac joints posteriorly. Pain experienced over either sacroiliac joint constitutes a positive test (Schafer and Faye 1989: 270).

The final test to confirm a sacro-iliac syndrome is **lateral recumbent compression** of the sacroiliac joint. The patient lies in the lateral recumbent position with the involved side upper most. The examiner stands facing the patient, but at right angles and then places a load forces over the area between the greater trochanter of the femur and the patient's iliac crest.

Aggravation of pain due to the increased pressure constitutes a positive test and thus indicates a possible sacroiliac syndrome (Schafer and Faye 1989: 270)

As patients were examined and found suitable, they completed an informed consent form (Appendix D). Simple consecutive randomized sampling was used to allocate each patient to either the manipulation or mobilization group. The method used was the "goldfish bowl technique" (Willemse 1990: 14).

As the total size of the study group was 30, numbers 1-15 were designated to the mobilization group, whilst number 16-30 were designated to the manipulation group.

As the patients were accepted into the study, they were asked to draw a number from a hat whilst their eyes were closed. The number drawn allocated the patient into a study group. The number chosen by the patient was then discarded. The process was repeated until the final patient initiated into the study was automatically allocated the last remaining number.

The result was two equal groups; one receiving spinal manipulation and one receiving spinal mobilization.

Due to the pragmatic nature of the study it was not possible to ensure blindness (Winer 1985: 98). However, patient naivety was induced by only using subjects who had never had manual therapy to the lumbar spine before or at least not within a six-month period preceding the study. This was accepted as a substitute to the blinding process as suggested by Assendelft *et al.* (1992).

The natural history of the chosen conditions indicated that patients should recover spontaneously within two months from initial onset (Kirkaldy-Willis 1988: 8). Thus, anyone with pain for a period of more than four weeks was excluded from the study to ensure a minimal effect related to natural history. Furthermore, according to the Kirkaldy-Willis classification, a four-week period or less, is also the window of duration for the classification of the diagnosed conditions into the dysfunction stage.

The study made use of both of both experimental and descriptive survey techniques for data collection.

The experimental design of the study involved the measurement of lumbar spine ranges of motion (as determined by goniometer) and pain sensitivity (determined by use of an algometer).

The lumbar spine ranges of motion measured were: flexion, extension, left lateral flexion, right lateral flexion, left rotation and right rotation, with the use of a BROM II (back range of motion) goniometer.

The instrument was supplied by Performance Attainment Associates- 3600 LA Bore Rd, Suite 6, Saint Paul, MN 55110-4144. Although all ranges of motion were measured in this study, Breum *et al.* (1995) could only demonstrate accuracy in extension and lateral flexion measurements with the instrument.

The instrument consisted of two parts (A and B). (A) was used in flexion- extension measurements, while (B) was used in the measurements of rotation (using the horizontal facing compass) and lateral flexion (using the coronal facing compass).

#### Flexion and extension:

The patient was in a standing position, with the feet approximately shoulder width apart. The examiner palpated and marked the spinous process of S1 and T12, respectively. The fulcrum of part (A) was then placed over point one, covering S1, and the Velcro straps secured around the patient's waist at an angle approximately parallel to the iliac crests. This was done in an effort to secure the contact point during flexion and extension. The l-shaped sliding arm was then placed over point two (T12). This position represented neutral and a reading in degrees was taken from the outer dial. Whilst providing additional stability to the contact points, the examiner measured the amount of flexion and extension which a patient could actively induce.

Each measurement was confirmed and no more than three degrees variance was accepted, if a large disparity was found the measurements were repeated. In the case of minimal variance, the highest reading was taken.

Left and right lateral flexion was measured according to the BROM user manual:

The Velcro strap of part (B) was secured around the patient's waist between the areas of T12 and S1. A magnet was then attached to the strap. The part (B) instrument was then placed over the affected segment so that the coronal-facing compass faced the researcher in the coronal plane. In the event of more than one tender area, readings were taken over the most tender point.

With the compass needle facing down the initial reading was taken. Whilst the examiner fixed the goniometer to the patient's body, the patient laterally flexed as far as possible by running their hand down the postero-lateral surface of the leg. Second readings were taken to the left and right and subtracted from the baseline measurement. Each measurement was confirmed

and no more than three degrees variance was accepted, if a large disparity was found the measurements were repeated. If variance fell within three degrees the highest measurement was taken.

For left and right rotation:

Part (B) of the instrument was again used, but this time the horizontal-facing compass was utilized. The patient was in a seated position, with the arms crossed over the chest. Instrument fixation was as before. However, the compass was zeroed according to the magnet position. Maximal left and right rotation was then induced and the measurements taken. As with lateral flexion three degrees of variance was allowed for when measurements were confirmed.

Once the initial ranges of motion were recorded, a pressure threshold reading (algometer) reading was obtained from each patient. Pain sensitivity was measured using the pressure algometer supplied by Wagner Instruments (P.O. Box 1217, Greenwich, CT 06836, USA). The patient was asked to indicate the area of most pain/discomfort. The patient was instructed to indicate immediately when the pressure exerted with the algometer became painful by saying "yes".

Upon the patient's response the instrument was removed and the measurement was taken in kg per square centimetre (maximum 10 kg per square centimetre). In the event of two painful areas being pointed out, measurements were taken from both and the average between the two, rounded off to the nearest decimal place, was used.

Fischer (1986) conducted a study on 50 patients in an attempt to quantify tender spots through the use of the algometer. His conclusion was that the unit yielded highly reproducible results and showed excellent validity of measurements obtained.

The descriptive survey design made use of the Oswestry Low Back Disability Index (Appendix E) and the NRS-101, a numerical pain rating scale (Appendix F).

The Oswestry questionnaire consists of ten sections of six questions each. For each section, the total possible score is 5 points, with the point distribution ranging from zero (if the first statement of the respective section was marked) to five (if the sixth (last) statement was

chosen). Upon completion of the questionnaire the points for each section were added, with the maximum score possible, being fifty. The final score was then converted into a percentage for each patient, for that particular consultation. In the event that one section was not completed, the highest possible score became 45 and the total score was then calculated out of 45, and then converted to a percentage.

If more than one section was not completed, five points per section were deducted and a corresponding maximum was calculated, from which the percentage for that patient was then found.

These scores were calculated and recorded in the patient's file at the respective times of data collection.

Fairbank *et al.* (1980), confirms this questionnaire as being a reliable and valid method of measuring the percentage disability suffered by patients with low back pain. Test re-test reliability of the questionnaire was measured at a correlation coefficient of 0.99 ( $p < 0.001$ ), when completed on two consecutive days by 22 patients suffering from chronic low back pain.

The NRS-101, a numerical pain intensity scale, was used to measure the subjective response of patients to treatments in terms of their perception of pain intensity. The questionnaire instructed the patient to rate their pain at its worst and at its least on a numerical scale of zero to one hundred, with zero indicating "no pain at all" and one hundred indicating "pain as bad as it could be". The average pain intensity was calculated by adding the values representing worst and least pain and then dividing this value by two (Jensen *et al.* 1986). The average pain intensity experienced by each patient over the treatment and follow-up periods were then utilized for statistical analysis.

After the ranges of motion, algometer and questionnaire procedures were completed, patients were given their respective treatments.

Motion palpation was utilized to identify segments with restricted or abnormal motion



patterns in the lumbar spine and sacroiliac joints (Schafer and Faye 1989: 211-216, 256-259).

This method is currently regarded as the most reliable test of identifying restricted spinal entity that chiropractors adjust (Walker and Buchbinder 1997). The motion palpation procedure is of further value in identifying along which plane of articulation an adjustive technique should be applied, in order to maximally restore joint play, whilst causing the least amount of discomfort to the patient (Schafer and Faye 1989: 7).

Patients were positioned for their respective manipulations according to the diversified method of spinal manipulative therapy.

The techniques were applied as described by Szaraz (1990). These included, the lumbar roll (pisiform-mamillary), spinous push/hook, sitting lumbar technique, upper sacro-iliac (flexed innominate) technique, and lower sacroiliac joint (extended innominate) technique.

Discrimination of the technique used was based on success on manipulation using the lumbar roll; if this failed (i.e.: no audible sound), the spinous hook was used and if this failed the sitting lumbar technique was used.

The mobilization group received specific passive mobilization at the involved area. These mobilizations were based on techniques found in Vertebral Manipulation (Maitland 1986: 115-143). If joint pain was encountered at the beginning of the range of motion, the mobilization was performed as a grade I specific passive manoeuvre with small, rhythmical movements (Maitland 1986: 106). As the pain-free range was increased a specific passive grade II manoeuvre into the direction of pain production with a slow rhythm and large amplitude was performed.

When pain production shifted to the end range of the joint, the power of mobilization was increased to that of a grade IV mobilization in order to reduce joint stiffness. The character of the movement was also altered to a quick, staccato, oscillatory manoeuvre with a small amplitude (Maitland 1986: 99).

No matter the specific character, the mobilizations all consisted of three 30 second

mobilization sequences, with a five second gap between each sequence. (Approximately 90 oscillations per mobilization sequence was achieved.)

After treatment patients were advised not to engage in activities varying from their normal daily routines.

Each patient received six treatments over a two-week period and then a 1-month follow-up consultation. This was in accordance with the treatment frequencies as suggested by both Haldeman(1993: 124) and Maitland(1986: 106).

Data was collected using the ranges of motion measurements, algometer measurements, Oswestry and Numerical Pain Rating Scale questionnaires before treatment at visits 1, 6 and at the 1 month follow-up consultation.

If any of the patients became asymptomatic before the last visit, treatment was discontinued, but the patient was monitored for the full two weeks and then re- assessed at the one-month follow-up consultation. The frequency and duration of treatment as stipulated by Haldeman et al.(1993: 124), were the parameters abided by, logic therefor dictated that once a patient was symptom free it would be pointless to continue with treatment.

A recurrence in any of the patient's condition(s) after treatment six were noted as part of the follow-up consultation.

A small sample size made it a necessity to conduct non-parametric tests for statistical analysis. It was therefor assumed that the data populations were symmetric (i.e. normally distributed).

The data was analysed using the STATGRAPHICS PLUS VERSION 6 computer programme ( Manugistics Inc.).

The Wilcoxin Test was used to determine whether any significant change occurred between the initial and final treatments, the initial and follow-up appointment, and between the final treatment and the one month follow-up consultation, within each study group. In each respective hypothesis conducted, the null hypothesis (Ho) stated that no significant difference existed between for example the initial and follow-up consultation. The null hypothesis (Ho)

was rejected if the P value was less than alpha; and it was concluded that there was a significant difference within the group at the  $\alpha = 0.05$  level of significance.

$H_0$  was accepted if P was greater than or equal to alpha; with the conclusion that there was no significant difference within the group at the  $\alpha = 0.05$  level of significance. The P value was calculated by dividing the value of the two-tailed probability of equalling or exceeding the value of Z, by 2, and where  $\alpha = 0.05$  i.e.: 95% level of significance.

The Mann-Whitney Test was used to determine whether any significant difference existed between the two groups at the time of the initial, final and follow-up consultations. Each respective hypothesis test conducted was treated similarly to that described for the Wilcoxin Signed Rank Test.

Descriptive statistics incorporating mean, standard deviation and standard error were used to analyse the p-values acquired in order to further interpret the results from data collected, once in spread sheet format.

The measurement of the central tendency found, within the raw data, was interpreted by calculating the mean value. This was done in order to provide a practical quantitative summary of each group's characteristics.

The mean value was calculated by adding the sum of a set of measurements and then dividing them by the number of scores used (n) (Portney 1993: 322).

From the mean values the standard deviation(s.d.) was calculated in order to measure the variation of the data from the mean values acquired.

Standard error (s.e.) of measurement was used to indicate the response stability within the measured data. If we were to administer a test to one individual an infinite amount of times, we can assume that the response would vary from trial to trial. These differences would be a function of random measurement error. If a graph could be drawn to plot these responses, the distribution would resemble a normal curve, with the mean equal to the true score and errors

falling above and below the mean.

This distribution of measurement errors is a theoretical distribution that represents the population of all possible measurement errors that could occur for that variable. With a more reliable measurement, errors would be smaller and the distribution will be less variable. Therefore, the standard deviation of the measurement errors reflects the reliability of the response.

This standard deviation is the standard error of measurement (SEM) (Portney 1993: 523-524).

Finally, Power Analysis was utilized to indicate the possibility of a Type II error. This is especially important in studies with smaller sample sizes as there is a greater chance of incorrectly rejecting the null hypothesis. A high power would lessen the likelihood of a Type II error of occurring.

The results obtained from these tests were then used to discuss and draw conclusions as to the relative effect of spinal manipulation versus spinal mobilization in the treatment of acute or sub-acute mechanical low back pain.

## Chapter 4

### 4.0 The Results

#### 4.1 Introduction:

This chapter concerns itself with the results obtained after statistical analysis of the data from the measurement criteria as discussed in chapter 3. The data is presented in table form with relevant comments and interpretation in order to accept or reject the null hypotheses.

#### 4.2 The Hypotheses:

The null hypothesis is the same for both groups and is defined as follows:

Ho: There would be no statistical difference in the subjective and objective findings on analysis of the intra-group data, indicating that this treatment was statistically insignificant.

The alternative hypothesis is again the same for both treatment groups and is defined as follows:

Ha: There would be no statistical difference in the subjective and objective findings on analysis of the intra-group data, showing that this treatment protocol was statistically significant.

In order to integrate the data from the two groups, a third null hypothesis and alternative hypothesis are required.

Defined below as:

Ho: There would be no statistical difference in the subjective and objective findings on analysis of the inter-group data, showing that the two treatment groups were equally effective.

Ha: There would be a statistical difference in the subjective and objective findings on analysis of the inter-group data, showing that that the two treatment groups were not equally effective.

**Key for table abbreviations:**

man: manipulation

mob: mobilization

s.d.: Standard deviation

s.e.: Standard error

**Bold numbers:** statistically significant

v1: initial consultation

v6: final consultation

vf1: one month follow-up

**4.3 Demographic data:**

This study consisted of a sample of thirty patients: 15 receiving spinal mobilization and 15 receiving spinal manipulation. Two volunteers were rejected due to non-compliance to study criteria.

**Table 4.1 Age distribution of patients**

Age	Mobilization group	Manipulation group	Total % of Patients
15-24	2	3	16.66
25-34	2	4	20.00
35-44	5	4	30.00
45-54	4	2	20.00
55-65	2	2	13.33

**Table 4.2 Gender distribution**

Gender	Mobilization group	Manipulation group	Total
Male	8	8	16
Female	7	7	14

#### 4.4 The analysed data:

##### a) P-value:

The data was analysed at the  $\alpha = 0.05$  level

The decision rule was applied and states:

Reject the null hypothesis ( $H_0$ ) if,  $p \leq \alpha \div 2$ .

Accept the null hypothesis ( $H_0$ ) if,  $p > \alpha \div 2$ .

Now,  $\alpha = 0.05$

therefore,  $\alpha \div 2 = 0.025$

Therefore the p-value would have to be below or equal to 0.025 to reject the null hypothesis and

conclude that there is a statistically significant improvement at the  $\alpha = 5\%$  level.

##### b) Power:

The probability of Type II error is  $\beta$ .

The power of a statistical test is  $(1 - \beta)$ .

This is the probability of detecting a difference between the groups.

Therefore, power value should be as close to one as possible.

Thus, if a test has low power of 0.20, it would mean that the probability of detecting a result could be

purely chance, 20 times out of a hundred.

4.4.1 The non-parametric Wilcoxin signed rank tests:

Table 4.3 Statistical results of the goniometric and algometer measurements comparing the first and final treatments of the mobilization group

Mobilization group									
Consultation 1						Final consultation 6			
goniometer	mean	median	s.d	s.e.	p-value	mean	median	s.d	s.e.
flex	21.60	22.0	7.008	1.81	0.005	25.90	28.0	6.04	1.56
ext	8.60	9.0	3.01	0.78	0.026	10.10	10.0	1.55	0.40
R-lat.flex	25.50	24.0	5.92	1.53	0.15	28.06	28.0	5.27	1.36
L-lat.flex	25.67	24.0	6.51	1.68	0.34	26.93	28.0	7.09	1.83
R-rot	8.47	9.0	2.39	0.62	0.001	10.73	10.0	2.25	0.58
L-rot	9.40	10.0	1.99	0.51	0.008	11.53	12.0	1.88	0.48
algometer	4.90	5.0	1.49	0.38	0.77	5.38	5.4	1.54	0.39

power	
flex	0.403
ext	0.360
R-lat.flex	0.217
L-lat.flex	0.075
R-rot	0.729
L-rot	0.829
algometer	0.127

According to the above table there was a significant improvement within the mobilization group from the first to final treatment for flexion, right and left rotation. The null hypothesis is therefore rejected for the afore mentioned ranges of motion.



**Table 4.4** Statistical results of the goniometric and algometer measurements comparing the first and final treatments in the manipulation group

<b>Manipulation group</b>									
<b>goniometer</b>	<b>mean</b>	<b>Consultation 1</b>				<b>Final consultation</b>			
		<b>median</b>	<b>s.d</b>	<b>s.e.</b>	<b>p-value</b>	<b>mean</b>	<b>median</b>	<b>s.d</b>	<b>s.e.</b>
<b>flex</b>	22.20	25.0	7.63	1.97	<b>0.0005</b>	28.80	30.0	5.47	1.41
<b>ext</b>	8.60	9.0	3.01	0.78	<b>0.0008</b>	10.87	11.0	1.89	0.49
<b>R-lat.flex</b>	24.73	24.0	5.06	1.31	0.043	26.46	28.0	4.63	1.19
<b>L-lat.flex</b>	22.93	22.0	3.08	0.79	<b>0.0015</b>	26.67	28.0	4.56	1.18
<b>R-rot</b>	8.60	10.0	2.26	0.58	<b>0.0009</b>	11.20	11.0	1.42	0.37
<b>L-rot</b>	9.60	10.0	1.92	0.49	<b>0.009</b>	11.66	12.0	1.23	0.31
<b>algometer</b>	4.04	5.0	0.88	0.22	<b>0.0003</b>	5.18	5.4	0.74	0.19

<b>power</b>	
<b>flex</b>	0.745
<b>ext</b>	0.657
<b>R-lat.flex</b>	0.149
<b>L-lat.flex</b>	0.714
<b>R-rot</b>	0.950
<b>L-rot</b>	0.918
<b>algometer</b>	0.958

From the above table a significant improvement was noted within the manipulation group for all the ranges of motion, except left lateral flexion, as well as the algometer measurements. Thus, for the period between the first and final treatment, the null hypothesis was rejected for all the above values except left lateral flexion.

**Table 4.5** Statistical results of the goniometric and algometer measurements comparing the first treatment and the 1month follow-up consultation in the mobilization group

Mobilization group									
		Consultation 1				1 month follow-up			
goniometer	mean	median	s.d	s.e.	p-value	mean	median	s.d	s.e.
flex	21.60	22.0	7.008	1.81	<b>0.009</b>	25.90	26.0	5.64	1.47
ext	8.60	9.0	3.01	0.78	0.15	15.80	10.0	20.84	5.38
R-lat.flex	25.50	24.0	5.92	1.53	0.026	27.13	28.0	5.87	1.51
L-lat.flex	25.67	24.0	6.51	1.68	0.15	26.87	28.0	5.95	1.54
R-rot	8.47	9.0	2.39	0.62	<b>0.016</b>	10.20	10.0	1.21	0.31
L-rot	9.40	10.0	1.99	0.51	0.54	10.60	10.0	1.40	0.36
algometer	4.90	5.0	1.49	0.38	<b>0.009</b>	5.58	5.7	1.50	0.38

power	
flex	0.422
ext	0.218
R-lat.flex	0.108
L-lat.flex	0.078
R-rot	0.661
L-rot	0.443
algometer	0.216

From the above table it can be seen that the only significant improvements within ranges of motion that of flexion and right rotation. The algometer measurement was also significant within the mobilization group between the first treatment and the 1-month follow-up. The null hypothesis is therefore rejected for the above measurements.

**Table 4.6** Statistical results of the goniometric and algometer measurements comparing the first treatment and the 1 month follow-up consultation in the manipulation group

<i>Manipulation group</i>									
		Consultation 1				1 month follow-up			
goniometer	mean	median	s.d.	s.e.	p-value	mean	median	s.d.	s.e.
flex	22.20	25.0	7.63	1.97	<b>0.0005</b>	30.10	31.0	4.53	1.17
ext	8.60	9.0	3.01	0.78	<b>0.0008</b>	11.13	11.0	1.81	0.47
R-lat.flex	24.73	24.0	5.06	1.31	<b>0.009</b>	27.47	28.0	3.83	0.99
L-lat.flex	22.93	22.0	3.08	0.79	<b>0.0005</b>	27.40	28.0	3.91	1.01
R-rot	8.60	10.0	2.26	0.58	<b>0.006</b>	10.93	11.0	1.67	0.43
L-rot	9.60	10.0	1.92	0.49	<b>0.016</b>	11.13	11.0	1.18	0.30
algometer	4.04	4.2	0.88	0.22	<b>0.0003</b>	5.37	5.1	1.10	0.28

power	
flex	0.910
ext	0.761
R-lat.flex	0.354
L-lat.flex	0.917
R-rot	0.871
L-rot	0.712
algometer	0.802

From the above table it can be seen that a significant improvement was found on all ranges of motion as well as for the algometer measurement within the manipulation group for the period between the first consultation and the 1 month follow-up. The null hypothesis is therefore rejected for all of the above.

**Table 4.7** Statistical results of the goniometric measurements comparing the final treatment and the 1month follow-up consultation in the mobilization group

Mobilization group									
goniometer	mean	Final consultation				1 month follow-up			
		median	s.d	s.e.	p-value	mean	median	s.d	s.e.
flex	25.90	28.0	6.04	1.56	1.00	25.90	26.0	5.64	1.45
ext	10.10	10.0	1.55	0.40	1.00	15.80	10.0	20.84	5.38
R-lat.flex	28.06	28.0	5.27	1.36	0.50	27.13	28.0	5.87	1.51
L-lat.flex	26.93	28.0	7.09	1.83	0.55	26.87	28.0	5.95	1.54
R-rot	10.73	10.0	2.25	0.58	0.23	10.20	10.0	1.21	0.31
L-rot	11.53	12.0	1.88	0.48	0.11	10.60	10.0	1.40	0.36
algometer	5.38	5.4	1.54	0.39	0.77	5.58	5.7	1.50	0.38

power	
flex	0.050
ext	0.153
R-lat.flex	0.071
L-lat.flex	0.050
R-rot	0.113
L-rot	0.305
algometer	0.063

There were no significant improvements from the final treatment to the 1-month follow-up consultation in the mobilization group. The null hypothesis is therefore accepted for this time frame.

**Table 4.8** Statistical results of the goniometric and algometer measurements comparing the final treatment and the 1 month follow-up consultation in the manipulation group

<b>Manipulation group</b>									
<b>goniometer</b>	<b>mean</b>	<b>Final consultation</b>				<b>1 month follow-up</b>			
		<b>median</b>	<b>s.d.</b>	<b>s.e.</b>	<b>p-value</b>	<b>mean</b>	<b>median</b>	<b>s.d.</b>	<b>s.e.</b>
<b>flex</b>	28.80	30.0	5.47	1.41	0.34	30.10	31.0	4.53	1.17
<b>ext</b>	10.87	11.0	1.89	0.49	1.00	11.13	11.0	1.81	0.47
<b>R-lat.flex</b>	26.46	28.0	0.63	1.19	0.34	27.47	18.0	3.83	0.99
<b>L-lat.flex</b>	26.67	28.0	4.56	1.18	0.22	27.40	28.0	3.91	1.01
<b>R-rot</b>	11.20	11.0	1.42	0.37	0.62	10.93	11.0	1.67	0.43
<b>L-rot</b>	11.66	12.0	1.23	0.31	0.22	11.13	11.0	1.18	0.30
<b>algometer</b>	5.18	5.0	0.74	0.19	1.00	5.37	5.1	1.10	0.28

<b>power</b>	
<b>flex</b>	0.101
<b>ext</b>	0.065
<b>R-lat.flex</b>	0.143
<b>L-lat.flex</b>	0.072
<b>R-rot</b>	0.072
<b>L-rot</b>	0.204
<b>algometer</b>	0.080

There were no significant improvements from the final treatment to the 1-month follow-up consultation in the manipulation group. The null hypothesis is therefore accepted for this time frame.

**Table 4.9** Statistical results of the subjective findings within the mobilization group

MOBILIZATION GROUP									
Consultation 1						Consultation 6			
	mean	median	s.d.	s.e	p-value	mean	median	s.d.	s.e.
Nrs-101	46.86	45.0	15.86	4.09	0.42	46.26	35.0	15.97	4.12
Oswestry	22.46	20.0	15.13	3.90	0.09	22.26	16.0	12.69	3.27
power									
NRS-101					0.051				
Oswestry					0.050				
Consultation 1						Final consultation			
Nrs101	46.86	45.0	15.86	4.09	0.42	32.60	35.0	24.65	6.36
Oswestry	22.46	20.0	15.13	3.90	0.12	15.73	14.0	14.82	3.82
power									
NRS-101					0.430				
Oswestry					0.212				
Consultation 6						Final consultation			
Nrs101	32.40	35.0	18.73	4.83	0.57	32.60	35.0	24.65	6.36
Oswestry	13.73	16.0	9.47	2.44	1.00	15.73	14.0	14.82	3.82
power									
NRS-101					0.055				
Oswestry					0.109				

From the above table it can be seen that no significant improvement was noted at any stage of the treatment protocol within the mobilization group for both questionnaires and therefore the null hypothesis is accepted.

**Table 4.10** Statistical results of the subjective findings within the manipulation group

MANIPULATION GROUP									
Consultation 1						Final consultation			
	mean	median	s.d.	s.e	p-value	mean	median	s.d.	s.e.
Nrs-101	46.26	45.00	15.97	4.12	0.002	18.18	20.0	15.26	3.94
Oswestry	22.26	18.00	12.69	3.27	0.002	10.33	6.0	10.67	2.75
power									
NRS-101					0.996				
Oswestry					0.767				
Consultation 1						1 month follow-up			
Nrs101	46.26	45.00	15.97	4.12	0.002	16.13	10.00	19.31	4.98
Oswestry	22.26	18.00	12.69	3.27	0.002	15.00	14.00	9.87	2.54
power									
NRS-101					0.993				
Oswestry					0.383				
Final consultation						1 month follow-up			
Nrs101	18.13	20.00	15.26	3.94	0.23	16.13	10.00	19.31	4.98
Oswestry	10.33	6.00	10.67	2.75	0.002	15.00	14.00	9.87	2.54
power									
NRS-101					0.060				
Oswestry					0.215				

From the above table it can be seen that significant improvements were found in both questionnaires, except the NRS-101 in the period between the final consultation and the 1-month follow-up. The null hypothesis is therefore rejected for all the subjective measurements except the afore mentioned.

**Table 4.11** Statistical summary results highlighting the p-values of the Wilcoxin's signed ranked test for lumbar ranges of motion and algometer measurements

	<u>V1-V6</u>		<u>V1-VFU</u>		<u>V6-VFU</u>	
	<b>MOB</b>	<b>MAN</b>	<b>MOB</b>	<b>MAN</b>	<b>MOB</b>	<b>MAN</b>
<b>FLEX</b>	0.005	0.0005	0.009	0.0005	1.00	0.34
<b>EXT</b>	0.026	0.0008	0.15	0.0008	1.00	1.00
<b>R-LF</b>	0.15	0.043	0.026	0.009	0.50	0.34
<b>L-LF</b>	0.34	0.0015	0.15	0.0005	0.55	0.22
<b>R-ROT</b>	0.001	0.0009	0.016	0.006	0.23	0.62
<b>L-ROT</b>	0.008	0.009	0.54	0.016	0.11	0.22
<b>ALGOM.</b>	0.77	0.0003	0.009	0.0003	0.77	1.00

**Table 4.12** Statistical summary of the results highlighting the significant findings of the Wilcoxin's signed rank test for the Numerical pain rating scale 101 (NRS-101) and the Oswestry Disability index

	<u>V1-V6</u>		<u>V1-VFU</u>		<u>V6-VFU</u>	
	<b>MOB</b>	<b>MAN</b>	<b>MOB</b>	<b>MAN</b>	<b>MOB</b>	<b>MAN</b>
<b>NRS-101</b>	0.42	0.002	0.42	0.0019	0.57	0.23
<b>Oswestry</b>	0.09	0.002	0.12	0.0019	1.00	0.0019



## 4.4.2 The non-parametric Mann-Whitney Unpaired tests:

**Table 4.13** Statistical results of the goniometric and algometer measurements comparing the initial lumbar ranges of motion and algometer readings

		MOBILIZATION GROUP consultation 1				MANIPULATION GROUP consultation 1			
goniometer	mean	median	s.d.	s.e.	p-value	mean	median	s.d.	s.e.
flexion	21.60	22.0	7.008	1.81	0.77	22.20	25.0	7.63	1.97
extension	8.60	9.0	3.01	0.78	0.44	8.60	9.0	3.01	0.78
(R)Lat Fl	25.50	24.0	5.92	1.53	0.82	24.73	24.0	5.06	1.31
(L)Lat Fl	25.67	24.0	6.51	1.68	0.36	22.93	22.0	3.08	0.79
(R)Rot	8.47	9.0	2.39	0.62	0.91	8.60	10.0	2.26	0.58
(L)Rot	9.40	10.0	1.99	0.51	0.98	9.60	10.0	1.92	0.49
algometer	4.90	5.0	1.49	0.38	0.081	4.04	4.2	0.88	0.22

power	
flexion	0.055
extension	0.050
(R)Lat Flex	0.064
(L)Lat Flex	0.275
(R)Rotation	0.052
(L)Rotation	0.058
Algometer	0.444

**Table 4.14** Statistical results of the goniometric and algometer measurements comparing the final treatment lumbar ranges of motion and algometer readings

		MOBILIZATION GROUP final consultation				MANIPULATION GROUP Final consultation			
goniometer	mean	median	s.d.	s.e.	p-value	mean	median	s.d.	s.e.
Flexion	25.90	28.0	6.04	1.56	0.19	28.80	30.0	5.47	1.41
Extension	10.10	10.0	1.55	0.40	0.30	10.87	11.0	1.89	0.49
(R) Lat Fl.	28.06	28.0	5.27	1.36	0.67	26.46	28.0	4.63	1.19
(L) Lat Fl.	26.93	28.0	7.09	1.83	0.88	26.67	28.0	4.56	1.18
(R) Rot.	10.73	10.0	2.25	0.58	0.55	11.20	11.0	1.42	0.37
(L) Rot.	11.53	12.0	1.88	0.48	0.84	11.66	12.0	1.23	0.31
algometer	5.38	5.4	1.54	0.39	0.49	5.18	5.0	0.74	0.19

power	
Flexion	0.255
Extension	0.208
(R)Lateral flex.	0.130
(L)Lateral flex.	0.051
(R)Rotation	0.096
(L)Rotation	0.055
Algometer	0.069

**Table 4.15** Statistical results of the goniometric and algometer measurements comparing the one month follow-up lumbar ranges of motion and algometer readings

		<b>MOBILIZATION GROUP 1 month follow-up</b>				<b>MANIPULATION GROUP 1 month follow-up</b>			
<b>goniometer</b>	<b>mean</b>	<b>median</b>	<b>s.d.</b>	<b>s.e.</b>	<b>p-value</b>	<b>mean</b>	<b>median</b>	<b>s.d.</b>	<b>s.e.</b>
flexion	25.90	26.0	5.64	1.47	0.041	30.10	31.0	4.53	1.17
Extension	15.80	10.0	20.84	5.38	0.45	11.13	11.0	1.81	0.47
(R) Lat lex.	27.13	28.0	5.87	1.51	0.74	27.47	28.0	3.83	0.99
(L) Lat Flex.	26.87	28.0	5.95	1.54	0.68	27.40	28.0	3.91	1.01
(R) Rot.	10.20	10.0	1.21	0.31	0.23	10.93	11.0	1.67	0.43
(L) Rot.	10.60	10.0	1.40	0.36	0.44	11.13	11.0	1.18	0.30
<b>algometer</b>	<b>5.58</b>	<b>5.7</b>	<b>1.50</b>	<b>0.38</b>	<b>0.52</b>	<b>5.37</b>	<b>5.1</b>	<b>1.10</b>	<b>0.28</b>

<b>power</b>	
<b>Flexion</b>	0.577
<b>Extension</b>	0.117
<b>(R)Lateral flex.</b>	0.053
<b>(L)Lateral flex.</b>	0.058
<b>(R)Rotation</b>	0.251
<b>(L)Rotation</b>	0.183
<b>Algometer</b>	0.069

From tables 4.13-4.15 it can be seen that there was no statistically significant difference between the ranges of motion or goniometer values of the two groups at the initial, final and 1 month follow-up consultations. The null hypothesis is therefore accepted indicating that both groups were equally effective. Standard deviation revealed a relative familiarity around the mean for both treatment groups over all the treatment periods.

**Table 4.16** Statistical results of the subjective findings comparing the mobilization and manipulation groups at the initial, final and follow-up consultations

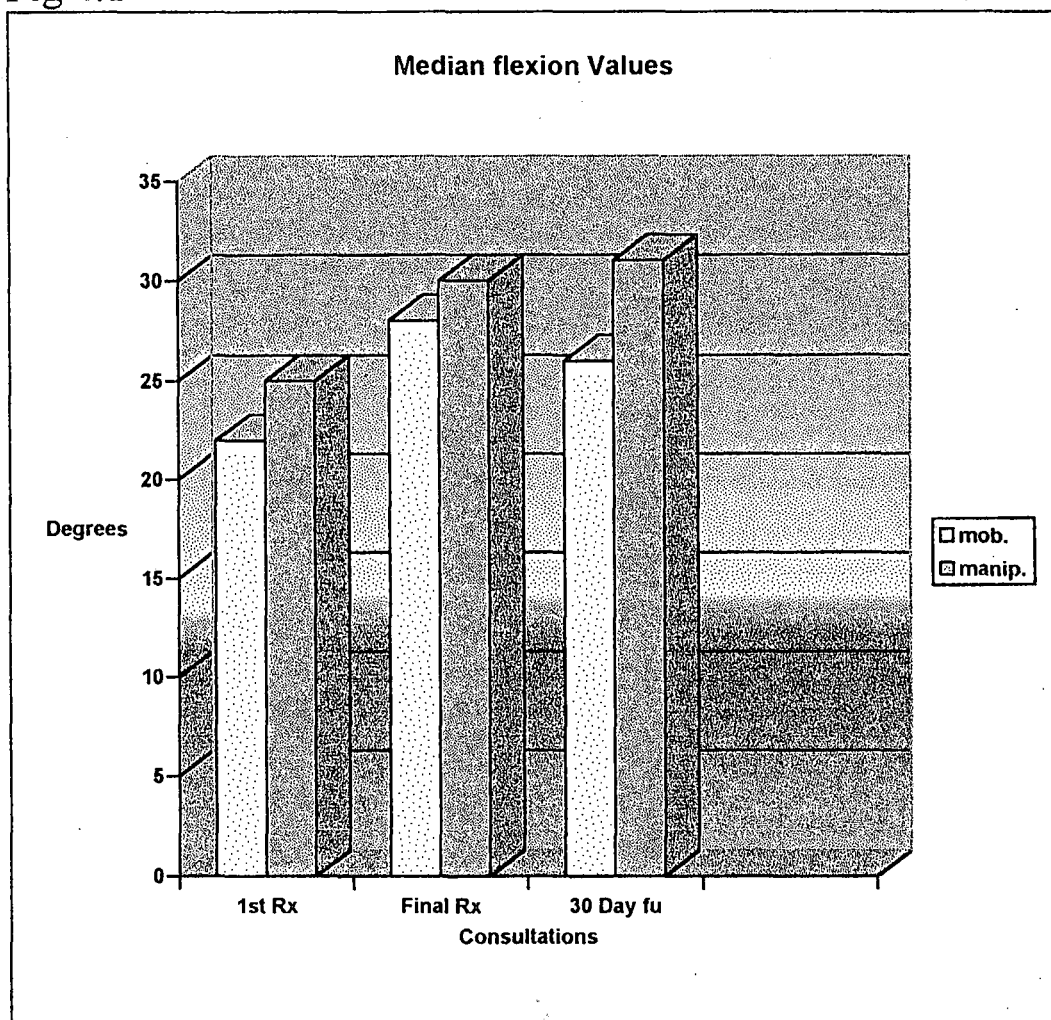
MOBILIZATION						MANIPULATION				
Consultation 1						Consultation 1				
	mean	median	s.d.	s.e	p-value	mean	median	s.d.	s.e.	
Nrs-101	46.86	45.0	15.86	4.09	0.69	46.26	45.0	15.97	4.12	
Oswestry	22.46	20.0	15.13	3.90	1.00	22.26	18.0	12.69	3.27	
power										
NRS-101				0.636						
Oswestry				0.050						
Consultation 6				Consultation 6						
Nrs101	32.40	35.0	18.73	4.83	0.037	18.13	20.0	15.26	3.94	
Oswestry	13.73	16.0	9.47	2.44	0.29	10.33	6.0	10.67	2.75	
power										
NRS-101				0.592						
Oswestry				0.138						
Final consultation				Final consultation						
Nrs101	32.6	35.0	24.65	6.36	0.043	16.13	10.0	19.31	4.98	
Oswestry	15.73	14.0	14.82	3.82	0.16	15.0	4.0	9.87	2.54	
power										
NRS-101				0.494						
Oswestry				0.052						

From table 4.6 it can be seen that there was no statistically significant difference between the subjective, pain and disability, data of the mobilization and manipulation group at the initial, final and 1 month follow-up consultations. The null hypothesis is therefore accepted indicating that both groups were equally effective. Standard deviation revealed a relative familiarity around the mean for both treatment groups over all the treatment periods.

Figures 4.1-4.9 are a visual representation of the median value changes as found within the first, final and one month follow-up consultations.

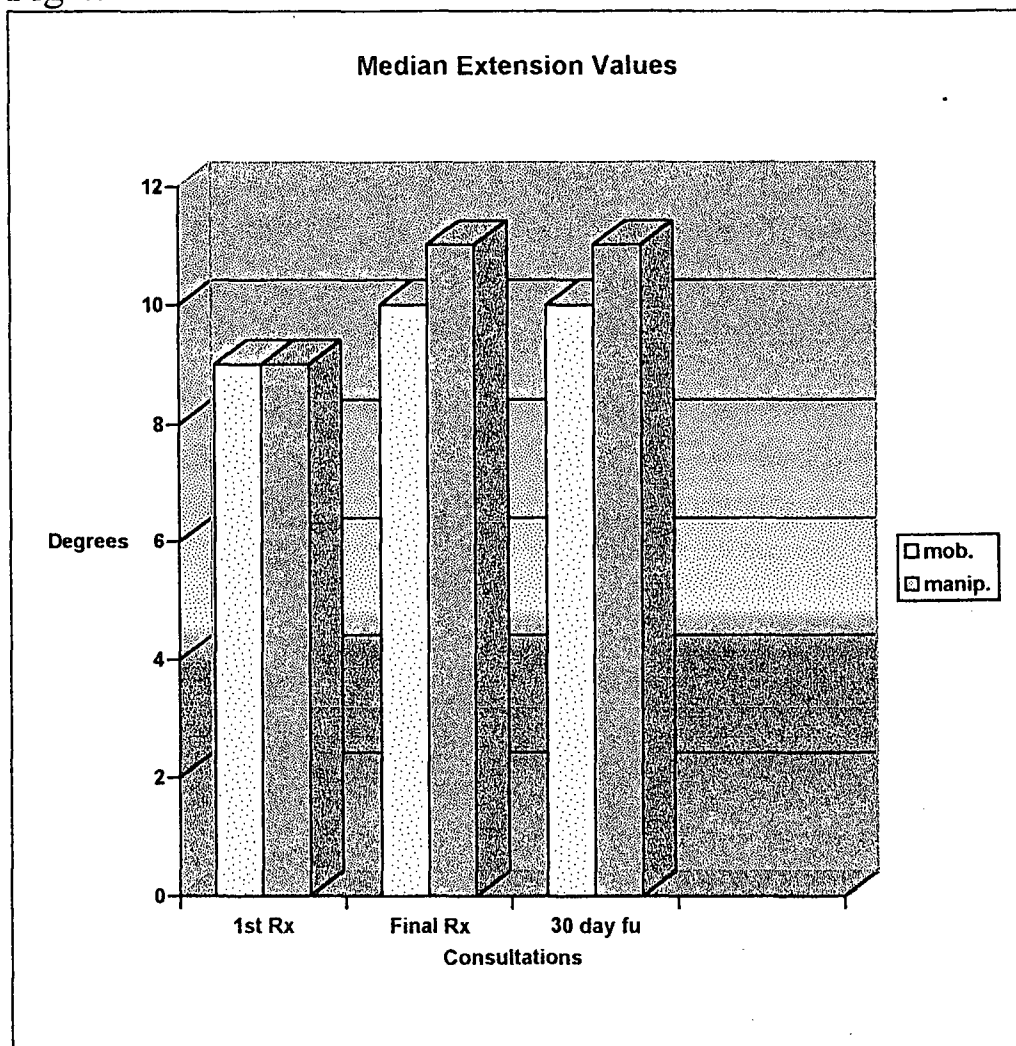
These values were taken from the summary statistics and are not intended as a comparison between the two study groups as this could not be done from median values. However, they serve to augment the discussion of the results in chapter 5 and serve to indicate possible trends within the two groups.

Fig 4.1



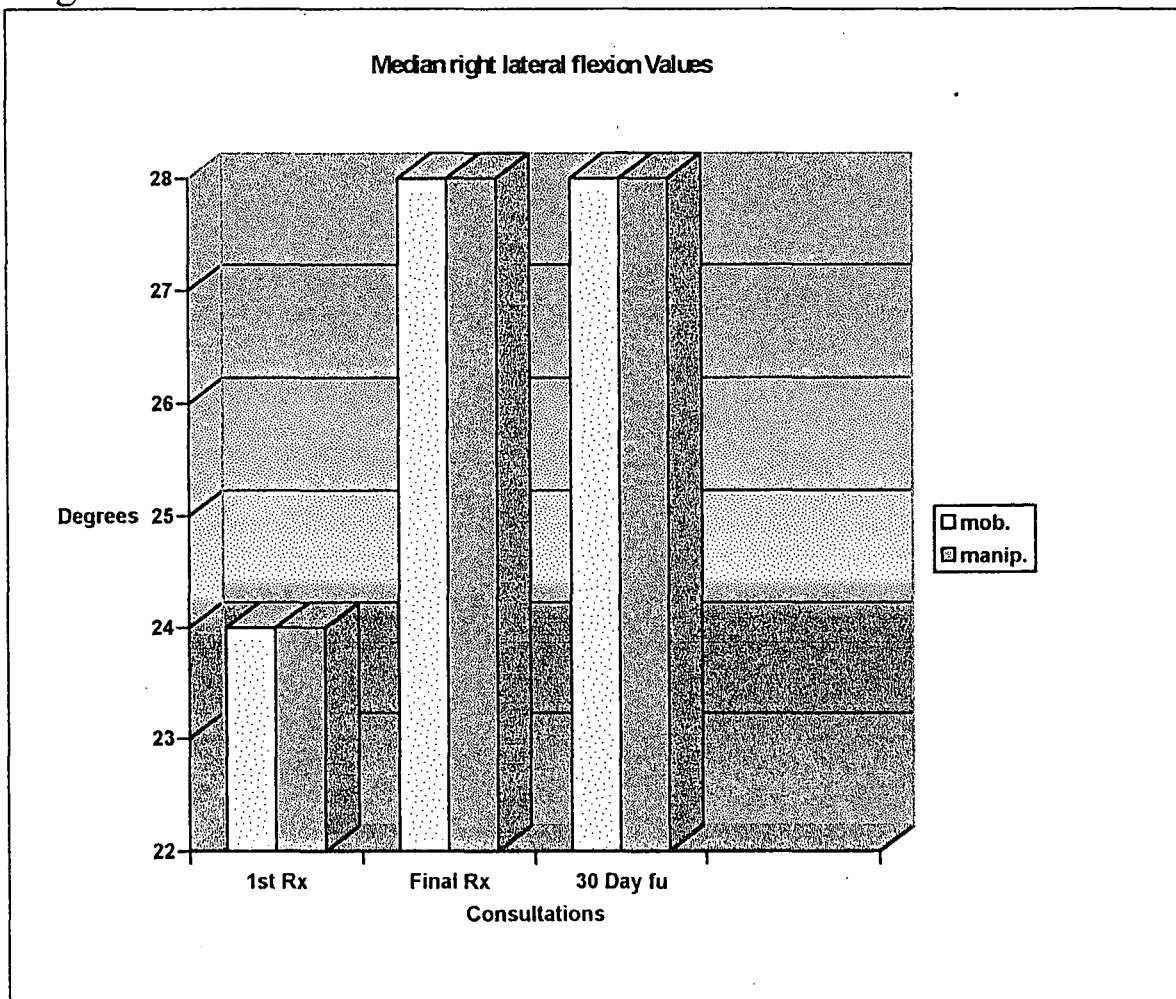
This figure indicates the changes in the median flexion values over the period of evaluation.

Fig 4.2



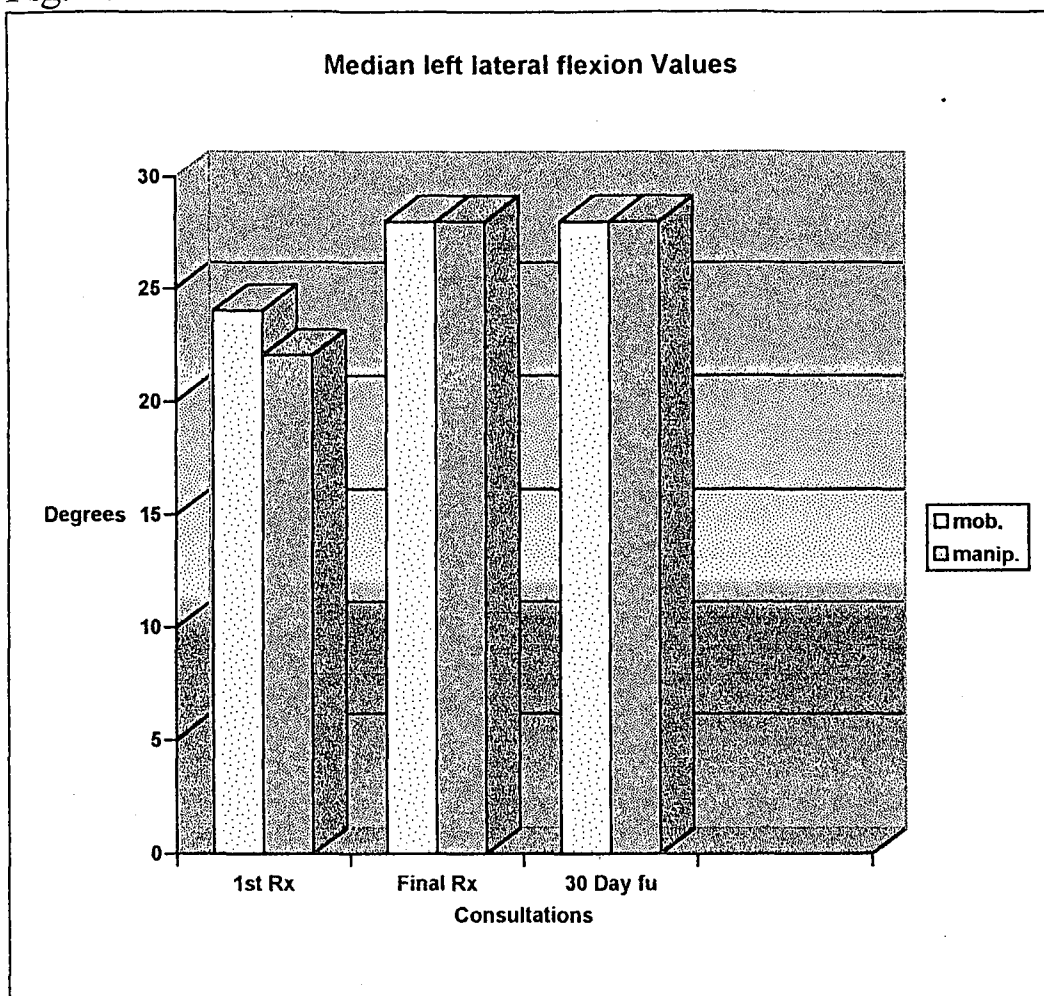
This figure indicates the changes in the median extension values over the period of evaluation.

Fig 4.3



This figure indicates the changes in the median right lateral flexion values over the period of evaluation.

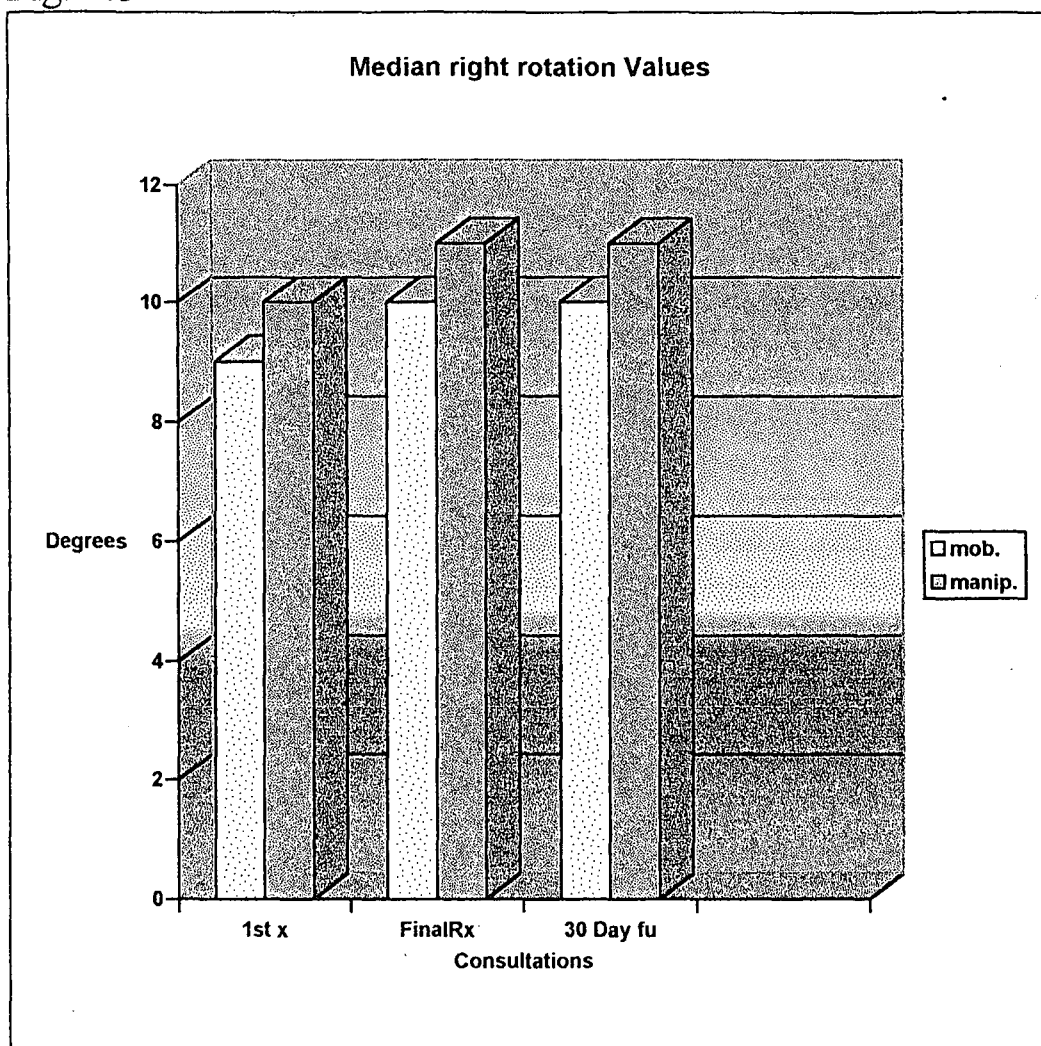
Fig. 4.4



This figure indicates the changes in the median left lateral flexion values over the period of evaluation.

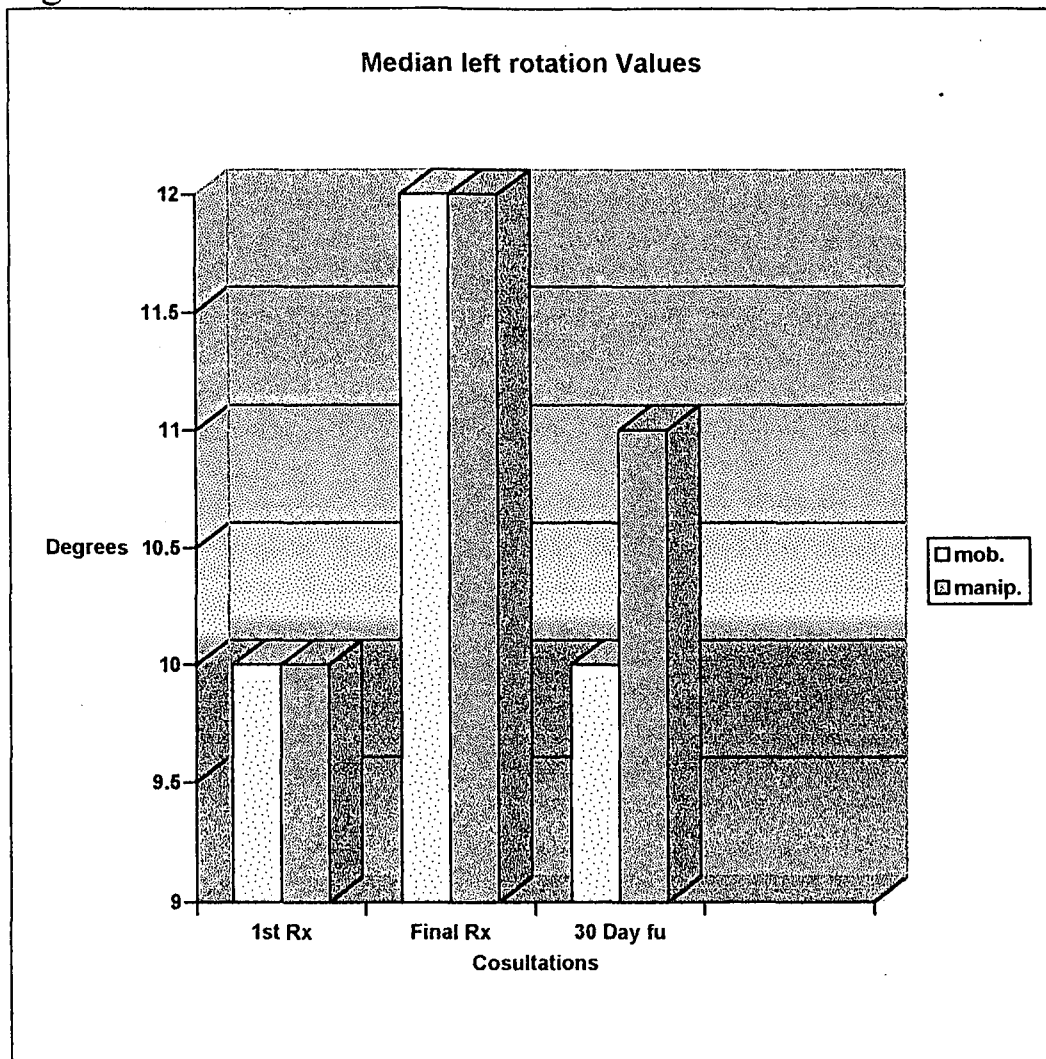


Fig. 4.5



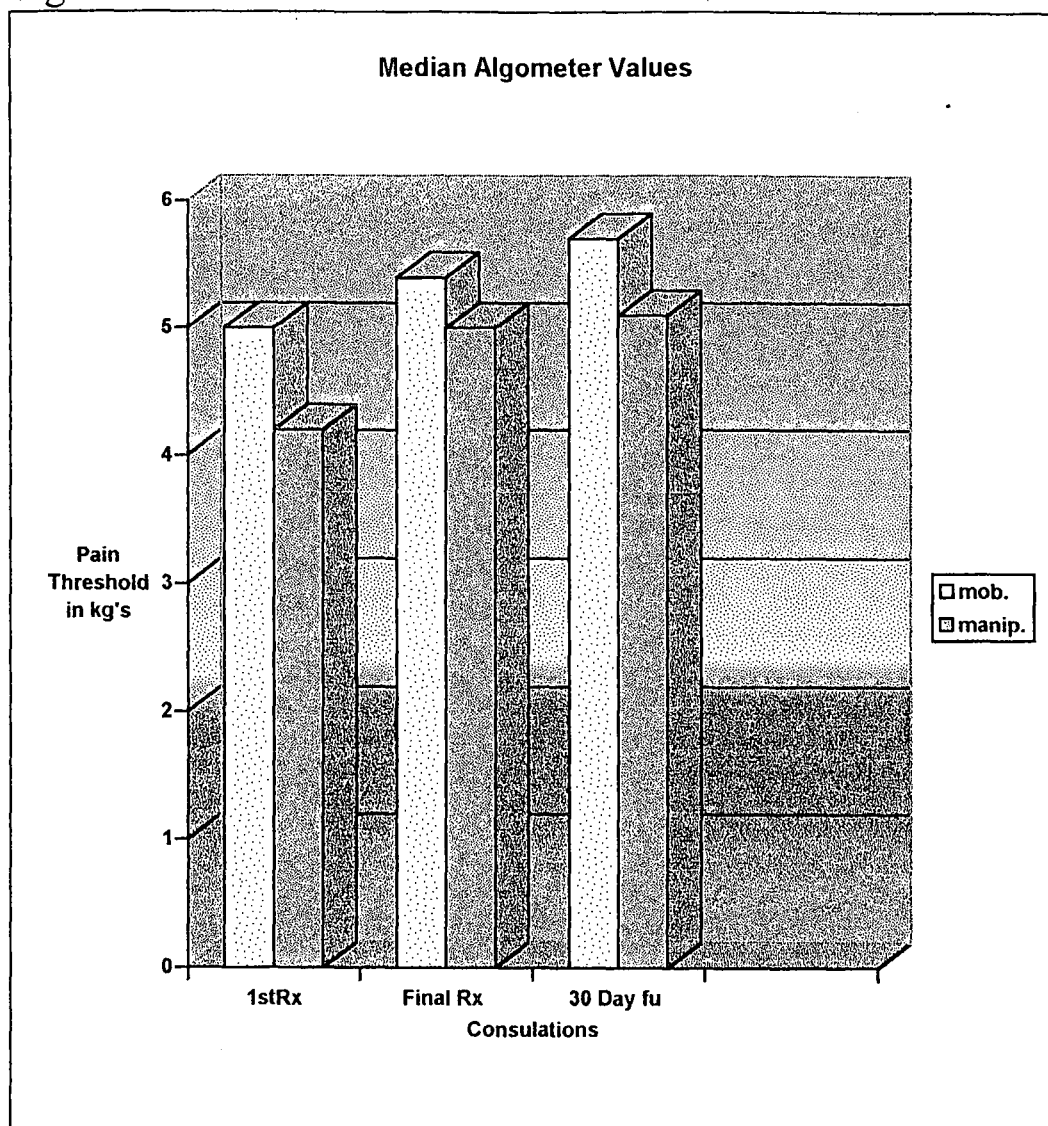
This figure indicates the changes in the median right rotation values over the period of evaluation.

Fig. 4.6



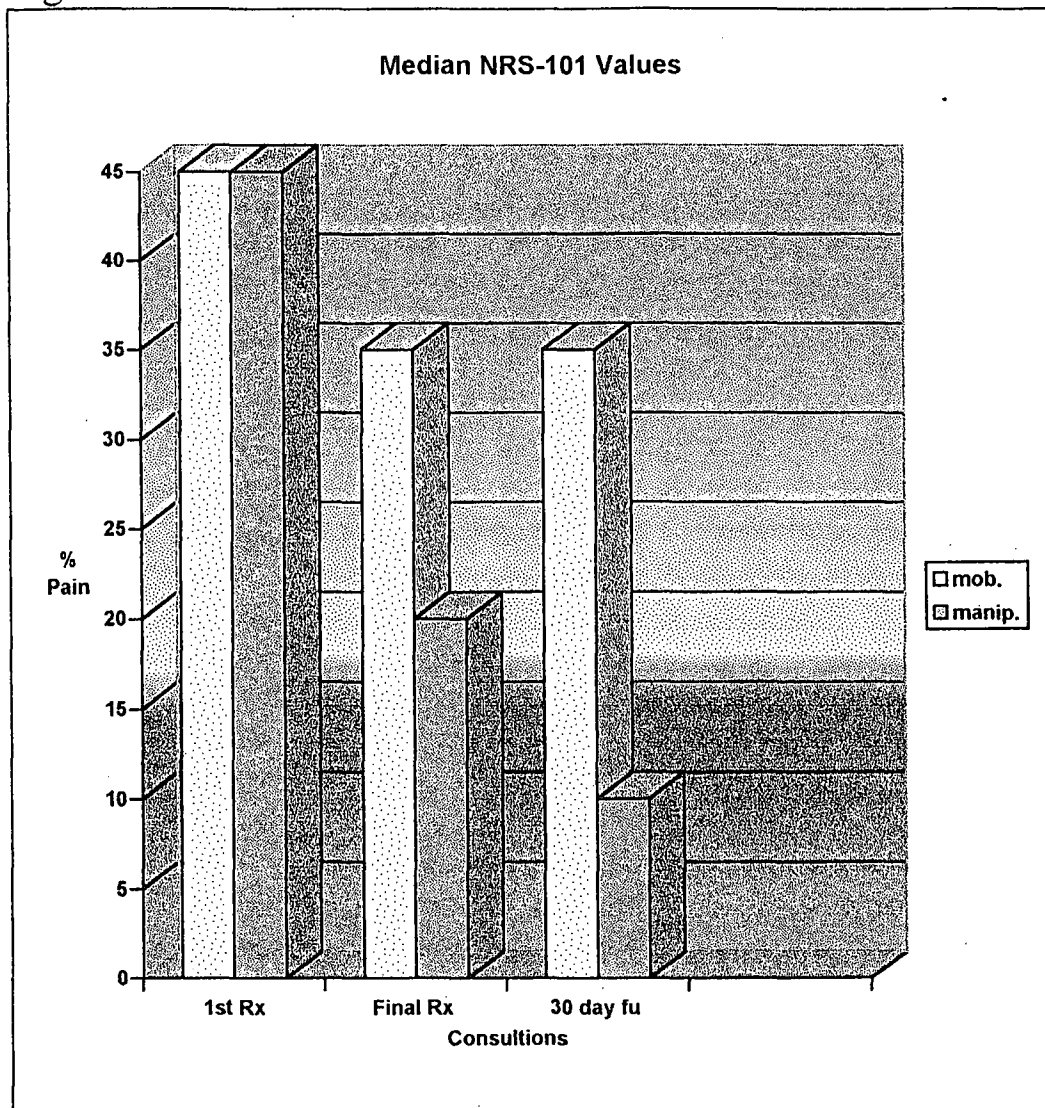
This figure indicates the changes in the median left rotation values over the period of evaluation.

Fig. 4.7



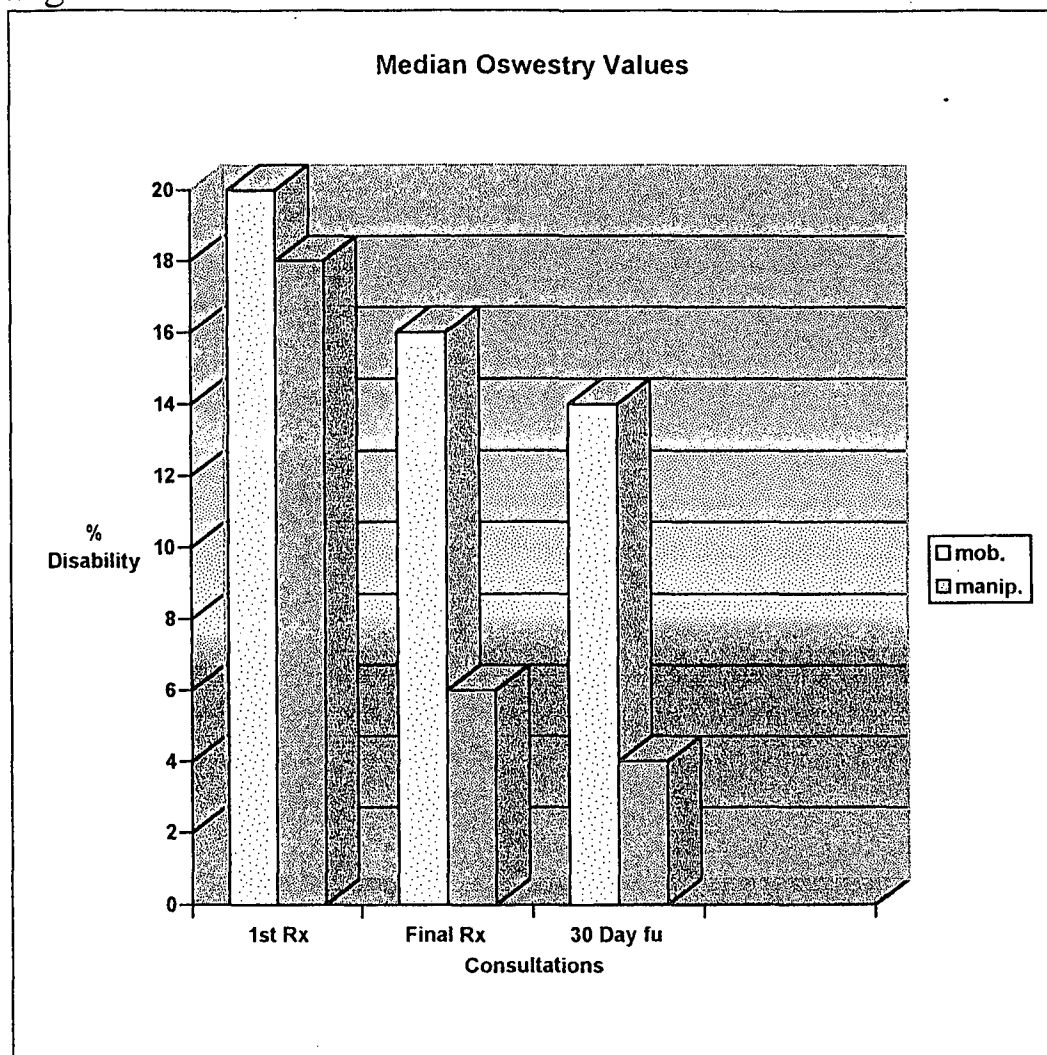
This figure indicates the changes in the median pain threshold values over the period of evaluation.

Fig. 4.8



This figure indicates the changes in the median percentage pain values over the period of evaluation.

Fig. 4.9



This figure indicates the changes in the median percentage disability values over the period of evaluation.

## Chapter 5

### 5.0. Discussion

#### 5.1 Introduction:

This chapter will discuss the results of the objective and subjective findings as gathered from the lumbar ranges of motion, algometer measurements the Oswestry Low Back Disability Index and Numerical Pain Rating Scale 101, respectively. This will be followed by the study conclusions and recommendations for future studies.

#### 5.2 Intra-group comparisons:

##### 5.2.1 The objective data:

The statistical data for the lumbar ranges of motion and algometer measurements can be found in tables 4.3- 4.8. A summary of the p-values are presented in table 4.11.

The mobilization group showed a significant improvement in flexion, right rotation and left rotation during the period between visits 1 and 6. When viewing the period between visit 1 and the 1-month follow-up, a significant increase in flexion and right rotation was found. The mobilization group showed no significant change in any of the objective measurements during the period between visit 6 and the 1-month follow-up.

The mobilization group showed two values, namely extension during the period from visit 1 to visit 6 and right lateral flexion during the period between visit 1 and the 1 month follow-up, to be very close to significant ( $p=0,026$  in both cases). These values were not included as the set confidence interval of 95% excluded them from being of statistical significance.

A significant improvement in the algometer measurements were found during the period between the first visit and the 1 month follow-up, indicating a substantial reduction of pain over the six week treatment period.

For the manipulation group a significant improvement in all objective range of motion measurements except right lateral flexion were evident during the period between visit 1 and visit 6. These effects were still evident at the 1-month follow-up with the addition of right lateral flexion, which also became significant during the period between visit 1 and the 1-month follow-up. The manipulation group showed no significant changes in the objective range of motion findings between the final consultation and the 1-month follow-up consultation.

The algometer measurements were significantly improved at the final consultation as well as the 1 month follow-up, indicating a significant decrease in pain over the two week treatment period, which was still evident four weeks after treatment was discontinued. On comparison of the significant p-value findings (table 4.11), the manipulation group showed a greater number of significant findings and with a higher degree of significance of each measurement. It is of potential clinical significance that spinal manipulation caused a significant increase in especially as this is motion most often affected in the type mechanical low back pain under investigation (Kirkaldy-Willis 1988: 133-137).

The intra-group comparison suggests that the manipulation group was more effective in universally increasing lumbar ranges of motion as well as being more effective in increasing pain thresholds during the course of the treatment protocol. However, this was not supported by the inter-group comparison as will be discussed later.

When the relevant power of the objective data is considered, the power tests show a great variation, some being very strong and others extremely weak.

It is of importance to note that the power of the measurements gathered from the manipulation group comparing visit 1 and 6 and visit 1 and the follow-up, respectively, generally have strong power values when compared to the corresponding data in the mobilization group. However, as power is a function of study sample size the question has to be raised whether possible significant results could have been missed. A larger study size may have made statistically significant changes more evident, thereby allowing the null hypothesis to be rejected more often. It must also be said that significant findings

with low power may have proven insignificant with a larger study sample. However, the general trends reflected in the median value bar charts (Fig 5.1-5.7), indicate that this is a less likely conclusion and that a larger sample size would still indicate a universally greater response in objective findings within the manipulation group.

### 5.2.2 The Subjective Data:

The statistical data can be found in tables 4.9 and 4.10 with a summary of the p-values in table 4.12.

Within the mobilization group no significant improvements were found during the first to final or first to follow-up visits for both the Oswestry and NRS-101 questionnaires. In contrast the manipulation group showed significant improvement during the first to final visits and during the first to 1 month follow-up in both the perception of pain and disability. This indicates that only the manipulation group was successful in significantly reducing the pain and disability.

A further significant improvement was noted within the manipulation group Oswestry Low Back Disability Index, during the period between the final consultation and the 1-month follow-up. This indicates that patients continued to improve after the treatment period.

The power values indicate a low power for the results gained from the mobilization group, suggesting a strong possibility that certain significant results were missed. The significant Oswestry finding within the manipulation group found within the time period between the final consultation and the follow-up was also quite low, indicating the possibility of a type-II error.



### 5.3 Inter-group comparisons:

#### 5.3.1 The objective data:

The statistical data for the lumbar ranges of motion algometer measurements can be found in tables 4.13-4.15.

On statistical analysis, no significant difference could be detected between the two groups. Standard deviation revealed a relative familiarity around the mean therefore both groups may display a similar predictability and reliability over the treatment periods. The power for all three assessment periods were weak, indicating that even if significant changes were present, they would not have been detected due the small sample size. The median values for the groups (fig. 4.1-4.7) tend to indicate a similar response to their respective treatments.

#### 5.3.2 The Subjective data:

The statistical data can be found in table 4.16.

On statistical analysis, no significant difference could be detected between the two groups. Standard deviation revealed a relative familiarity around the mean therefore both groups may display a similar predictability and reliability over the treatment periods. The power for all three assessment periods were not close to 1, this was true especially for the Oswestry questionnaire, indicating that even if significant changes were present, they would not have been detected due the small sample size. The median values for the groups (fig. 4.8-4.9) tend to indicate a similar response to their respective treatments.

### 5.4 Study limitations:

From the statistical analysis of this study there seems to be no significant difference in the treatment of acute mechanical low back pain by means of specific passive

mobilization or by spinal manipulation. Both treatment approaches improved the state of disease of the patient to such a degree that it was not possible to distinguish a better treatment modality over the six treatments given.

Having stated the above, the following factor must be considered for future studies of this nature:

#### 5.4.1 Study size and power:

Arguably, the most profound shortcoming of this study is the sample size of 15 patients. In their criteria for methodological assessment of a clinical trial, Assendelft *et al.* (1992), sub-divided their criteria list into 5 subsections. The sub-section addressing the study population counted for 30 out of a possible 100 points. The authors attached a value of 12 out of a possible 30 points, to any clinical trial with a sample size of 100 subjects or greater. This indicates the immediate strength that a larger study population lends to a study. The reason for this is clearly the power of the larger study or inversely the lack of power of a small sample size.

The power of a statistical test is  $\beta$  ( $1-\beta$ ). This is the probability of detecting the difference between two groups (Bailar III and Mosteller 1992: 359, 387). There is a close connection between sample size and the power of a statistical test (Bailar III and Mosteller 1992: 195). The smaller the study size the greater the risk of Type II error and thus a weaker power will probably be reflected. Ideally the power value should be as close to 1 as possible to decrease the chance of incidental results (Crichton 1993: 13). From a practical point of view it was not possible to use a larger study population in this study, due to time and financial constraints.

#### 5.4.2 Homogeneity:

It is held by Koes *et al.* 1995, that the greater the number of comparable baseline characteristics between study subjects, the better the study design. However, this presents the researcher with somewhat of a catch-22 situation. It is not always possible to have subjects with a high homogeneity in terms of age, sex, occupation etc., that can be compared to maximize the method quality, whilst at the same time not falling into the

trap of selection bias. In this study's clinical setting and time restraint, it was not possible to achieve this. When considering the demographic data it can be seen that the two groups were very similar in sex distribution, but not that similar in age distribution.

#### 5.4.3 Blinding:

According to Pocock (1993: 32) to achieve a gold standard within a clinical trial, double blinding must be utilized within the study to prove that a therapy is effective. However, Assendelft et al. (1992) states that for a pragmatic type study, where another treatment group is used as a reference, patient naivete has to be used as a substitute. Within the designs of this study this was attempted by not entering patients into the study if they had received either of the treatment modalities within 6 months of the study. Even though this not a full proof method of ensuring patient blinding, it minimizes the risk of results being influenced, in either direction, through preconceived ideas on the part of the patient.

The study was conducted solely by the author; thus the possibility of practitioner bias exists. There was also no blinded outcome assessment, which caused the possibility of observer bias. Both of the previously discussed factors are mentioned by Assendelft et al. (1992) as important factors influencing the effect of a study in either direction. It was not practically possible to address these factors effectively within this study, which must lead to the conclusion that the weight of the study is reduced due to the lack of both single and double blinding.

#### 5.4.4 Significance:

Koes *et al.* (1995) states that there is consensus that outcome measures should be valid, precise and sensitive for measuring small, but clinically relevant changes. However, there is a debate as to whether the assessment should be left up to the patient or should be done by a blinded observer who decides based on physical examination, the extent of clinical changes.

It is the authors view that both of these should be considered, depending on the specific questions that need to be answered, however this may be fruitless labour as the clinical

significance may not be revealed by statistical analysis of the objective or subjective data used. We cannot be sure that the clinical phenomenon under investigation is being correctly measured and consequently the statistical outcome may not reveal the true impact of the treatments given.

From the method discussion in chapter 3, it is evident that the objective measurements of goniometry and pressure algometry, along with the Oswestry and Numerical Pain Rating questionnaires represent valid methods of capturing changes within test subjects.

However, it could still be questioned whether the true clinical changes in dysfunctional joints of the lumbar spine and/or sacro-iliac joints undergoing specific spinal mobilization or manipulation, have been completely measured from both a clinical and statistical point of view.

### 5.5 Outcome commentary:

Although this study could find no significant differences between the two treatment modalities on inter-group comparison, it once again showed that manual treatment is an effective tool in the treatment of mechanical back pain. However, the highly significant changes in the manipulation group during the intra-group comparison (tables 4.11- 4.12), indicate that spinal manipulation may act to a greater extent in restoring lost ranges of motion and certainly in reducing the perception of pain and disability. This seems to be the trend when viewing the bar charts indicating the median values (fig. 4.1-4.9), especially when the first visit is compared to the final and 30-day follow-up.

A possible reason for the lack of a definite outcome is that the natural history of the study conditions favor spontaneous recovery, during which time the manual interventions described carry with them a strong placebo effect, encouraging a quicker return to health Kosei et al. (1992). Thus, the importance of placebo-controls, sensitive measurement instruments, more stringent inclusion criteria and accurate measurements to show small, but significant differences between the manual interventions, become of even greater importance. This is the same point of view held by Di Fabio (1992), Assendelft *et al.* (1992) Koes *et al.* (1996) in their various reviews of studies relating to the topic.

## Chapter 6

### 6.0 Recommendations and Conclusions

#### 6.1 Recommendations:

With greater time and financial freedom the author would recommend a study that could fully investigate the possible differences that could be present between treating mechanical low back pain of the lumbar spine, sacro-iliac joint or a combination of both by means of either spinal mobilization or spinal manipulation. The following improvements are suggested.

##### **Sample size:**

A larger sample size would have to be selected. A sample size of 30 would allow greater statistical freedom and allow for the use of paired as well as unpaired t-tests. The  $\beta$  should be pre-determined (as done with  $\alpha$ ) to have the chance of Type II error limited to a set level. It was not possible to pre-determine this effectively due to the time and budget constraints of the study.

It is the authors view that a sample size of 100 should be used to be certain of a sample that is representative of the population.

##### **Homogeneity:**

Making the inclusion and exclusion criteria more strict and then using matched pairs with respect to age, sex, race and history of complaint, would greatly enhance the strength of the study.

##### **Placebo group:**

A placebo group should be incorporated into the study. The author suggests a group

receiving a sham ultra-sound treatment.

**Blinding:**

Observer bias can be eliminated by not informing the examiner collecting and collating data as to which group the patient falls within.

**Accuracy:**

As more advanced technology is developed the instrumentation used should become more accurate and sensitive, allowing small, but significant changes to be detected.

**Crossing over:**

A cross-over feature could be considered within the two experimental treatments, so that those patients not showing strong signs of improvement are switched to the opposite treatment to see if any improvement is noticed.

**6.2 Conclusions:**

The statistical analysis revealed statistically significant improvements, within the manipulation group objectively as well as subjectively, after the treatment period. These changes were still evident at the one-month follow-up. The mobilization group also showed significant objective changes within the group, however these were to a lesser degree than the manipulation group. No statistically significant intra-group changes were present within the mobilization group for the subjective findings after treatment or at the follow-up assessment.

When statistical analysis was used to compare the two groups no statistical significant results were noted. This leads to the conclusion that both treatment groups responded favourably in terms of objective and subjective measures.

The study thus indicates that specific spinal mobilization and spinal manipulation are equally effective in the treatment of dysfunction in the lumbar spine and sacro-iliac joints.

From a practical point of view it is the recommendation of author are as follows:

This study indicates that there should be no significant difference in treating patients with either one of the two techniques. However, the clinical art of medicine would dictate that judgements should be made as to which technique can be applied more effectively with respect to each individual or indeed if a combination of the two would yield a more favourable response.

As a standard treatment frequency was chosen, the optimum number of treatments it would take to secure a significant recovery was not addressed. It therefore stands to reason as to the minimum number consultations it would require, for patients to at least subjectively report significant relief of symptoms. However, it is the clinical impression of the author that patients receiving manipulation showed a greater subjective improvement between the first and second consultations and that the manipulation subjects reported less residual joint stiffness at the end of the treatment period.

It is further postulated, that in patients suffering from chronic back pain with periodic acute episodes or in the extremely acute patient, that the mobilization protocol should be followed until no further symptomatic improvement can be elicited, after which spinal manipulation could be applied in order to further ameliorate symptoms and increase spinal mobility, if required.

As no clear treatment protocols yet exist for the treatment of mechanical low back pain, the responsibility of every practitioner addressing this problem, becomes much greater, in that they owe it to their patients not to apply "cook-book" treatments to every case.

A system of constant re-evaluation must be applied in order to clinically monitor patient response. It is the author's opinion that in uncomplicated mechanical back pain, patients should be show a significant improvement to treatments given, within four visitations from the initial consultation. If this is not the case, diagnostic and treatment adjustments should be considered.

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Addenda:

Appendix A- Case history

Appendix B- Physical Examination

Appendix C- Regional Lumbar Examination

Appendix D- Letter of Informed Consent

Appendix E- Oswestry Low Back Disability Index Questionnaire

Appendix F- Numerical Pain Rating Scale 101 Questionnaire

**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: \_\_\_\_\_

Current: \_\_\_\_\_

**X-Ray Studies:**

Previous: \_\_\_\_\_

Current: \_\_\_\_\_

**Clinical Path. lab:**

Previous: \_\_\_\_\_

Current: \_\_\_\_\_

**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)



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. Immediate Family Medical History:

- ▶ Age
- ▶ Health
- ▶ Cause of Death
- ▶ DM
- ▶ Heart Disease
- ▶ TB
- ▶ Stroke
- ▶ Kidney Disease
- ▶ CA
- ▶ Arthritis
- ▶ Anaemia
- ▶ Headaches
- ▶ Thyroid Disease
- ▶ Epilepsy
- ▶ Mental Illness
- ▶ Alcoholism
- ▶ Drug Addiction
- ▶ Other

**TECHNIKON NATAL CHIROPRACTIC DAY CLINIC**

**PHYSICAL EXAMINATION**

Patient: \_\_\_\_\_ File#: \_\_\_\_\_ Date: \_\_\_\_\_  
 Clinician: \_\_\_\_\_ Signature: \_\_\_\_\_  
 Intern: \_\_\_\_\_ Signature: \_\_\_\_\_

**1. VITALS**

Pulse rate:  
 Respiratory rate:  
 Blood pressure:      R                      L  
 Temperature:  
 Height:  
 Weight:

**2. GENERAL EXAMINATION**

General Impression:  
 Skin:  
 Jaundice:  
 Pallor:  
 Clubbing:  
 Cyanosis (Central/Peripheral):  
 Oedema:  
 Lymph nodes      - Head and neck:  
                              - Axillary:  
                              - Epitrochlear:  
                              - Inguinal:

Urinalysis:

**3. CARDIOVASCULAR EXAMINATION**

- 1) Is this patient in **Cardiac Failure** ?
- 2) Does this patient have signs of **Infective Endocarditis** ?
- 3) Does this patient have **Rheumatic Heart Disease** ?

**Inspection**   - Scars  
                      - Chest deformity:  
                      - Precordial bulge:  
                      - Neck -JVP:

**Palpation:**   - Apex Beat (character + location):  
                      - Right or left ventricular heave:  
                      - Epigastric Pulsations:  
                      - Palpable P2:  
                      - Palpable A2:

- Masses (intra- or extramural)
- Aorta:

**Percussion** - Rebound tenderness:

- Ascites:
- Masses:

**Auscultation** - Bowel sounds:

- Arteries (aortic, renal, iliac, femoral, hepatic)

**Rectal Examination**

- Perianal skin:
- Sphincter tone & S4 Dermatome:
- Obvious masses:
- Prostate:
- Appendix:

## 6. G.U.T EXAMINATION

External genitalia:

Hernias:

Masses:

Discharges:

## 7. NEUROLOGICAL EXAMINATION

**Gait and Posture**

- Abnormalities in gait:
- Walking on heels (L4-L5):
- Walking on toes (S1-S2):
- Rombergs test (Pronator Drift):

**Higher Mental Function**

- Information and Vocabulary:
- Calculating ability:
- Abstract Thinking:

**G.C.S.:**

- Eyes:
- Motor:
- Verbal:

**Evidence of head trauma:**

**Evidence of Meningism:**

- Neck mobility and Brudzinski's sign:
- Kernigs sign:

**Cranial Nerves:**

I

Any loss of smell/taste:  
Nose examination:

II

External examination of eye:

- Visual Acuity:
- Visual fields by confrontation:

- Forearm = Supination & Pronation:
  - Fingers = Extension (Interphalangeals & M.C.P's):
  - Thumb = Opposition:
  - Hip = Flexion & Extension:
  - = Adduction & Abduction:
  - Knee = Flexion & Extension:
  - Foot = Dorsiflexion & Plantar flexion:
  - = Inversion & Eversion:
  - = Toe (Plantarflexion & Dorsiflexion):
- b. Tone
- Shoulder:
  - Elbow:
  - Wrist:
  - Lower limb - Int. & Ext. rotation:
  - Knee clonus:
  - ankle clonus:
- c. Reflexes
- Biceps:
  - Triceps:
  - Supinator:
  - Knee:
  - Ankle:
  - Abdominal:
  - Plantar:

### Sensory System:

- a. Dermatomes
- Light touch:
  - Crude touch:
  - Pain:
  - Temperature:
  - Two point discrimination:
- b. Joint position sense
- Finger:
  - Toe:
- c. Vibration:
- Big toe:
  - Tibial tuberosity:
  - ASIS:
  - Interphalangeal Joint:
  - Sternum:

### Cerebellar function:

#### Obvious signs of cerebellar dysfunction:

- = Intention Tremor:
- = Nystagmus:
- = Truncal Ataxia:

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 & Soft Tissue Contours

Spinous Percussion  
Schober's Test (6cm)  
Treadmill  
Body Type  
Attitude

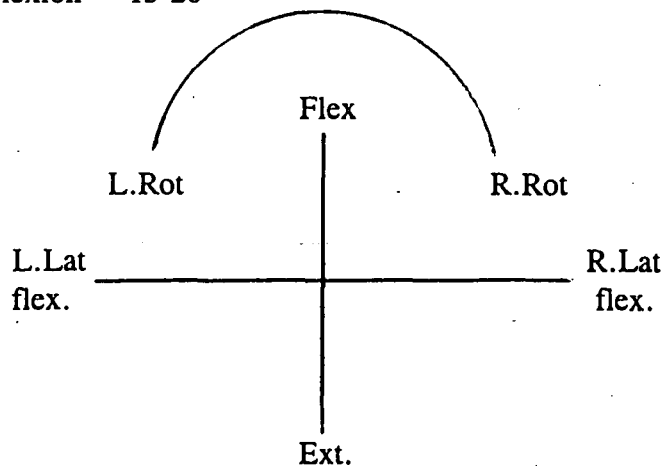
RANGE OF MOTION

Forward Flexion =  $40-60^{\circ}$  (15cm from floor)

Extension =  $20-35^{\circ}$

L/R Rotation =  $3-18^{\circ}$

L/R Lateral Flexion =  $15-20^{\circ}$



SUPINE:

Skin  
Hair  
Nails  
Palpate Abdomen/groin  
Pulses (abdomen)

Observe abdomen  
Fasciculations  
Abdominal Reflexes

## NEUROLOGICAL EXAMINATION

DERMATOMES			MYOTOMES			REFLEXES		
	L	R		L	R		L	R
T12			Hip Flex			Pat.		
L1			Hip int rot			Achil		
L2			Hip ext rot			H/S		
L3			Hip abd					
L4			Hip add					
L5			Knee flex					
S1			Knee ext					
S2			Dorsiflex					
S3			Plantarflex					
			Eversion					
			Ext.hal.long					

Tripod  
Kemp's Test

### MOTION PALPATION and JOINT PLAY:

LEFT:      Upper Thoracics:  
             Lumbar Spine:  
             Sacroiliac Joint:

RIGHT:     Upper Thoracics:  
             Lumbar Spine:  
             Sacroiliac Joint:

**Basic Exam: Hip**  
Case History:

ROM: Active:  
      Passive:  
      RIM:  
Orthopaedic/Neuro/  
Vascular:

Observ/Palpation:

**Basic Exam: Thoracic Spine**  
Case History:

ROM: Motion Palp:  
      Active:  
      Passive:  
Orthopaedic/Neuro/  
Vascular:

Observ/Palpation:

LETTER OF INFORMED CONSENT:

I, \_\_\_\_\_, hereby state that I am willing to participate in the research study of Cornelius Myburgh. I will adhere to the conditions of the project and instructions of the researcher to the best of my ability. All information divulged by me will be truthful and I understand that all information will be dealt with in a strictly private and confidential manner.

Signed: \_\_\_\_\_

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

Witness: \_\_\_\_\_

# OSWESTRY BACK DISABILITY INDEX

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

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

## Section 1 - Pain Intensity

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

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

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

## Section 3 - Lifting

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

## Section 4 - Walking

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

## Section 5 - Sitting

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

## Section 6 - Standing

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

## Section 7 - Sex Life

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

## Section 8 - Social Life

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

## Section 9 - Sleeping

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

## Section 10 - Travelling

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



## **NUMERICAL PAIN RATING SCALE- 101 QUESTIONNAIRE**

Patient Name: \_\_\_\_\_ File no: \_\_\_\_\_ Date: \_\_\_\_\_

Please indicate on the line below, the number between 0 and 100 that best describes the pain you experience **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

\_\_\_\_\_

Please indicate on the line below, the number between 0 and 100 that best describes the pain you experience **when it is at its least.** A zero (0) would mean "no pain at all", and one hundred would mean "pain as bad as it could be". Please write only one number.

\_\_\_\_\_