A COMPARISON OF TWO MANIPULATIVE TECHNIQUES IN THE TREATMENT OF SACROILIAC SYNDROME

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BY ALAN ROGER REID

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I, Alan Roger Reid, declare that this dissertation represents my own work.

Signed  Date 16-5-97

A.R.REID

Approved for final submission

Supervisor:  Date: 16-5-97

A.V. PEERS M.Dip.C (S.A.)

DEDICATION

I dedicate this research to my exceptional parents, Eric and Joan, and to my wonderful wife, Nicky.

Thank you all for your unwavering love, support and encouragement, without which I would not have achieved this goal.

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ABSTRACT

Sacroiliac syndrome is a painful, debilitating condition that may cause considerable discomfort (Haldeman 1992), it is a common condition causing low back pain (Mierau, et al 1984, Guo and Zhao 1994), it is also believed by Bernard and Cassidy (1991) to be a frequently overlooked source of low back pain. Between 9 and 19.5 % of all sickness absence days are due to low back pain (Andersson 1981).

The side posture "roll" adjustment seems to be the treatment of choice (Schafer and Faye 1990, Gatterman 1990, Haldeman 1992, Robinson et al. 1987). However, some authors believe that adjusting the PI ilium with a Drop Table developed by Thompson, is the only precise means of consistently moving and correcting this joint (Harrison 1994, Moulton 1985). To this researchers' knowledge, no research has been done to compare these treatments with one another.

It was hypothesised that both treatments are effective in the management of sacroiliac syndrome. It was further hypothesised that the two treatment groups would not be equally effective in terms of the subject's perception and objective clinical findings.

The objective of this study was thus to establish which of the two treatments is the most effective in the management of sacroiliac syndrome, in order to try to reduce patient

morbidity, improve quality of life and reduce treatment costs.

This study consisted of a controlled trial of a sample population diagnosed with sacroiliac joint dysfunction. Thirty subjects were randomly divided into two groups: the control group and the experimental group. The control group was treated with a side posture "roll" adjustment of the sacroiliac joint and the experimental group received prone "drop mechanism" adjustments.

All subjects were subjectively monitored using the Oswestry Back Disability Index, the Numerical Pain Rating Scale and the McGill Short-Form Pain Questionnaire. The objective responses to the treatment were recorded by algometer readings (Wagner Force Dial).

Each subject was treated a maximum of ten times or until clinically asymptomatic over a period of four weeks, with a follow-up evaluation three weeks after the month treatment period.

The results were analyzed at a 95% confidence interval as follows:

1. The median values of the first, last and follow-up treatments obtained from the Oswestry Back Disability Index, Numerical Pain Rating Scale and algometer readings

were statistically evaluated using the non-parametric Wilcoxon Signed Rank test.

2. A comparison was made using the median value of the first, last and follow-up treatments for each of the measurement parameters of the control group, and the experimental group by statistical analysis using the Mann-Whitney U test.

The average number of treatments for the control group was 6.7, and for the experimental group, 6.1 per subject with a mean of 6.4.

The results for both subjective and objective data indicated that there was a significant improvement within both treatment groups ($P < 0.05$) and that the rate of improvement was similar. There was no significant difference in the efficacy when comparing the two treatment groups ($P < 0.05$).

In conclusion, it must be stated that both treatment methods produced favourable results. The age and duration of symptoms were not taken into account while analysing the data.

This study lends further support to the use of manipulation of the sacroiliac joint in the management of subjects with sacroiliac syndrome, as there is sufficient clinical evidence to conclude that both treatment groups showed significant improvement within the natural progression of the conditions.

A larger sample size is necessary to identify subtle changes in the measurement parameters and to add to the validity of the results. Individual patient characteristics such as age, gender and duration of symptoms should also be taken into account in future studies of this nature.

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LIST OF ABBREVIATIONS

BST	=	Back School Therapy
Gr 1	=	Group 1 (roll)
Gr 2	=	Group 2 (drop)
If P	=	< 0.05 = significant difference (5% level of significance)
If P	=	> 0.05 = no significance (5% level of significance)
LBP	=	Abbreviation of low back pain.
P	=	Two-tailed probability of equalling or exceeding P
PSIS	=	Abbreviation for posterior superior iliac spine.
SIJ	=	Sacroiliac joint
sig	=	Significance
SMT	=	Spinal Manipulative Therapy
Tx 1	=	First treatment
Tx L	=	Last treatment
Tx FU	=	Follow-up treatment

DEFINITIONS OF TERMS

(All definitions obtained from Bryner 1984)

ADJUSTMENT (Chiropractic): A specific form of direct articular manipulation utilising a short lever and characterised by a dynamic, forceful, high velocity thrust of low amplitude, after appropriate stabilisation of other joints has occurred and the joint is tractioned.

CHIROPRACTIC: A discipline of the scientific healing arts concerned with the pathogenesis, diagnostics, therapeutics, and prophylaxis of functional disturbances, pathomechanical states, pain syndromes and neurophysiological effects related to the statics and dynamics of the locomotor system, especially of the spine and pelvis.

CONTRA-INDICATION: Symptoms, signs or diagnosis that mitigate against the use of a particular procedure.

FIXATION: A state whereby a vertebra or pelvic bone has become temporarily immobilised in a position it may normally occupy during any phase of physiological spinal movement.

JOINT DYSFUNCTION: Joint mechanics showing area disturbances of function without structural change.

MOBILIZATION: A form of manipulation applied within the physiological passive range of joint motion and is characterised by non-thrust passive joint manipulation.

MOTION PALPATION: Diagnosis of passive and active segmental joint ranges of motion.

NUTATION: Motion of the sacrum about a coronal axis in which the sacral base moves anteriorly and inferiorly and the tip of the coccyx moves posteriorly and superiorly, nodding as of the head.

RANGE OF MOTION: The range of translation and rotation of a joint for each of its six ranges of freedom.

REFERRED PAIN: Pain felt in a part other than that in which the cause is situated.

RELEASE (Cavitation): The audible "crack" or "pop" heard after the application of an adjustment to a particular articulation.

SACROILIAC FIXATION: (Sacroiliac joint locking) - The absence of normal motion at the sacroiliac joint, demonstrable by motion palpation in which the axis of rotation has shifted to either the superior or the inferior portion of the sacroiliac joint, or, rarely a situation in which there is total

fixation with no axis of rotation.

THOMPSON TERMINAL POINT TECHNIQUE: A technique based on the theory that patterns of subluxations exist because of muscle contracture and that involves analysis of leg length. Sophisticated mechanisms of "drop" are built into the adjusting table sections. These are used for correction by releasing on application of chiropractic adjustive force.

X-AXIS: A line passing horizontally from side to side. Also called the coronal or frontal axis. Movement around the X-axis is said to be in a horizontal plane.

Y-AXIS: A line perpendicular to the ground. Also referred to as the vertical axis. Movement around the Y-axis is said to be in the horizontal or transverse plane.

Z-AXIS: A line passing horizontally from front to back. Also referred to as the sagittal axis. Movement around the Z-axis is said to be in the coronal plane.

CHAPTER ONE

1.0 INTRODUCTION

Publications resulting from most of the research conferences have focused on the emerging evidence from randomised trials of the clinical efficacy of spinal manipulative therapy (SMT), especially for low back pain (LBP) (Cassidy and Mierau 1992).

Sacroiliac syndrome is a painful, debilitating condition that may cause considerable discomfort (Cassidy and Mierau 1992). Sacroiliac joint dysfunction is a common condition causing low back pain (Mierau 1984, Bernard and Cassidy 1991, Cassidy and Mierau 1992). In a study of school-aged children, Mierau et al (1984) found a prevalence of low back pain in 23.5% of the population studied. A frequency of sacroiliac hypomobility (positive Gillet test) was observed in 28.1% of the same group. There was thus a significant association found between sacroiliac hypomobility and low back pain.

Swedish surveys have shown that between 9 and 19.5 percent of all sickness absence days are due to LBP, the disease group responsible for the largest number of lost days (Andersson 1981). Chiropractic adjustment utilises specific short levers to which a high velocity thrust of controlled amplitude is directed to restore mobility to individual articulations (Gatterman 1990).

Haldeman (1992) states that manipulation of the painful sacroiliac joint is successful in the majority of cases.

The side posture "roll" adjustment seems to be the treatment of choice (Schafer and Faye 1990, Gatterman 1990, Cassidy and Mierau 1992). This adjustment is advocated by Schafer and Faye (1990) as it does not restrict its force to one articulation, or even one part of an articulation. Robinson et al (1987) reported successful treatment of putative sacroiliac joint syndrome by long lever rotary manipulation. Harrison (1994) believes that adjusting the PI ilium with a Drop Table developed by Thompson, is the only precise means of consistently moving and correcting this joint. According to Haldeman (1992) the method of manipulation should vary according to patient tolerance. He believes that there is an obvious need for more research into the role of the sacroiliac joint in low back pain.

In view of the fact that so little research has been done to prove the efficacies of either treatment, and no controlled studies have been done, to this researcher's knowledge, that compare the clinical efficacies of these two adjustive procedures, it is important to establish which of the two treatments (side posture "roll" or prone "drop mechanism") adjustment, is the most effective in the management of sacroiliac syndrome, as well as to expand our knowledge on the subject of sacroiliac syndrome in order to reduce patient morbidity, improve quality of life and reduce treatment costs. Hopefully, this research will also add to the validity of spinal manipulative

therapy for the treatment of the painful, hypomobile sacroiliac joint.

This research can be broken down into three objectives, firstly to evaluate the efficacy of the side posture "roll" adjustment in the treatment of subjects with sacroiliac syndrome, in terms of the subject's perception and objective clinical findings. The second objective is to evaluate the efficacy of the prone "drop mechanism" adjustment in the treatment of sacroiliac syndrome, in terms of the subject's perception and objective clinical findings. The third objective is to integrate the data obtained from objectives one and two, in order to determine which is a more effective treatment of sacroiliac syndrome.

CHAPTER TWO

2.0 REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

According to Cassidy and Mierau (1992), sacroiliac syndrome is a painful debilitating condition that may cause considerable discomfort to the patient. Any degree of sacroiliac fixation or hypermobility disturbing reciprocal motion bilaterally can, according to Schafer and Faye (1990), be associated with:

- the direction of excessive rotary forces to the lumbar spine, leading to disc protrusion and potential rupture.
- an adaptive lumbar scoliosis away from the side of pain, leading to compensatory biomechanical changes in the thoracic and cervical regions.
- compensatory overstress at the acetabulum, leading to hip pain and arthritis.

2.2 PREVALENCE OF SACROILIAC SYNDROME

Sacroiliac joint dysfunction is a common but frequently overlooked source of low back pain, (Bernard and Cassidy 1991). In a study of school-aged children, Mierau et al (1984) found a prevalence of low back pain in 23.5% of the population studied, and a frequency of sacroiliac hypomobility (positive Gillet test) in 28.1% of the same group. There was thus a significant

association found between sacroiliac hypomobility and low back pain. Swedish surveys have shown that between 9 and 19.5 percent of all sickness absence days are due to LBP and that 50 to 80 percent of adults at some time suffer from low back pain, making this the disease group responsible for the largest number of lost work days (Anderson 1981). Some authors believe that the sacroiliac joint is responsible for a large proportion of mechanical backache. The incidence in the general population is unknown, but it was reported to be the primary source of back pain in 22.5% of 1293 subjects with low back pain, in 30% of subjects with L5-S1 isthmic spondylolisthesis, Bernard and Kirkaldy-Willis (1987) concluded that the radiographic finding was incidental and that the sacroiliac joint was the anatomical source of the pain . In a study of 855 pregnant women, the nine month prevalence of back pain was 49 percent, with a point prevalence of 25 percent throughout pregnancy. The back pain could be divided into three groups of which one that was localised to the sacroiliac area increased as the pregnancy progressed (Ostgaard, Andersson and Karlsson, 1991). A retrospective study done by Schmid (1984) showed a prevalence of 467 cases of sacroiliac joint syndrome out of 1344 patients that presented with "back disorders".

2.3 RECURRENCE RATE

Sacroiliac syndrome appears to be short-lived. However the chances of the condition recurring are high. About 60 percent of these patients will have a second episode of back pain over the

following two years (Bergquest-Ullman and Larson, 1970).

2.4 ANATOMY, MOVEMENT AND FUNCTIONS OF THE SACROILIAC JOINT

The sacroiliac joint is a true synovial joint. It has a joint capsule, synovial fluid, a synovial membrane and a cartilaginous surface (Alderink 1991, White and Punjabi 1990). The sacroiliac joint is usually auricular or C-shaped, with the convex contour facing anteriorly and slightly inferior. It is an atypical synovial joint with a well defined joint space, it has two opposing cartilage surfaces, the iliac surface is covered with fibrocartilage and the sacral surface with hyaline. Together with the symphysis pubis, these joints impart a limited degree of flexibility to the pelvic ring (Cassidy and Mierau 1992). The fibrocartilaginous surface tends to undergo early degenerative changes, and the joint is surrounded by many powerful muscles none of which are known to directly influence its movement (Cassidy 1992, Cassidy and Mierau 1992). This is substantiated by Walker (1992) who states that the sacroiliac joint is not crossed by any muscle. All adjacent muscles (i.e. the quadratus lumborum, erector spinae, gluteus maximus, gluteus minimus, piriformis, and iliacus muscles and even the more distantly located latissimus dorsi muscle) have fibrous expansions that blend with anterior and posterior SIJ ligaments and contribute to the strength of the joint capsule and ligaments, and thus to the joint's stability. This fascial reinforcement is greater posteriorly, as more muscles are adjacent to the joint on that aspect, and Walker (1992) goes on to say that the tissues derived from muscle

expansions may be placed in tension when the muscle bellies contract. Muscle activity, therefore, is likely to increase any symptoms arising from SIJ pathology. Factors such as a dense strong ligamentous complex, the irregular interlocking joint surface topography and the great magnitude of force required to disrupt the joint suggest that the sacroiliac joint is very stable and only capable of minimal movement (Cassidy and Mierau 1992). Bernard and Cassidy (1991) suggest that the anterior sacroiliac ligament is a thickening of the anterior joint capsule. The joint capsule may be rudimentary or absent and the interosseous ligament forms the posterior border of the joint. This ligament binds the sacrum and the ilium and is the strongest of the sacroiliac ligaments. Accessory ligaments are the iliolumbar, sacrotuberous, and sacrospinous.

Schafer and Faye (1990) describe the sacroiliac joint as being antero-lateral to the PSIS (Posterior-superior-iliac-spine) and PIIS (Posterior-inferior-iliac-spine) of the ilia. The iliac facets articulate with the sacrum which has rough, concave, boot-shaped bony articulations, the toes of the boot facing posteriorly. The "foot" of the articulation allows a slight sliding motion anteriorly-inferiorly or posteriorly-superiorly and there is also a rotating action. The upper part offers relief to the relatively weak supero-anterior sacroiliac ligaments. The structure also serves to prevent sacral displacement during loading. The importance, chiropractically, of the structural anatomy of the joint according to Schafer and Faye is that two distinct articulations are found: an upper one which articulates

with the first sacral segment and a lower one which articulates between the second and third sacral segments. When mobile, these two articulations act reciprocally. If one becomes partially fixed, however, the other can only pivot in an arc around the abnormal axis of the fixated joint. The slight but important rotating, sliding, gliding and pivoting action of the sacroiliac facets serve as a singular link point where the axial skeleton is attached to the pelvis. They go on to say, the posterior aspect of the joint is innervated by the posterior rami of L5-S2 spinal nerves, inflammation at the posterior aspect of the joint refers pain to the buttocks, back and thigh, following dermatomal distribution. The anterior aspect of the joint is innervated by both posterior branches from the L3-S2 roots and the superior gluteal nerve (L5-S2) (Schafer and Faye 1990). Schafer and Faye believe that irritation of the joint anteriorly usually refers pain to the groin and anterior thigh. If the sciatic nerve pierces the piriformis rather than exiting the pelvis over or under the muscle (a common occurrence), sacroiliac distortion or inflammation may involve any of the sciatic fibres (Schafer and Faye 1990). According to Cassidy and Mierau (1992) a wide range of segmental innervation could account for the large spectrum of somatic referred pain patterns attributed to sacroiliac disorders. Bernard and Cassidy (1991) say that articular nerves are thought to have a unique feedback mechanism on the overlying muscles which receive the same innervation. This arthrokinetic reflex exists because articular mechanoreceptors regulate muscle tone (hence the unilateral muscle spasm associated with sacroiliac syndrome mentioned by Cassidy and Mierau 1992). The

synovial capsule of the sacroiliac joint and overlying ligaments have unmyelinated free nerve endings that transmit pain and thermal sensations. The sacroiliac capsule is also innervated by encapsulated and complex unencapsulated nerve endings, providing pressure and position sense information, according to Bernard and Cassidy (1991), who go on to say that pain from the sacroiliac joint may be localized or referred distally to an extremity which produces a deep, dull and often ill-defined sensation radiating in the sclerotomal distribution. There is, however no associated motor, sensory or reflex deficit with pain from the sacroiliac joint.

The contours of the joint surface continue to change with age, and by the end of the third decade there is an increase in the size and number of elevations which interlock and limit movement (Gatterman 1990). According to Gatterman (1990), after the third decade, the cartilage becomes rough, and degeneration leads to fibrosis of fibrocartilaginous adhesions and occasionally ankylosis of the sacroiliac joints. White and Punjabi (1990) say that the joint may become completely ankylosed by the age of fifty. Bernard and Cassidy (1991), in describing the age-related changes, say that in the second decade of life, a crescent-shaped ridge develops on the entire length of the iliac surface, with a corresponding depression on the sacral side. By the third decade, this interdigitation is well developed and further limits joint motion to x-axis rotation or sacral nutation. They further state that in the joints of males, degenerative changes occur on the iliac side as early as the third decade of life and are

manifested by increased joint irregularity, fibrillation, crevice formation, and clumping of the chondrocytes, but similar changes do not occur on the sacral side until the fourth or fifth decade. Degenerative arthrosis of the sacroiliac joint is histologically similar to that occurring in other joints, but occurs at an earlier stage in life. Whether these changes predispose patients towards developing sacroiliac symptoms is unknown, according to Bernard and Cassidy (1991), as this occurrence may be a normal part of aging.

The general consensus for the axis of rotation of the sacroiliac joint, according to Alderink (1991) and Bellamy et al (1983), appears to be at the level of the second sacral segment.

The movement of the pelvis, described by Gemmell and Jacobson (1990), is a rhythmic torsion in a horizontal plane, which, due to sacroiliac movement, causes no distress to the spine as a whole, but if the sacroiliac movement were compromised, by fixation for example, the altered biomechanics may cause stress elsewhere in the spine. The predominant finding is a small variable range of X-axis rotation with some degree of Z-axis translation (Bernard and Cassidy 1991, Cassidy 1992). Jacob and Kissling (1995) studied the mobility of the sacroiliac joints in fifteen men and nine women, all healthy and between the age of 20 and 50, and found the total average rotational motion to be about 2 degrees (0.4 to 4.3 degrees).

2.5 DIAGNOSTIC CONSIDERATIONS OF SACROILIAC JOINT SYNDROME

The diagnosis of sacroiliac syndrome is based largely on the history and clinical examination (Cassidy and Mierau 1992, Bernard and Cassidy 1991).

THE HISTORY is that of mechanical back pain with or without referred pain into the lower extremity or groin in a nondermatomal pattern. According to Cassidy and Mierau (1992), there is usually tenderness over the postero-superior iliac spine and posterior sacroiliac ligaments. This syndrome is often accompanied by a unilateral lumbar paraspinal muscle spasm and gluteal trigger points (Cassidy and Mierau 1992). The pain can be sharp, aching or dull, it can be referred to the buttocks, groin and posterior thigh and occasionally below the thigh. The symptoms are usually unilateral and have a right-sided predominance, according to Bernard and Cassidy (1991), who go on to say that the pain is aggravated by bending, sitting and riding in an automobile and alleviated by standing and walking. Rarely are there associated neurological symptoms of weakness, paraesthesias or dysaesthesias (Bernard and Cassidy 1991).

This condition rarely presents as lower quadrant abdominal pain, which may be confused with urological disease or appendicitis (Norman 1968). Groin, trochanteric and knee pain can occur in sacroiliac syndrome, according to Cassidy and Mierau, who go on to say that due to the fact that the sacroiliac innervation is from such a wide range of spinal levels, referred pain patterns

from this joint can be quite varied (Cassidy and Mierau 1992). A retrospective study done by Bernard and Cassidy (1991) of 250 patients whose symptoms were consistent with sacroiliac syndrome showed that the onset of the condition was unknown or due to minor trauma in 58% or due to a compensable injury in 42% of the patients.

ON EXAMINATION; a slight limp may be observed due to a difficulty weight bearing on the affected side (Robinson et al 1987). Signs and symptoms of sacroiliac syndrome: researchers have found that pain in the sacroiliac joint was either associated with a marked increase or decrease in mobility of the joint (Mierau et al 1984). Cassidy and Mierau (1992) say there is usually tenderness over the postero-superior iliac spine and posterior sacroiliac ligament. This syndrome is often accompanied by a unilateral lumbar paraspinal muscle spasm and gluteal trigger points. Straight-leg raising may be reduced due to tightness of the hamstrings and or the associated back pain. There are no signs of nerve root tension or neurological deficit in sacroiliac syndrome. Cassidy and Mierau (1992) go on to say that the patient may complain of paraesthesia or subjective decrease in light touch sensation in the lower limb, but there is preservation of temperature, pain and position sense. Any loss of muscle strength in the lower extremities is due to pain, not a neurological deficit. Other causes for low back pain, mechanical and pathological, should be excluded according to Cassidy and Mierau, who go on to say that clinical tests such as Gaenslen's, Faber-Patrick's test and the extension tests (Erikson's test) are

provocative tests used to place stress on the sacroiliac joint and elicit pain in sacroiliac syndrome. It is important to differentiate hip joint pathology, as these tests place an equal amount of stress on the hip joints. In most cases two of these three tests are positive in sacroiliac syndrome (Cassidy and Mierau 1992, Kenna and Murtagh 1989, Bernard and Cassidy 1991). A study of selected provocation tests for sacroiliac joint pathology revealed a substantial inter-therapist reliability (Laslett and Williams 1994). Cibulka et al (1988) also found excellent inter-rater reliability for the presence or absence of sacroiliac joint dysfunction.

2.6 DIFFERENTIAL DIAGNOSIS

The sacroiliac joints are affected by many different arthritides, the most common being degenerative joint disease (osteoarthritis). The inflammatory arthritides may present with either unilateral or bilateral sacroiliiitis. In addition, many disease processes may affect the sacrum or posterior ilium and become superimposed upon the sacroiliac joint. This often produces a pseudosacroiliiitis appearance (Yochum and Barry 1995). The sacroiliac joint can be the site of serious disease, according to Cassidy and Mierau (1992), therefore the possibility of infection, inflammation, arthropathy and neoplasm should always be ruled out. Radiographs and / or blood tests should be considered if there is any doubt. In the majority of cases of sacroiliac syndrome the X-rays are unremarkable (Cassidy and Mierau 1992, Bernard and Cassidy 1991).

2.7 TREATMENT OF SACROILIAC SYNDROME

MANIPULATION

Chiropractic manipulation (adjustment) utilises specific short "leavers" to which a high velocity thrust of controlled amplitude is directed to restore mobility to individual articulations (Gatterman 1990). Passive motion of small or large amplitude within the physiologic range of motion of a joint constitutes mobilization. When the motion is carried into the paraphysiologic zone, increased joint separation leads to a change in the intra-articular pressure, which is followed by the liberation of a bubble of nitrogen gas from the synovial tissues. This bubble rapidly collapses, producing an audible crack, this, Sandoz (1976) believes, constitutes a manipulation. A review article by Hendler et al (1995) revealed that symptoms from sacroiliac subluxations are dramatically relieved with manipulation. Kirkaldy-Willis (1983) advocates daily manipulation for up to ten days in self limited cases, a success rate of up to 90% has been reported by orthopaedic surgeons and manipulation has been purported to work by stimulation of the mechanoreceptors. Herzog et al (1991) compared the effects of spinal manipulative therapy (SMT) given by a chiropractor, to back school therapy (BST) given by a physiotherapist, on gait symmetry for patients with sacroiliac joint pain. The results of this study showed that the BST was a better treatment in terms of subjective measures. However, objective measures showed that the SMT group had better results. The mean pain scores for both groups were always lower after the treatment than before treatment for all experimental

sessions. This adds viability to the use of adjustments in the event of sacroiliac syndrome. It also advocates the adjunctive use of BST (not done in this research). A possible explanation for this result, suggested by Herzog et al (1991), was that the subjects receiving BST received a longer treatment which it was thought may have influenced the responses of the subjects in the BST group to the Oswestry and pain questionnaires. Herzog et al (1991) concluded that SMT was more effective than BST in restoring normal gait symmetry in chronic sacroiliac joint patients. Robinson et al (1987) showed, in a study using force platform variables, that there was a distinct tendency toward improved gait symmetry after chiropractic adjustment of the sacroiliac joint of subjects with sacroiliac dyskinesia, where the gait was asymmetric prior to the treatment. Reduction of the painful sacroiliac joint in pregnant and postpartum women is well documented and advocated by numerous therapists of varying disciplines (Mantle 1994, Fraser 1976, Mahoney and Erhard 1996). **The Side Posture "Roll" Adjustment** seems to be the treatment of choice (Schafer and Faye 1990, Gatterman 1990, Cassidy and Mierau 1992). This adjustment is advocated by Schafer and Faye (1990) as it does not restrict its force to one articulation, or even one part of an articulation. The functions of an adjustment, according to Gillet, are to break up adhesions in the articulation by opening it, force it to glide in the plane lines of its articular surfaces (in any direction that it is restricted), but with a preference for the direction that will "replace" the "subluxated" bone, and / or move the two bones in fixation in such a way that separates the two ends of the muscle

to "break down" the hypertonicity, or apply a force at right angles to the shortened muscle or ligament to elongate it (Schafer and Faye, 1990).

Prone "Drop Mechanism" Adjustments: Harrison (1994) believes that adjusting the PI ilium with a Drop Table, developed by Thompson, is the only precise means of moving and correcting this joint consistently. Moulton (1985) also advocates the use of the terminal point drop principle, as he claims it is effective, versatile, consistent and efficient. He goes on to say that the drop principle allows a low force high velocity adjustment, an alternative to forceful or leverage type adjusting. The chiropractor need only apply a light thrust, setting the drop mechanism free, passing the momentum to the patient. A small applied force is thought to speedily release vertebral subluxations at the "terminal point" (defined as the termination of the drop's motion), This also reduces or eliminates the muscular effort needed for an adjustment due to the mechanical advantage of the drop mechanism. The patient cannot resist because the drops give way crisply and as a result the doctor does not become fatigued (Moulton 1985).

Drop tables incorporate a drop-piece mechanism for the head, thoracic, lumbar and pelvic supports. They were introduced with the intent of lessening patient pain during the adjustment and to reduce the concussion of force experienced by the adjuster, thus causing the practitioner to suffer less fatigue. Each drop piece support allows a downward movement toward the floor as the dynamic thrust is applied (Haldeman 1992).

The fundamental use of the drop table is to overcome the moment of inertia of different spinal areas, according to Harrison (1994). When raised, the drop pieces are approximately one inch high. For different body mass, these drop pieces have a changeable resistance. The resistance is changed for the mass of the individual area of each patient (Harrison 1994). The tension or resistance of these drop mechanisms is set slightly above the weight of the body part to be "dropped", then only a light force is needed to set in motion the body part and drop piece. The force from the chiropractor's hands continue into the contact area after the drop piece reaches its one inch range of motion, thus a sudden deceleration of the body part occurs at the same instant that force continues on a moving contact point, according to Harrison. This drop mechanism and chiropractic force application allows for a considerable shear on the spinal structures (Harrison 1994). Cooperstein (1995) claims that the drop tables serve three primary functions:
(a) reduce wear and tear on the doctor; (b) enable low force adjustments to be delivered safely and effectively; and
(c) permit fine tuning of the forces applied through adjustment of the tension on the drop pieces.

Hessell et al (1990) conducted an uncontrolled study to evaluate the forces exerted during spinal manipulation using the Thompson technique. Six patients received three treatments each from two chiropractors for sacroiliac joint fixations. The results showed certain common characteristics: preload force was always followed by a large thrusting force; large standard deviations were found

between a given adjuster and between patients for the preload force, peak force, duration and impulse. They claimed that this was the first study to report force results in a clinical situation. No control group was used and the sample size was very small, therefore future studies of this nature, with a larger sample size and a control group, need to be done. The effectiveness of the treatment measured against the peak force, duration and impulse also needs to be measured to try to prove the efficacy of the technique, so that the forces used for adjustment can be more specific.

The author is not aware of any clinical efficacy studies on Thompson tables or Thompson terminal point technique.

2.8 Summary of the literature review

The sacroiliac joint as a primary source of low back pain is an old hypothesis that is resurgent but still controversial (Bernard and Cassidy 1991). Mierau et al (1984) found a significant association between sacroiliac hypomobility and low back pain. Symptoms from sacroiliac subluxations are dramatically relieved with manipulation (Hendler et al, 1995). Kirkaldy-Willis (1983) advocates daily manipulation for up to ten days in self-limited cases, with a success rate of up to 90 percent. Herzog et al (1991) concluded that SMT was more effective than BST in restoring normal gait symmetry in chronic sacroiliac joint pain patients. Robinson et al (1987) showed there was a distinct tendency toward improved gait symmetry after chiropractic

adjustment of the sacroiliac joint of subjects with sacroiliac dyskinesia, where the gait was asymmetric prior to the treatment. Haldeman (1992) states that manipulation of the painful sacroiliac joint is successful in the majority of cases.

The Side Posture "Roll" Adjustment seems to be the treatment of choice (Schafer and Faye 1990, Gatterman 1990, Cassidy and Mierau 1992).

Many practitioners advocate the use of Drop Tables, developed by Thompson. Harrison (1994) believes that adjusting the PI ilium can only be done consistently using pelvic drop pieces. Moulton (1985) claims it is effective, versatile, consistent and efficient, and that a low force high velocity adjustment can be delivered. This reduces the muscular effort needed for an adjustment due to the mechanical advantage. The patient cannot resist because the drops give way crisply and as a result the doctor does not become fatigued. The drop tables serve three primary functions: to reduce wear and tear on the doctor, to enable low force adjustments to be delivered safely and effectively; and to permit fine tuning of the forces applied through adjustment of the tension on the drop pieces (Cooperstein 1995).

Owing to the lack of research on the effectiveness of drop tables, the scarcity of viable clinical trials proving the effectiveness of the Side Posture "Roll" Adjustment, and the apparent absence of the two techniques ever having been compared

previously in a controlled clinical trial, there seemed to be a need for these techniques to be researched further in order to establish which of the two treatments is the most effective in the management of sacroiliac syndrome, and thus try to reduce patient morbidity, improve quality of life and reduce treatment costs. According to Haldeman (1992) the method of manipulation should vary according to patient tolerance. He believes that there is an obvious need for more research into the role of the sacroiliac joint in LBP.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Introduction

This chapter deals with the location and collection of data and the research methodology used. The treatment interventions and process of statistical analysis are discussed here.

3.2 Measurement and Observation

3.2.1 Method of Measurement

Subjective Measurement

1. **McGill Short Form Pain Questionnaire** (Appendix A) The questionnaire is designed to define the sensory dimension of the pain experienced by the patient (Melzack and Katz 1992). This questionnaire was developed for research purposes when there is limited time to obtain information from patients. The questionnaire consists of 15 representative words (descriptors) derived from the McGill Long-form Questionnaire, selected on the basis of their frequency of endorsement by patients. Each descriptor was ranked on an intensity scale of: 0 = none, 1 = mild, 2 = moderate, 3 = severe (Melzack and Katz 1992).

Melzack and Katz (1992) stated that the questionnaire had been used in studies measuring chronic pain and the sensory dimensions of pain. The results correlated well with that of the Long-Form questionnaire. They concluded that due to the subjective nature of the pain, the most accurate form of measurement was one where the patient provided a "self report".

Melzack (1987) also stated that the McGill Short-Form Pain Questionnaire was one of the most widely used measurement tests for evaluation of pain, and was sensitive to clinical therapies.

2. Numerical Pain Rating Scale (101 Scale) (Appendix B) - The patient is required to indicate by means of a percentage the intensity of the pain experienced prior to a treatment when (a) it was at its worst, and (b) when it was at its least. The average between these two figures gives an indication of the average pain intensity experienced by the patient.

Jensen et al (1986) conducted a study where six methods of judging pain intensity were compared according to five criteria: (a) ease of administration of the scoring; (b) relative rates of incorrect responding; (c) sensitivity as defined by the number of available response categories; (d) sensitivity as defined by statistical power; and (e) the magnitude of the relationship between each scale and a linear combination of pain intensity indices. The results of this study were as follows: the Numerical Pain Rating Scale - 101 had practical advantages over the other measures because

(i) it was simple and practical to administer and score;
(ii) it can be administered in either written or verbal form; and
(iii) the scale does not appear to be associated with age. "...The superior measure seems to be the Numerical Pain Rating Scale - 101." (Jensen et al 1986).

3. **Oswestry Back Disability Index** (Appendix C) - This is a questionnaire designed to give the researcher an indication of how the back pain affects the subject's ability to manage in everyday life. The questionnaire consists of ten questions, each scoring a maximum of 5 points and a minimum of 0. The questionnaire is scored out of fifty and represented as a percentage disability (Haas and Nyiendo 1992).

Objective Measurement

1. **Algometer** (Appendix D) - using the Force Dial (push-pull force gauge), a product of Wagner Instruments, measurements were taken by applying force to the most tender / painful area overlying the sacroiliac joint. The appropriate sacroiliac joint was selected after the following orthopaedic tests were found to be positive. According to Cassidy and Mierau (1992) usually two out of three of the following provocative tests are positive in sacroiliac joint syndrome: (a) Gaenslen's;
(b) Faber-Patrick's; and (c) extension test. Motion palpation of the sacroiliac joints (see page 32 of this dissertation) and sacroiliac tenderness were also used to diagnose the condition. The force readings were measured in kilograms per square

centimetre. The higher the reading the less tenderness was felt by the patient, thus indicating a higher tolerance to pain.

Fischer (1986) states that pressure algometers have been used on numerous occasions to measure sensitivity in normal tissues: "Localised tenderness, as measured by pressure threshold, is a diagnostic hallmark of tender spots...". He goes on to say that the algometers ability to measure pressure sensitivity and to identify abnormally tender areas provides a means of quantifying treatment, including manipulation, so as to identify improvement. The algometer was fitted with a one square centimetre rubber disc, as this is more suitable for the measurement of tenderness in muscle, ligaments, joint capsules and tendons (Fischer 1986).

3.3 The Location of the Data

The primary data were obtained from the Numerical Pain Rating Scale, the Oswestry Back Disability Index and Mcgill Short-Form Pain Questionnaire answered by all subjects before the first treatment, at the end of the treatment period (after one month), and again after a three-week follow-up period. All consultations and treatments took place at the Technikon Natal Chiropractic Day Clinic.

The secondary data were collected from current journals, text books and CD-Rom, obtained through the Technikon Natal library.

3.4 Study Design and Protocol

3.4.1 Object of the study

The objective of this study was to identify the efficacy of each treatment method in terms of the objective and subjective measurements. The study attempted to identify more effective treatment method which could be used in the future by the chiropractic profession in the treatment of sacroiliac syndrome.

3.4.2 Allocation of the subjects

The sample size consisted of 30 subjects, which complied with the governing criteria of the study. They were randomly divided into two groups as follows: 6 blocks of 4 sequences of treatment group-1 (A) and treatment group-2 (B) were drawn up (1)AABB (2)ABAB (3)ABBA (4)BBAA (5)BAAB (6)BABA. The first combination was then repeated viz. AABB, and this gave 28 subjects. A random number between one and six was chosen by rolling a dice, which gave the number: six. The order therefore started with group : six and went as follows: BABA AABB AABB ABAB ABBA BBAA BAAB, which gave 28. A coin was then tossed to find out whether treatment group-1 (A) or treatment group-2 (B) was next (ie. the 29th Number). It was B, therefore the last patient was in treatment group A. The order was thus randomly chosen as: BABAAABBAABBABABABBABBAABAABBA.

(a) Group 1 consisted of 15 subjects who received Side Posture "roll" adjustments.

(b) Group 2 consisted of 15 subjects who received Prone "Drop Mechanism" adjustments.

3.4.3 Criteria for acceptance of Subjects

Subjects were obtained by the use of advertisements. All subjects accepted into the study had to meet the following criteria:

(a) each subject underwent a full case history (Appendix E);

(b) each subject underwent a full physical examination (Appendix F);

(c) each subject underwent an orthopaedic examination (regional low back examination)(Appendix G) and was diagnosed as having sacroiliac syndrome;

(d) the subjects were not to exhibit any contraindications to spinal manipulative therapy and did not include subjects with the following:

  (i) marked osteoporosis;

  (ii) akylosing spondylitis;

  (iii) the presence of fever, tumours, tuberculosis or any infectious disease;

  (iv) local inflammation, thrombosis, pregnancy, metal implants or a hip prosthesis;

  (v) spinal fusion, spinal surgery or gynaecological surgery;

  (vi) acute disc herniations;

(e) subjects were not accepted if they were on medication for

their pain, or if they were undergoing any other treatment for their pain;

(f) this study was limited to the treatment of sacroiliac syndrome;

(g) all subjects gave informed consent before they were treated. (Appendix H)

(h) when required, subjects had to undergo x-rays to exclude pathology.

3.4.4 Interventions

At the initial consultation the patient was required to complete the Mcgill Short-Form Pain Questionnaire (Appendix A), the Numerical Pain Rating Scale (Appendix B) and the Oswestry Back Disability Index (Appendix C). The algometer reading was also taken on the initial visit (Appendix D). Algometer readings were taken on each patient in the following manner: the algometer was zeroed and pressed upon the patient to the point of tolerance and a reading was taken. The three questionnaires and the algometer readings were obtained prior to the first treatment, at the end of the one month treatment period and again at the end of the three-week follow-up period.

Each patient was treated until clinically asymptomatic, with a maximum of ten treatments, over a four-week period. The treatment consisted of a chiropractic adjustment to the sacroiliac joint that was identified on examination to be dysfunctional. Clinical tests such as Gaenslen's, FABER-Patrick's test and the extension

tests (Erikson's test) are provocative tests that were used to place stress on the sacroiliac joint and elicit pain in sacroiliac syndrome. According to Cassidy and Mierau (1992), it is important to differentiate hip joint pathology, as these tests place equal amount of stress on the hip joints. In most cases, two of these three tests are positive in sacroiliac syndrome (Cassidy and Mierau 1992, Kenna and Murtagh 1989). A study of selected provocation tests for sacroiliac joint pathology revealed a substantial inter-therapist reliability (Laslett and Williams 1994).

Motion Palpation of the Sacroiliac Joint:

Standing Flexed-Knee-Raising Test (Schafer and Faye 1990:)

(a) **Standing superior joint motion palpation:** The left thumb is placed on the patient's sacral base, the right thumb is placed on the right postero-superior iliac spine (PSIS). The patient is then asked to raise the right flexed knee as if taking a high step. Separation of the thumbs is noted. The PSIS will normally move backward and downward. The test is then repeated with the patient raising the left knee. During these tests the tissue over the sacroiliac joint should relax. If the superior sacroiliac joint or symphysis pubis is locked, the pelvis will move as a unit, the thumbs will not separate appreciably, and the ligaments and spinal muscle attachments will remain taut. There is invariably a degree of forward tilting of the pelvis and associated lumbar hyperlordosis.

(b) **Standing inferior joint motion palpation:** The left thumb is placed on the patient's sacral apex and the right on the ischial

protuberance. The patient is then asked to raise the right flexed knee. The ischium should be felt to move antero-superiorly and slightly laterally on the sacrum. If the inferior sacroiliac joint is locked, the ischium and sacral apex move as a unit (Schafer and Faye 1990).

Treatment:

The biomechanically based "Diversified" adjusting technique was used. Adjustments were give in the form of Side Posture "roll" adjustment - Group 1, and Prone "Drop" Mechanism adjustments - Group 2, as follows:

1. The subject's in the first treatment group received side posture "roll" adjustment of the sacroiliac joint:

(a) Fixation at upper aspect of the sacroiliac joint: postero-inferiorly rotated innominate (Schafer and Faye 1990).

Subject in the lateral recumbent position with the fixated side up; the uppermost knee is flexed; ensure the subject's lumbar spine and shoulders are in a neutral position; contact hand takes the contact on the involved (uppermost) posterior superior iliac spine; stabilise the subject's upper shoulder with the indifferent hand; pressure on the subject's flexed upper knee is applied inferiorly with the adjustor's knee; a thrust is delivered with the contact hand in a cephalad and anterior direction; in the form of an impulse, and a body drop is given simultaneously to mobilize the area of fixation.

(b) Fixation at the lower aspect of the sacroiliac joint, antero-superior rotation of the innominate: (Schafer and Faye 1990).

Subject in the lateral recumbent position with the fixated side up; the uppermost knee is flexed, ensure the subject's lumbar spine and shoulders are in a neutral position, contact hand takes the contact on the involved (uppermost) ischial tuberosity; stabilise the subjects upper shoulder with the indifferent hand; pressure on the subject's flexed upper knee is applied inferiorly with the adjustor's knee; a thrust is delivered with the contact hand in the form of an impulse, a body drop is given simultaneously to mobilize the area of fixation.

2. The subjects in the second treatment Group were treated by using the prone "drop mechanism" adjustment as follows:
Drop tables incorporate a drop-piece mechanism for the head, thoracic, lumbar and pelvic supports. They were introduced with the intent of lessening patient pain during the adjustment and to reduce the concussion of force experienced by the adjustor, thus causing the practitioner to suffer less fatigue. Each drop piece support allows a downward movement toward the floor as the dynamic thrust is applied. Subjects in the second treatment group received prone adjustments with the pelvic piece of the adjusting table set to "drop" away with the force of the adjustment (Schafer and Faye 1990).

(a) The subjects with a postero-inferiorly rotated innominate:
Hi-Lo Prone PI ilium push adjustment: The subject lies prone with both arms resting over the side of the table. The doctor stands on the opposite side to the subject's PI ilium at the level of the subject's thigh and as close to the table as possible, with

the outside foot placed directly in front of the inside foot. The contact point is the contralateral PI ilium and it is contacted with the base of the doctor's inside hand, just inferior to the subjects PSIS. The doctor stabilises the near side ischial tuberosity with the heel of the outside hand. The adjustment is made by applying pressure to take up tissue slack and thrusting with a straight arm in a posterior to anterior direction, and inferior to superior in the plane of movement of the joint (Plaugher and Lopes 1993).

In all subjects in this group, four individual, firm, rapid and short thrusts were delivered, with the pelvic drop piece reset each time.

(b) The subjects that present with an antero-superiorly rotated innominate: **Hi-Lo Prone AS ilium push adjustment:**
The subject lies prone with both arms resting over the side of the table. The doctor stands on the side of the subject's AS ilium at the level of the subject's thigh and as close to the table as possible, with the outside foot placed directly in front of the inside foot. The heel of the doctor's outside hand contacts the ipsilateral ilium over the ischial tuberosity. The doctor's inside hand stabilises the far side PSIS. The adjustment is made by applying pressure to take up tissue slack and thrusting with a straight arm in a posterior to anterior direction and a slightly inferior direction (Plaugher and Lopes 1993).
In all subjects in this group, four individual, firm, rapid and

short thrusts were delivered, with the pelvic drop piece reset each time.

3.4.5 The Specific Treatment of Each Objective

Statistical analysis was conducted on the subjective and objective data collected, each of which is contained in the three objectives. The results obtained from the data were then used to solve each of the objectives.

The null (Ho) and alternative (Ha) hypothesis for each of the objectives was as follows:

The first objective was to evaluate the effectiveness of the Side Posture "Roll" adjustment in terms of subjective and objective clinical findings in the treatment of sacroiliac syndrome.

The hypothesis for the experiment and control groups were:
Ho: there would be a difference in the subjective and objective clinical findings on analysis of the intra-group data, showing that the treatment was effective.
Ha: there would be no difference in the subjective and objective clinical findings on analysis of the intra-group data, showing that the treatment was not effective.

The second objective was to evaluate the effectiveness of the prone "drop" mechanism adjustment in terms of subjective and objective clinical findings in the treatment of sacroiliac

syndrome.

The hypothesis for the experiment and control groups were:
Ho: there would be a difference in the subjective and objective clinical findings on analysis of the intra-group data, showing that the treatment was effective.
Ha: there would be no difference in the subjective and objective clinical findings on analysis of the intra-group data, showing that the treatment was not effective.

The third objective was to interpret the data obtained during this study, in terms of the subjective and objective data collected, in order to determine which of the treatment methods were more effective in the treatment of sacroiliac syndrome.

Comparing the control group to the experimental group, the hypotheses were:
Ho: there would be a difference in the subjective and objective clinical findings on analysis of the inter-group data, showing that the treatments were not equally effective.
Ha: there would be no difference in the subjective and objective clinical findings on analysis of the inter-group data, showing that the treatments were equally effective.

3.5 Statistical Analysis

3.5.1 Treatment of the Data

3.5.1.(a) Treatment of the Subjective Data:

To solve the subjective component, the data were treated as follows:

(i) the questionnaires were screened after completion by the subject, to ensure they were correctly completed;

(ii) the units obtained from the three questionnaires were converted to percentages and these percentages were recorded separately for the two groups;

(iii) the data were then statistically analyzed;

3.5.1.(b) Treatment of the Objective Data:

To solve the objective component, the data were treated as follows:

(i) the readings obtained with the algometer were recorded separately for Group - 1, and Group - 2;

(ii) the data then underwent statistical analysis.

3.5.2 STATISTICAL ANALYSIS OF THE DATA

The statistical analysis was conducted at 95% confidence level based on the advice given by the Technikon Natal statistician for the following reasons:

(i) the project consisted of a small sample size (30 subjects);

(ii) the statistical testing was of a non-parametric nature.

3.5.2.(a) Non-Parametric Paired Hypothesis Testing

The Subjective Data:

The subjective results for each of the questionnaires were derived after statistical analysis, using the Wilcoxon Signed Rank Test for both the treatment groups. The units (in percentages) compared were taken from:

(i) the initial consultation (IC) and the last consultation (LC);

(ii) the initial consultation (IC) and the follow-up consultation (FU);

(iii) the last consultation (LC) and the follow-up consultation (FU).

i.e.	GROUP-1	GROUP-2
	IC : LC	IC : LC
	IC : FU	IC : FU
	LC : FU	LC : FU

The figures were compared to determine the level of significance.

The Objective Data:

The subjects' pressure tolerances, measured with the algometer at the point of tenderness over the dysfunctional sacroiliac joint, were analyzed by means of the Wilcoxon Sign Ranked Test, for each of the two groups. The units (in kilograms per square centimetre) compared were taken from:

(i) the initial consultation (IC) and the last consultation (LC);

(ii) the initial consultation (IC) and the follow-up consultation (FU);

(iii) the last consultation (LC) and the follow-up consultation (FU).

i.e.	GROUP-1	GROUP-2
	IC : LC	IC : LC
	IC : FU	IC : FU
	LC : FU	LC : FU(i)

The figures were compared to determine the level of significance.

The Wilcoxon Sign Ranked Test was chosen, on the advice of the Technikon Natal statistician, because of its less restrictive assumptions and near equivalence in sensitivity to the parametric t-test.

3.5.2.(b) Non-Parametric Unpaired Hypothesis Tests

The Subjective Data:

The measurements, taken separately for each questionnaire, were analyzed by means of the Mann-Whitney U-test, comparing the median units of the two groups. The median units (in percentages) compared were:

(i) the initial consultations (IC) of Group-1 and Group-2; ii) the last consultations (LC) of Group-1 and Group-2; and
(iii) the follow-up consultations (FU) of Group-1 and Group-2.

i.e.	GROUP-1		GROUP-2
	IC	:	IC
	LC	:	LC
	FU	:	FU

These figures were compared to determine the level of significance.

The Objective Data:

The subjects' pressure tolerances, measured with the algometer at the level of joint dysfunction, were analyzed using the Mann-Whitney U-Test, comparing the median units of Group one and Group two. The Median units (in kilograms per square centimetre) compared were:

(i) the initial consultations (IC) of Group-1 and Group-2;

(ii) the last consultations (LC) of Group-1 and Group-2; and

(iii) the follow-up consultations (FU) of Group-1 and Group-2.

i.e.	GROUP-1		GROUP-2
	IC	:	IC
	LC	:	LC
	FU	:	FU

These figures were compared to determine the level of significance.

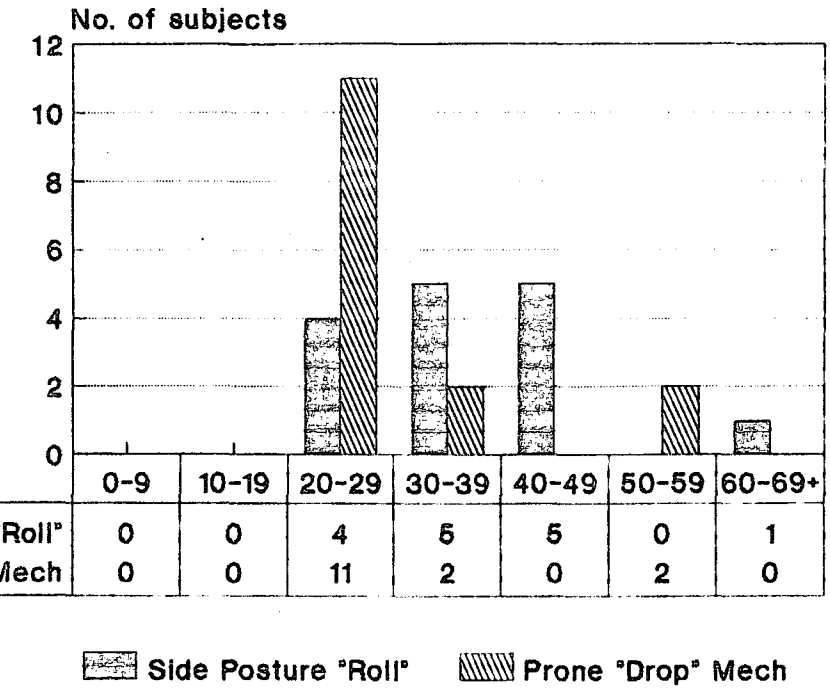
The Mann-Whitney U- Test was chosen, on the advice of the Technikon Natal statistician, because of its less restrictive assumptions and near equivalence in sensitivity to the t-test.

CHAPTER FOUR

THE RESULTS

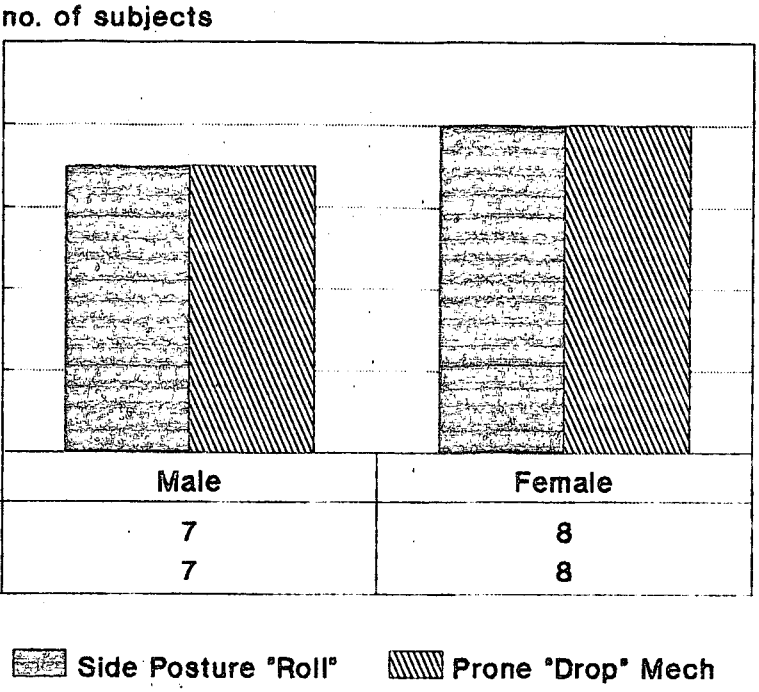
4.1 Demographic data of the subjects

Figure 4.1 Age distribution of subjects



	0-9	10-19	20-29	30-39	40-49	50-59	60-69+
Side Posture "Roll"	0	0	4	5	5	0	1
Prone "Drop" Mech	0	0	11	2	0	2	0

Figure 4.2 Gender distribution of the subjects



	Male	Female
Side Posture "Roll"	7	8
Prone "Drop" Mech	7	8

4.2 Introduction

The results obtained in terms of the subjective and objective data, for both the control and experimental group, are stated in this chapter.

The first set of results show the average subjective figures obtained for both groups, to give an overall impression of the result (Table 4.1 and 4.2).

The second set of results show the statistically analyzed figures which compared the intra-treatment and the inter-treatment data, and thus determine the efficacy of the two different treatments (Table 4.3). The null and alternative hypotheses were either accepted or rejected, based on the positive results found for each measurement parameter.

4.3 TABULATED RESULTS

4.3.1 The Subjective Data - Difference between first and last treatments.

TABLE 4.1 The average subjective improvement as perceived by the subjects:

Questionnaires	Group 1	Group 2
Numerical Pain Rating Scale	29.7%	24.2%
Oswestry Back Disability Index	15.5%	8.9%
McGill Pain Questionnaire	13%	12.2%

The higher the percentage the greater the average improvement as perceived by the subjects.

4.3.2 The Objective Data - Difference between first and last treatments

TABLE 4.2 The average improvement in algometer reading

	Group-1	Group-2
Algometer	2.6 Kg/cm	5 Kg/cm

The higher the unit, the greater the improvement in pain tolerance recorded and the less pain perceived by the patient.

4.3.3 Improvement of the Subjects

TABLE 4.3 The tabulated results of the average subjective improvement of the subjects

Improvement	Group-1	Group-2
Tx1 - Tx L	19.4%	15.1%
Tx1 - Tx FU	18.6%	16.1%
Tx L - Tx FU	-0.8%	1%

4.4 THE ANALYZED DATA

4.4.1 Non-parametric paired hypothesis tests

4.4.1.1 Algometer

TABLE 4.4 One sample analysis of algometer readings for the control group

	Tx 1 - Tx L	Tx 1 - Tx FU	Tx L - Tx FU
P Value	0.00097	0.00015	0.5

TABLE 4.5 One sample analysis of algometer readings for the experimental group

	Tx 1 - Tx L	Tx 1 - Tx FU	Tx L - Tx FU
P Value	0.00097	0.0049	0.3618

The null hypothesis is rejected for both the experimental and control groups as there was a statistically significant difference between the first and final treatments, indicating that there was an improvement as a result of the treatment.

Both the experimental and control groups show that there was not a statistically significant difference between the final treatment and the follow-up assessment, indicating that there was no further improvement during the three-week follow-up period.

4.4.1.2 **Oswestry Back Disability Index**

TABLE 4.6 One sample analysis of Oswestry Back Disability Index for the control group

	Tx 1 - Tx L	Tx 1 - Tx FU	Tx L - Tx FU
P Value	0.00015	0.00097	0.3864

TABLE 4.7 One sample analysis of Oswestry Back Disability Index for the experimental group

	Tx 1 - Tx L	Tx 1 - Tx FU	Tx L - Tx FU
P Value	0.00015	0.00025	0.3415

The null hypothesis is rejected for both the experimental and control groups as there was a statistically significant difference between the first and final treatments, indicating that there was an improvement as a result of the treatment.

Both the experimental and control groups show that there was not a statistically significant difference between the final treatment and the follow-up assessment, indicating that there was no further improvement during the three-week follow-up period.

4.4.1.3 McGill Short-Form Pain Questionnaire

TABLE 4.8 One sample analysis of McGill Short-Form Pain Questionnaire for the control group:

	Tx 1 - Tx L	Tx 1 - Tx FU	Tx L - Tx FU
P Value	0.00097	0.0049	0.2895

TABLE 4.9 One sample analysis of McGill Short-Form Pain Questionnaire for the experimental group

	Tx 1 - Tx L	Tx 1 - Tx FU	Tx L - Tx FU
P Value	0.0049	0.00015	0.252

The null hypothesis is rejected for both the experimental and control groups as there was a statistically significant difference between the first and final treatments, indicating that there was an improvement as a result of the treatment.

Both the experimental and control groups show that there was not a statistically significant difference between the final treatment and the follow-up assessment, indicating that there was no further improvement during the three-week follow-up period.

4.4.1.4 **Numerical Pain Rating Scale**

TABLE 4.10 One sample analysis of Numerical Pain Rating Scale Questionnaire for the control group

	Tx 1 - Tx L	Tx 1 - Tx FU	Tx L - Tx FU
P Value	0.00097	0.0016	0.3864

TABLE 4.11 One sample analysis of Numerical Pain Rating Scale Questionnaire for the experimental group

	Tx 1 - Tx L	Tx 1 - Tx FU	Tx L - Tx FU
P Value	0.00097	0.00015	0.3759

The null hypothesis is rejected for both the experimental and control groups as there was a statistically significant difference between the first and final treatments, indicating that there was an improvement as a result of the treatment.

Both the experimental and control groups show that there was not a statistically significant difference between the final treatment and the follow-up assessment, indicating that there was no further improvement during the three-week follow-up period.

4.4.3 Non-Parametric Unpaired Hypothesis Tests

4.4.3.1 Algometer

TABLE 4.12 Two sample analyses of algometer measurements comparing the experimental group and control group

	Tx 1 Control vs Tx 1 Exp.	Tx L Control vs Tx L Exp.	Tx FU Control vs Tx FU
P Value	0.0675	0.1169	0.1993

The null hypothesis was accepted as it was shown that the algometer readings did not indicate a statistically significant difference between final treatments of the experimental and control groups, indicating that there was no difference in the efficacy of the treatments.

4.4.3.2 Oswestry Back Disability Index

TABLE 4.13 Two sample analysis of Oswestry Back Disability Index comparing the experimental group and control group

	Tx 1 Control vs Tx 1 Exp.	Tx L Control vs Tx L Exp.	Tx FU Control vs Tx FU
P Value	0.0067	0.1165	0.192

The null hypothesis was accepted as it was shown that the Oswestry Back Disability Index did not indicate a statistically significant difference between final treatments of the experimental and control groups indicating that there was no difference in the efficacy of the treatments.

4.4.3.3 McGill Short-Form Pain Questionnaire

TABLE 4.14 Two sample analyses of McGill Sort-Form Pain Questionnaire comparing the experimental group and control group

	Tx 1 Control vs Tx 1 Exp.	Tx L Control vs Tx L Exp.	Tx FU Control vs Tx FU
P Value	0.32	0.32	0.41

The null hypothesis was accepted as it was shown that the McGill Short Form Pain Questionnaire did not indicate a statistically significant difference between final treatments of the experimental and control groups, indicating that there was no difference in the efficacy of the treatments.

4.4.3.4 Numerical Pain Rating Scale

TABLE 4.15 Two sample analyses of Numerical Pain Rating Scale comparing the experimental group and control group

	Tx 1 Control vs Tx 1 Exp.	Tx L Control vs Tx L Exp.	Tx FU Control vs Tx FU
P Value	0.075	0.47	0.308

The null hypothesis was accepted as it was shown that the McGill Short Form Pain Questionnaire did not indicate a statistically significant difference between final treatments of the experimental and control groups, indicating that there was no difference in the efficacy of the treatments.

CHAPTER FIVE

DISCUSSION

The results obtained from the Numerical Pain Rating Scale, the McGill Short Form Pain Questionnaire, the Oswestry Back Disability Index and the algometer readings are discussed here.

Evaluation of the intra-treatment results of the first and final treatments give an indication of the efficacy of each of the treatment regimes. Evaluation of results from the last treatment and the follow-up consultation show the benefit of the different treatments after a three week period.

Evaluation of the inter-treatment data, assessing the first treatment measurements, exhibits any difference in subjective and objective findings between the two patient groups, in terms of their original signs and symptoms. Comparison of the number of treatments demonstrates the rate of improvement. The inter-treatment evaluation of the final treatment measurements indicate which treatment method is more effective.

The subjective data of the intra-treatment comparison revealed that the paired analysis of the median measurements of the Oswestry Back Disability Index showed a significant improvement in both the control and the experimental group in terms of reduction in disability. A comparison of the median measurements

of the initial consultations indicated that there was a difference in the original degree of disability caused by the low back pain. This indicates that the treatment groups were not similar in nature at the initial consultation, and that the control group demonstrated subjectively more disability than the experimental group. Analysis of the median measurements of the last treatment of the two treatment groups indicated that both groups were equally effective over the four-week time period, and that patient recovery rate was similar. The average perceived disability (see Appendix I for graphical representation) also demonstrates the difference between the two groups (15.5% - control and 8.9% - experimental) from the first to the last treatments.

The intra-treatment comparison of the McGill Short-Form Pain Questionnaire revealed a significant improvement in the median measurements of both the control and the experimental group and was shown in terms of reduction of subject's perception of pain. Inter-treatment comparison showed that the statistical evaluation of the median measurements of the initial consultations indicated a strong similarity in the original degree of pain intensity caused by the low back pain, suggesting that both treatment groups were similar in nature. The average improvement in pain perception was also comparable over the four-week treatment period (13% - control and 12.2% - experimental), indicating a similarity in improvement (see Appendix J for graphical representation).

Intra-treatment comparison of the median measurements of the Numerical Pain Rating Scale revealed that there was a significant improvement in both the control and the experimental groups, in terms of the reduction in subjects pain intensity. Inter-treatment comparison of the statistical data of the initial consultations, using the median measurements, displayed little difference in the original degree of pain intensity, indicating a similarity in the nature in terms of pain intensity of both groups. Analysis of the statistical data also showed that the data was not significantly different when comparing the last treatments and follow-up treatments. This suggested that both treatments were equally effective over the follow-up period and that the lasting effects of the treatments were similar. The average improvement in pain perception (see Appendix K for graphical representation) between control and experimental group failed to show a statistically significant difference (29.7% and 24.2% respectively), indicating a comparable improvement in pain intensity.

Generally, all three subjective questionnaires showed the same results, with significant improvement over the treatment period with regard to the subjects' perception of their pain and disability, and this improvement was maintained over the three-week follow-up period. These subjective results support null hypotheses of hypotheses one and two, which stated that both groups would show a significant improvement in the subjective presentation of the patient. The results indicate that both treatment groups responded favourably to their respective

treatments, that each treatment method acted with equivalent efficacy and that the rate of patient improvement was similar.

The null hypothesis three, which stated that the treatments would not be equally effective is rejected, and the alternative hypotheses accepted, as both treatment groups were equally effective.

The objective data of the intra-treatment comparison indicated that there was an improvement in pressure/pain threshold (Algometer readings) of the subjects in both groups. This was deduced from the positive results observed after paired evaluation, using the median measurements of the first, last and follow-up treatments. Intra-treatment comparison of the initial treatment algometer readings demonstrated that there was no significant difference, indicating that the original pressure/ pain thresholds of the subjects in both treatment groups were similar. Generally, the objective data showed statistically positive results supporting null hypotheses one and two which stated that both treatments would be effective in the treatment of sacroiliac syndrome (see Appendix L for graphical representation). The objective data also support the subjective results of this study. Null hypothesis three, however, which stated that the treatments would not be equally effective was rejected, as according to the subjective and objective clinical findings of this study, there was not a statistically significant difference between treatment groups.

The results of this study support the use of manipulative techniques in the management of sacroiliac syndrome.

A comparison of these results to those of Bernard and Kirkaldy-Willis (1987) showed very similar results (see Appendix N for graphical representation). Bernard and Kirkaldy-Willis (1987) showed that of the 258 patients with uncomplicated sacroiliac syndrome that were manipulated, the results were as follows: 206 (80%) were excellent, 39 (15%) were good and 13 (5%) were poor. (Excellent = pain free + complete restoration of normal activity. Good = enough relief of their pretreatment pain, or experienced restoration of normal activity, which justified the time or discomfort during the treatment. Poor = no relief or deterioration.)

The results of this research, based on an average of the results from the three questionnaires and the algometer readings, indicate similar results although the numbers are much smaller (15 patients): Side posture "roll" adjustment: 10.25 (68.3%) were excellent, 3.5 (23.3%) were good and 1.25 (8.3%) were poor. Prone "drop" mechanism adjustment: 10.5 (70%) were excellent, 3 (20%) were good and 1.5 (10%) were poor. The measuring criteria of the two studies were different, making a direct comparison difficult.

A retrospective study done by Schmid (1984) showed a prevalence of 467 cases of sacroiliac joint syndrome out of 1344 patients who presented with "back disorders". Subjective results at discharge were: among 457 patients, 397 (86%) were excellent or

good; 330 of the 457 patients returned a questionnaire that was sent at least nine months after discharge; 266 (80.6%) reported their condition as good or excellent (see Appendix O for a graphical representation). Again, it is difficult to compare the two studies as the patients in Schmid's study were treated with mobilization in cases of hypomobility and stabilization in cases of hypermobility. During the treatment, manipulation, belt support, injection therapy, sclerosing therapy, physiotherapy and medication were used as indicated. The treatment period also ranged from under a month to over two years.

Guo and Zhao (1994) reported 100% success rate in 100 patients using two techniques unheard of by this author. The explanation of the techniques was also not specific enough, the relevance of this study being that, as Haldeman stated, manipulation of the painful sacroiliac joint is successful in the majority of cases.

Osterbauer et al (1993) conducted a study of ten patients diagnosed with chronic sacroiliac syndrome. The VAS score was said to have decreased by 40% in 7 of the 10 patients (mean 25% for the first 2 visits, and 12 at the last 2) after a five-week treatment period consisting of 3 manipulations per week with a short lever manually assisted instrument to "indicated" spinal and pelvic segments. This compared to an average of 27% decrease noted in the numerical pain rating scale of the side posture "roll" group scale, and 24.1% in the group who received prone "drop" mechanism adjustments (see Appendix P for graphical representation). The Oswestry back disability index revealed an

average drop of 15% (from 28% to 13%) in a study by Osterbauer et al, whereas the side posture "roll" group dropped on average 16.6% (from 23% to 6.4%), and the prone "drop" mechanism group decreased an average of 8.9% (from 13.2% to 4.3%) (see Appendix Q for graphical representation). Due to the fact that a different treatment modality was used, this study is also not readily comparable.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

This research has shown each of the two treatment techniques to be equally effective in that both groups showed significant improvement over the treatment period. However, neither treatment showed significantly more improvement than the other. Therefore there is an acceptance of null hypotheses one and two, and rejection of null hypothesis three (acceptance of alternative hypotheses three). Although both treatments are effective in the management of sacroiliac syndrome, on the basis of this research, neither can be recommended as the treatment of choice because both were equally effective. This study also advocates the use of manipulation for the treatment of sacroiliac syndrome in view of the improvement seen in both treatment groups.

The average number of treatments was 6.73 for the control group and 6.06 for the experimental group, with a mean of 6.4 (see Appendix M for graphical representation). The experimental group thus showed a marginally reduced treatment period on average. This figure is not significantly different enough to advocate one treatment over another. Unfortunately this study has not been able to identify a more cost effective treatment, as both treatments showed equivalent efficacies.

Other factors such as selection bias, psychological problems, placebo effect and natural history, or other complicating factors such as stress levels, physical activity, work habits or insensitivity of measurement tools, may have played a role in the outcome of the results. Another possible contaminating factor may have been the presence of secondary conditions such as lumbar facet syndrome, myofascial pain dysfunction syndrome of Quadratus Lumborum, Gluteal or other closely related muscles (adapted from Osterbauer 1993).

A larger sample size should be used in future studies of this nature. Possibly this would better show up the subtle differences between the treatments and the results of the study would also be more statistically viable. It would also be recommended that duration of symptoms be taken into account, in order to reduce the number of variables and add to the validity of the study. It was also recommended that in future, three algometer readings be taken on each occasion, and the median value be taken in order to reduce user error.

The three-week follow-up period demonstrated that the benefits of the treatments were maintained over this period. However, in future studies of this nature, follow-up consultations should be longer than three weeks, to demonstrate more the long term effects of the treatment.

Grieve (1976) states that no audible release is necessary for the adjustment to be successful. When doing the prone drop mechanism

adjustment, no audible release is heard, but the results of the prone drop mechanism adjustment show that the majority of the subjects in this group showed considerable improvement, does this improvement add to Grieve's theory or is there actually an audible release that is just not heard over the noise of the drop table? Possibly this is an area that needs to be researched further in the future.

Another advantage of the prone drop mechanism technique is that the patient cannot resist because the drops give way crisply and as a result the doctor does not become fatigued. This adjustment is effective, yet easy to perform. Some subjects, especially those with acute low back pain, do not relax in the side lying position, making it even more difficult to obtain a satisfactory release. This problem is not found using the prone drop mechanism adjustment. Personally, I found this adjustment more comfortable and I found the feedback from the subjects indicated that they found it both comfortable and effective. However I believe that the subjects perception of the drop mechanism after the first treatment (before they had a chance to feel the effects of the treatment) was that it " was not doing anything", thus cancelling out any placebo effect, whereas with the side posture "roll" adjustment there is an audible release, which, I feel, may add to the placebo effect, although no information was given to any of the subjects that would enhance their belief in either of the treatments. I feel that this is an excellent alternative to the conventional side posture "roll" adjustment of the sacroiliac joint.

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APPENDIX A

PATIENT NAME : _____

FILE # : _____ DATE : _____

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

McGILL PAIN QUESTIONNAIRE

APPENDIX B

NUMERICAL PAIN RATING SCALE 101.

Patient Name:_____

File number:_____ Date:_____

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

Please write only one number.

0 _____ 100

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

Please write only one number.

0 _____ 100

APPENDIX C

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 ppevents 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.

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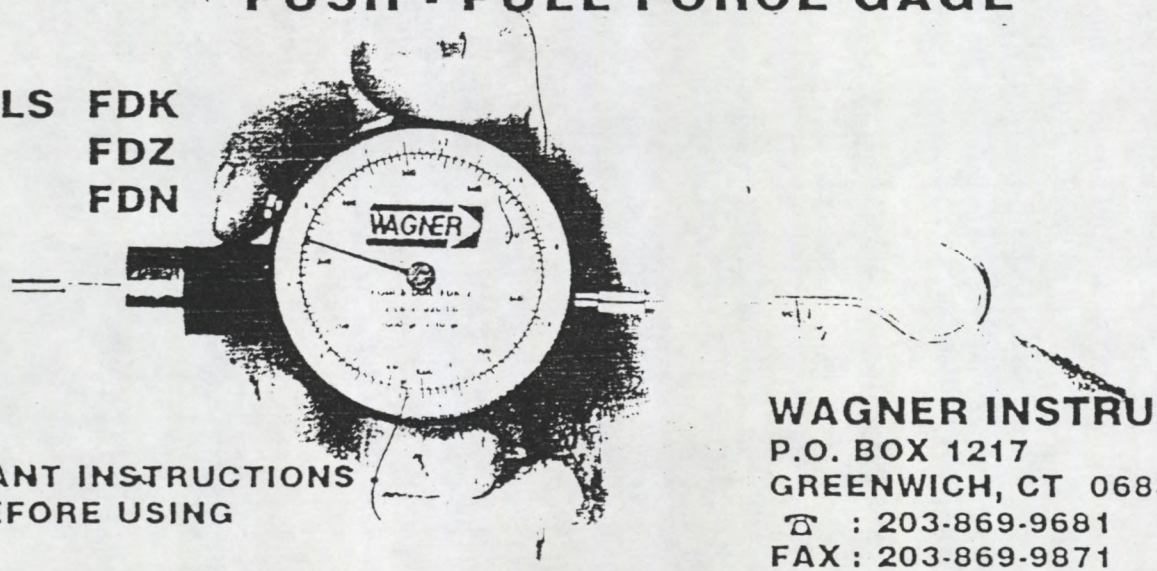

IMPORTANT INSTRUCTIONS
READ BEFORE USING

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GENERAL

Your FORCE DIAL should not be used to measure forces below 25% of full scale since true accuracy is degraded as readings decrease from full scale. Before placing the FORCE DIAL into service it is also recommended to test for accuracy according to procedures found in the CALIBRATION section of this manual.

Model FDK FORCE DIALS have no zero on the dial, since setting the pointer at zero has no significance in calibration or accuracy: see CALIBRATION for details.

Lubrication of the FORCE DIAL is not recommended.

IMPORTANT

To prevent damage, keep an implement/ accessory on the plunger even when the gage is not in use and when using the pull hook. This provides a positive stop and prevents the plunger from being pushed too far.

CALIBRATION

The calibration of the FORCE DIAL may be checked by attaching the pull hook and suspending test weights at 1/4, 1/2, 3/4, and full capacity in the vertical position. The weight of the plunger, flat, tip and pull hook (.03 LB, 17/32 OZ, 15 G) should be subtracted from test results. If it is determined that recalibration is required the instrument should be returned to the factory.

IMPLEMENT WEIGHT ADJUSTMENT

The FORCE DIAL is calibrated for use in the horizontal position. When using low capacity models - thru 2 LB/ 1000 G/ 10 N - in the vertical position, add or deduct the weight of the implements used from your readings, as follows:

WEIGHT OF IMPLEMENTS:

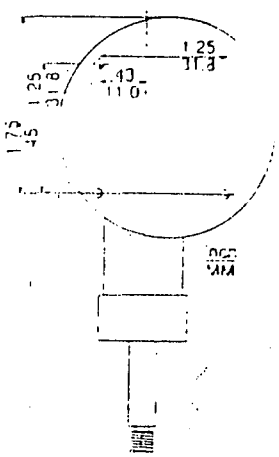
- Plunger: .015 LB/ 1/4 OZ/ 7 G
- Flat Tip: .004 LB/ 1/16 OZ/ 2 G
- Long Rod: .009 LB/ 5/32 OZ/ 4 G
- Pull Hook: .013 LB/ 7/32 OZ/ 6 G

ADJUSTMENT:

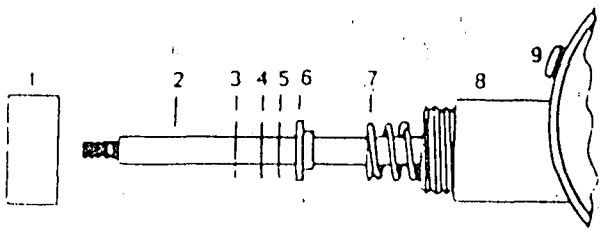
USE	WITH	+/-
Pushing Down	Plunger/Flat Tip	+9 G
Pushing Down	Pliunger/Long Rod	+11 G
Pulling Down	Plunger/Flat Tip/Hook	+15 G
Pushing Up	Plunger/Flat Tip	-9 G
Pushing Up	Plunger/Long Rod	-11 G
Pulling Up	Plunger/Flat Tip/Hook	-15 G

MOUNTING

Your FORCE DIAL may be mounted with three #6 (.138 in/3.5 mm O.D.) sheet metal screws using the hole pattern shown below. The three dimples on the rear housing will assist in starting the screws. Sturdy posts are located internally behind the dimples to accept the screws. The screws should penetrate no more than 3/8 inches or 10 mm.



PARTS



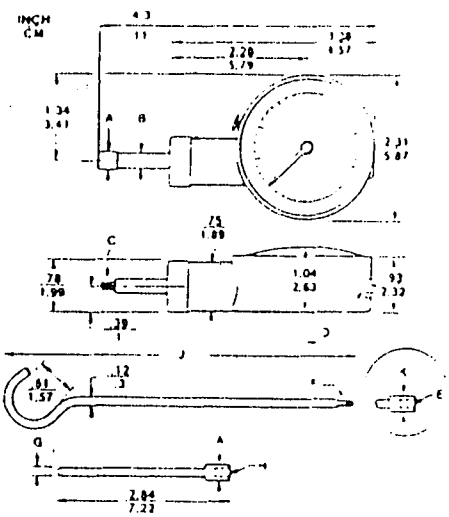
(1) Retainer
(2) Plunger
(3) Disc
(4) Clip
(5) Calibration Washers
(6) Plate
(7) Spring
(8) Case
(9) Push Button
(10) Crystal *
(11) Pointer *

ACCESSORIES: *

(12) Flat Tip (thru 2 LB / 1000 G / 10 N)
(13) Flat Tip (5 LB / 2500 G / 20 N & up)
(14) Long Rod (thru 2 LB / 1000 G / 10 N)
(15) Long Rod (5 LB / 2500 G / 20 N & up)
(16) Pull Hook (thru 2 LB / 1000 G / 10 N)
(17) Pull Hook (5 LB / 2500 G / 20 N & up)

* Not shown in diagram.

DIMENSIONS



High and low capacity models differ slightly in design. The lettered dimensions above, along with the corresponding measurements and comments shown below identify these small variations.

All dimensions are approximate.

	Low Capacity (thru 2 LB / 1000 G)		High Capacity (5 LB / 2500 G & up)	
A	.19"	.45 cm	.26"	.65 cm
B	.12"	.3 cm	.24"	.6 cm
C	M 3	male	M 4	male
D	M 3	male	M 3	female
E	M 3	female	M 3	male
F				
G	.12"	.3 cm	.14"	.35 cm
H	M 3	female	M 4	female
J	2.8"	7.1 cm	3.4"	8.6 cm
K	.19"	.45 cm		

Complete list of available FORCE DIALS

FDK

DECIMAL POUND / GRAM GRADUATIONS

Model	Capacity/Graduations					
FDK 025	.25 LB	x	.002 LB/	100 G	x	1 G
FDK 050	.50 LB	x	.005 LB/	200 G	x	2 G
FDK 1	1 LB	x	.010 LB/	500 G	x	5 G
FDK 2	2 LB	x	.020 LB/	1000 G	x	10 G
FDK 5	5 LB	x	.050 LB/	2500 G	x	25 G
FDK 10	10 LB	x	.100 LB/	5 KG	x	50 G
FDK 20	20 LB	x	.250 LB/	10 KG	x	100 G
FDK 40	40 LB	x	.500 LB/	20 KG	x	200 G
FDK 60	60 LB	x	.500 LB/	28 KG	x	250 G

OUNCE / GRAM GRADUATIONS

Model	Capacity/Graduation					
FDK 4	4 OZ	x	1/32 OZ/	100 G	x	1 G
FDK 8	8 OZ	x	1/16 OZ/	200 G	x	2 G
FDK 16	16 OZ	x	1/8 OZ/	500 G	x	5 G
FDK 32	32 OZ	x	1/4 OZ/	1000 G	x	10 G
FDK 80	5 LB	x	1 OZ/	2500 G	x	25 G
FDK 160	10 LB	x	2 OZ/	5 KG	x	50 G

FDN

NEWTON / GRAM GRADUATIONS

Model	Capacity/Graduation					
FDN1	1N	x	.01N/	100G	x	1G
FDN2	2N	x	.02N/	200G	x	2G
FDN5	5N	x	.05N/	500G	x	5G
FDN10	10N	x	.1N/	1000G	x	10G
FDN20	20N	x	.2N/	2000G	x	20G
FDN50	50N	x	.5N/	5KG	x	50G
FDN100	100N	x	1N/	10KG	x	100G
FDN200	200N	x	2N/	20KG	x	200G
FDN300	300N	x	2.5N/	30KG	x	250G

APPENDIX E

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

CASE HISTORY

Patient:_____ Date # _____

File #:_____

X-ray #:_____

Age: _____ Sex:_____ Occupation: _____

Intern: _____ Signature: _____

FOR CLINICIAN'S USE ONLY

Initial visit clinician: Signature:

Case History:

Examination:

Previous: TN Current: TN

Other Other

X-ray Studies:

Previous: TN Current: TN

Other Other

Clinical path. lab.:

Previous: TN Current: TN

Other Other

Case status:

PTT: Conditional: Signed off: Final sign out:

Recommendations:

Intern's case history

1. Source of history:

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

3. Present illness:

Location

Onset

Duration

Frequency

Pain (character)

Progression

Aggravating factors

Relieving factors

Associated S & S

Previous occurrences

Past treatment and outcome

4. Other complaints:

5. Past history:

General health status

Childhood illnesses

Adult illnesses

Psychiatric illnesses

Accidents/injuries

Surgery

Hospitalizations

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

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

8. Psychosocial history:

   Home situation

   Daily life

   Important experiences

   Religious beliefs

9. Review of systems:

   General

   Skin

   Head

   Eyes

   Ears

   Nose/sinuses

   Mouth/throat

   Neck

   Breasts

   Respiratory

   Cardiac

   Gastro-intestinal

   Urinary

Genital

Vascular

Musculoskeletal

Neurologic

Haematologic

Endocrine

Psychiatric.

APPENDIX F

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

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

Patient:_____ File #_____

Last name First name

Clinician:_____ Signature:_____

Intern:_____ Signature:_____

Date:_____

Height:_____ Weight:_____ Temp:_____

Rates: Heart:_____ Pulse:_____ Respiration:_____

Blood pressure: Arms: L / R /

Legs: L / R /

General appearance:

STANDING EXAMINATION.

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

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

Flex.

L.Rot. R.Rot.

L.lat flex. R.lat. flex.

Ext.

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

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

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

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

SEATED EXAMINATION.

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

	L			R		
	III	IV	VI	III	IV	VI

    visual fields
    accomodation
    iris
    pupils
    red reflex
    optic disc

vessels
general background
macula
vitreous
lens

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

Nose:
external
internal
septum
turbinates
olfaction

Sinuses (frontal & maxillary):
tenderness
transillumination

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

Neck:
posture
size
swelling
scars
discoloration
hair line

ROM:

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

Flex.

L.Rot. R.Rot.

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

Ext.

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

- Neurological:
  - Dermatomes
    - C5
    - C6
    - C7
    - C8
    - T1
  - Tendon reflexes
    - biceps
    - triceps
    - brachioradialis
  - Muscle strength
    - C5
    - C6
    - C7
    - C8
    - T1
  - Coordination:
    - point-to-point
    - dysdiadochokinesia
- Thorax:
  - Chest:
    - Inspection:
      - skin
      - shape
      - respiratory distress
      - rhythm (respiratory)
      - depth "
      - effort "
      - intercostal/supraclavicular retraction
    - Palpation:
      - tenderness
      - masses
      - respiratory expansion
      - tactile fremitus
    - Percussion:
      - lungs (posterior)
      - diaphragmatic excursion
      - kidney punch
    - Auscultation:
      - breath sounds
        - vesicular
        - bronchial
      - adventitious sounds
        - crackles (rales)
        - wheezes (rhonchi)
      - voice sounds
        - broncophony
        - whispered pectoriloquy
        - egophony

Cardiovascular:
auscultation (aortic murmurs)
Allen's test

SUPINE EXAMINATION

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

Male genitals and hernias.
  Inspection:
    skin
    prepuce
    glans
    meatus
    nits/lice
    scrotum
    inguinal/femoral bulges
  Palpation:
    penis (tenderness/induration)
    testes
    epididymis
    inguinal canal
    femoral canal
    cremasteric reflex
  Auscultation:
    scrotal mass.
Peripheral vasculature:
  Inspection:
    skin
    nail beds
    pigmentation
    hair loss
  Palpation:
    pulses - radial, brachial, femoral, popliteal, post.tibial,
             dorsalis pedis
    lymph nodes - epitrochlear, femoral (horizontal & vertical)
    temperature (feet & legs)
  Manual compression test
  Retrograde filling (Trendelenburg) test
  Arterial insufficiency test

Musculoskeletal:
    ROM
      hip
        flex. 90/120
        ext.   15
        abd.   45
        add.   30
        int rot 40
        ext rot 45
      knee
        flex. 130
        ext.   0/15
      ankle
        plantar flex   45
        dorsiflex   20
        inversion   30
        eversion   20
    leg length

Neurological:
- dermatomes
  - L1
  - L2
  - L3
  - L4
  - L5
  - S1
- muscle strength
  - hip flexion
  - knee extension
  - ankle dorsiflexion
  - plantar flexion
- tendon relexes
  - patellar
  - Achilles
- plantar reflex

Rectal examination:
- Inspection
  - sacrococcygeal & perianal areas
- Palpation
  - sphincter tone
  - tenderness
  - induration
  - nodules
  - prostate
  - seminal vesicles

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

APPENDIX G

TECHNIKON NATAL

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC.

REGIONAL EXAMINATION -- LUMBAR SPINE AND PELVIS.

PATIENT:_____

FILE # :_____ DATE:_____

INTERN/RESIDENT:_____

SUPERVISING CLINICIAN :_____

STANDING :

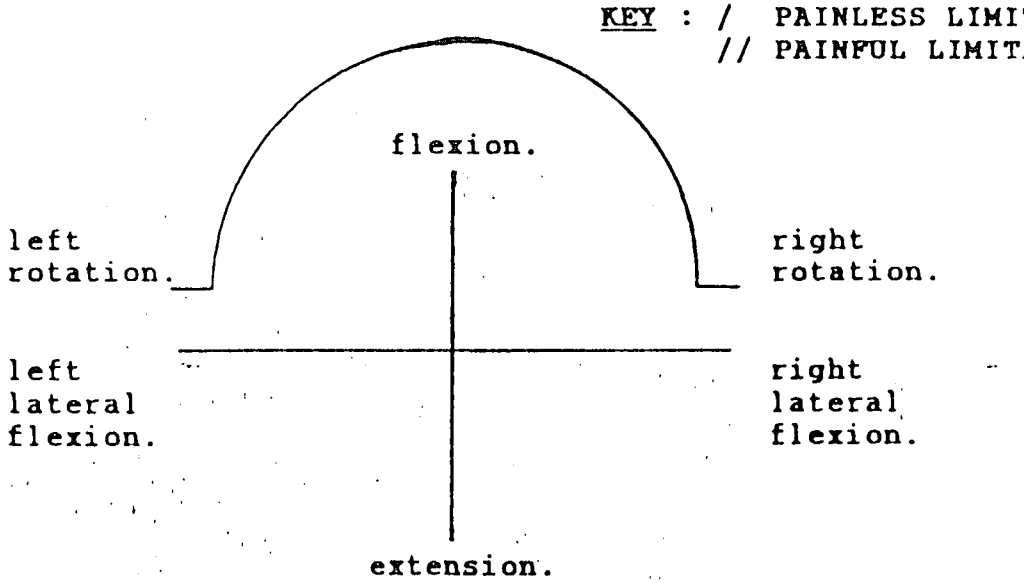
Posture
Minor's Sign
Skin
Scars
Discoloration
Muscle tone
Bony and soft tissue contours

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

RANGE OF MOTION.

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

KEY : / PAINLESS LIMITATION.
// PAINFUL LIMITATION.



GAIT :

Rhythm
On toes (standing)
On heels (standing)
Half-squat on one leg

Remarks :_____

_____

_____

_____

NEUROLOGICAL EXAMINATION :

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

Tripod
Kemp's Test

COMMENTS:_____

_____

_____

_____

SUPINE :

Skin.
Hair.
Nails.

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

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

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

LATERAL RECUMBENT :

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

PRONE :

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

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

NON-ORGANIC SIGNS :

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

MOTION PALPATION :

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

APPENDIX H

INFORMED CONSENT FORM.

THE PURPOSE OF THIS RESEARCH IS TO DETERMINE THE EFFICACY OF TWO ADJUSTIVE PROCEDURES.

AS A PATIENT INVOLVED IN THIS RESEARCH, YOU WILL BE RANDOMLY SELECTED TO JOIN ONE OF THE TWO GROUPS ONCE ACCEPTED. YOU MY HAVE TO HAVE X-RAYS TAKEN IN ORDER TO ENSURE THERE ARE NO CONTRA INDICATIONS TO THIS FORM OF TREATMENT, THE ONLY DANGERS INVOLVED HERE ARE DUE TO A SMALL AMOUNT OF RADIATION FROM THE X-RAYS.

THE TREATMENT WILL CONSIST OF TEN ADJUSTMENTS WHICH WILL BE DELIVERED OVER THREE TO FOUR WEEKS, THIS WILL BE FOLLOWED BY ONE APPOINTMENT AFTER THREE WEEKS.

YOU MAY AT ANY POINT DURING THE TREATMENT WITHDRAW FROM THE RESEARCH BY INFORMING ME OF THIS DECISION.

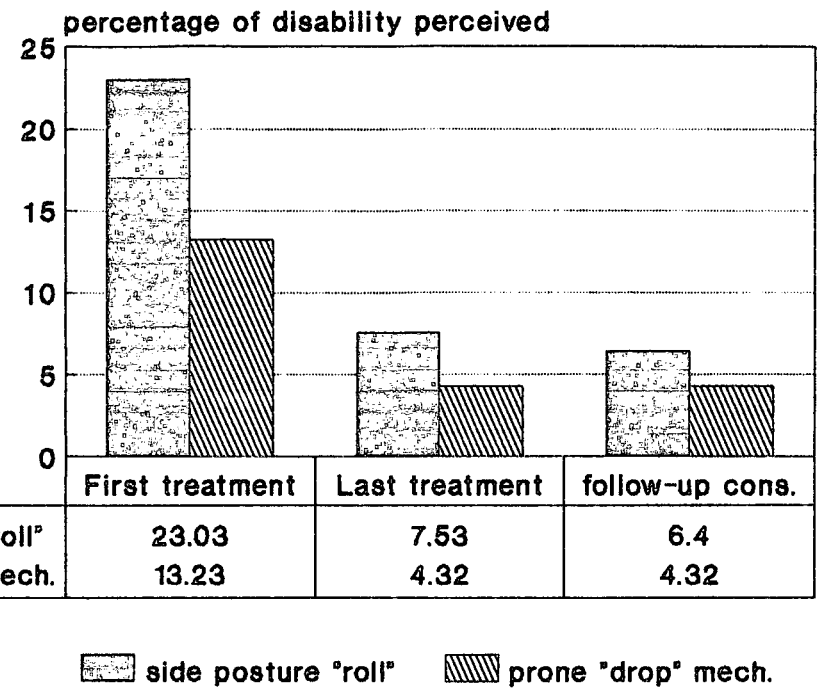
I .....(NAME) HEREBY STATE THAT I WISH TO VOLUNTARILY PARTICIPATE IN RESEARCH OF ROGER REID, I UNDERSTAND MY ROLE IN THIS RESEARCH, THAT THE TREATMENT IS FREE OF CHARGE
AND HAVE HAD ALL MY QUESTIONS ANSWERED.

SIGNED:..... DATE:.....

WITNESSED:..... DATE:.....

APPENDIX I A comparison of the average subjective data-

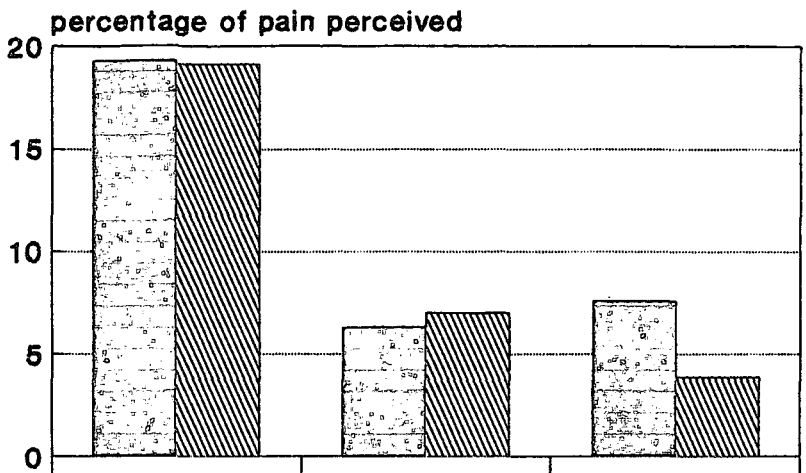
Oswestry Back Disability Index



	First treatment	Last treatment	follow-up cons.
side posture "roll"	23.03	7.53	6.4
prone "drop" mech.	13.23	4.32	4.32

Median Values

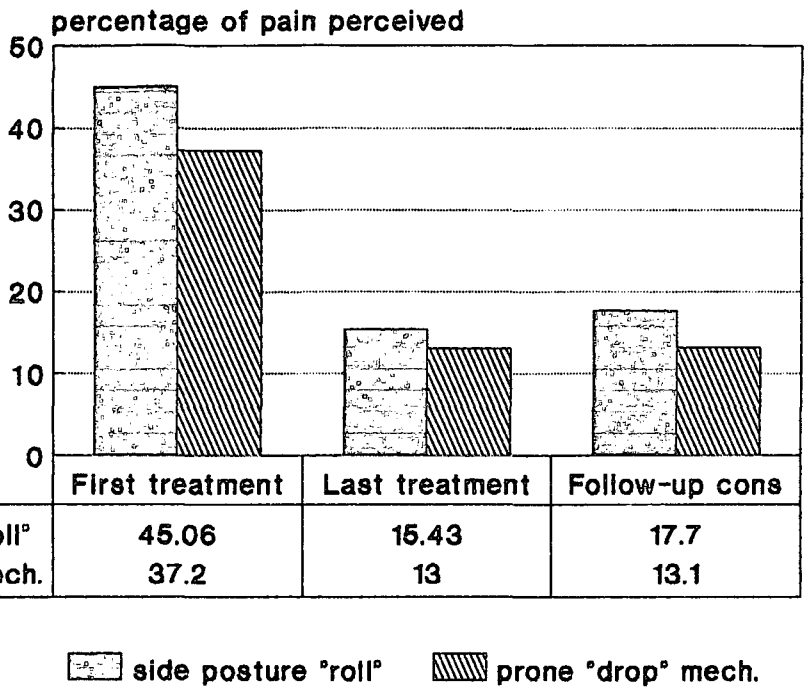
APPENDIX J A comparison of the average subjective data- McGill Pain Questionnaire.



	first treatment	last treatment	Follow-up cons.
side posture "roll"	19.31	6.31	7.6
prone "drop" mech.	19.17	7.01	3.88

Median values

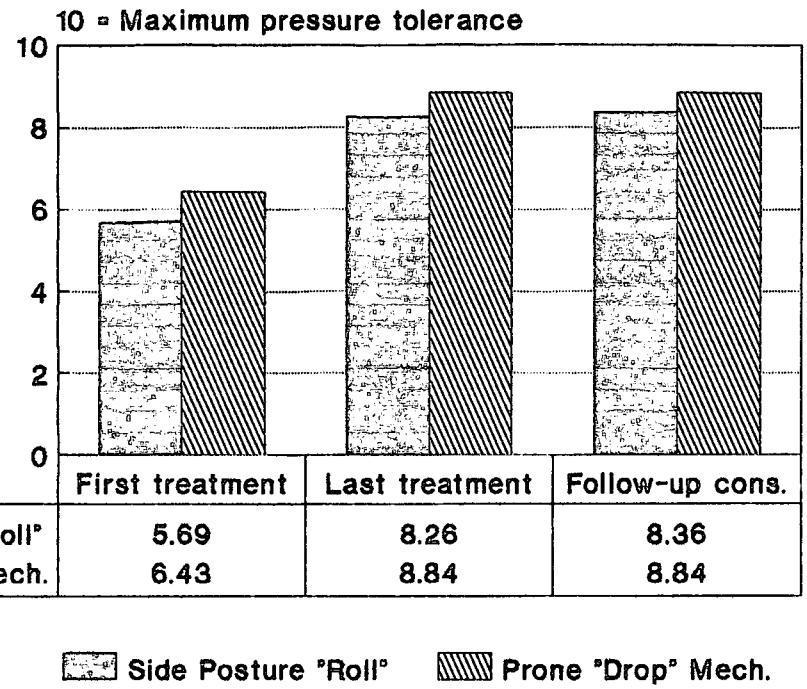
APPENDIX K A Comparison of the average subjective data-Numerical Pain Rating Scale.



	First treatment	Last treatment	Follow-up cons
side posture "roll"	45.06	15.43	17.7
prone "drop" mech.	37.2	13	13.1

Median Values

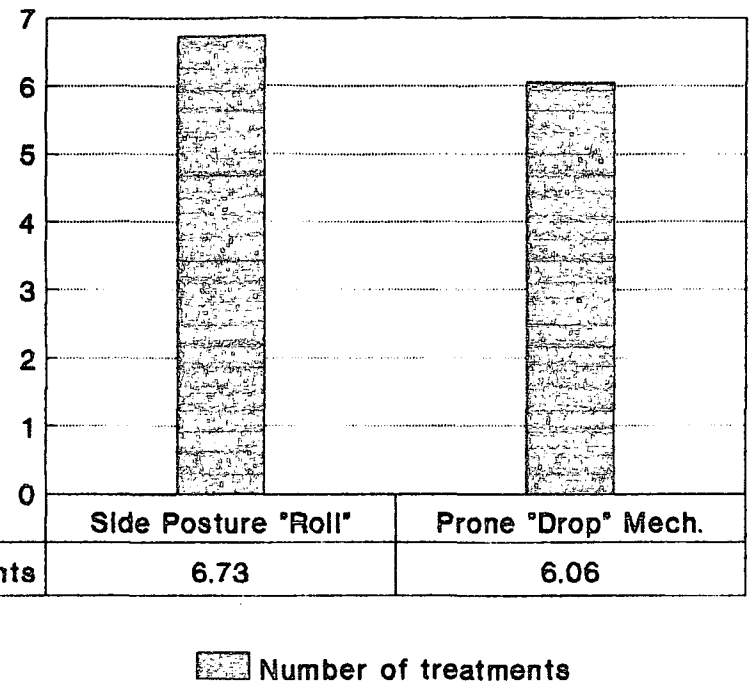
APPENDIX L A comparison of the average Algometer readings.



	First treatment	Last treatment	Follow-up cons.
Side Posture "Roll"	5.69	8.26	8.36
Prone "Drop" Mech.	6.43	8.84	8.84

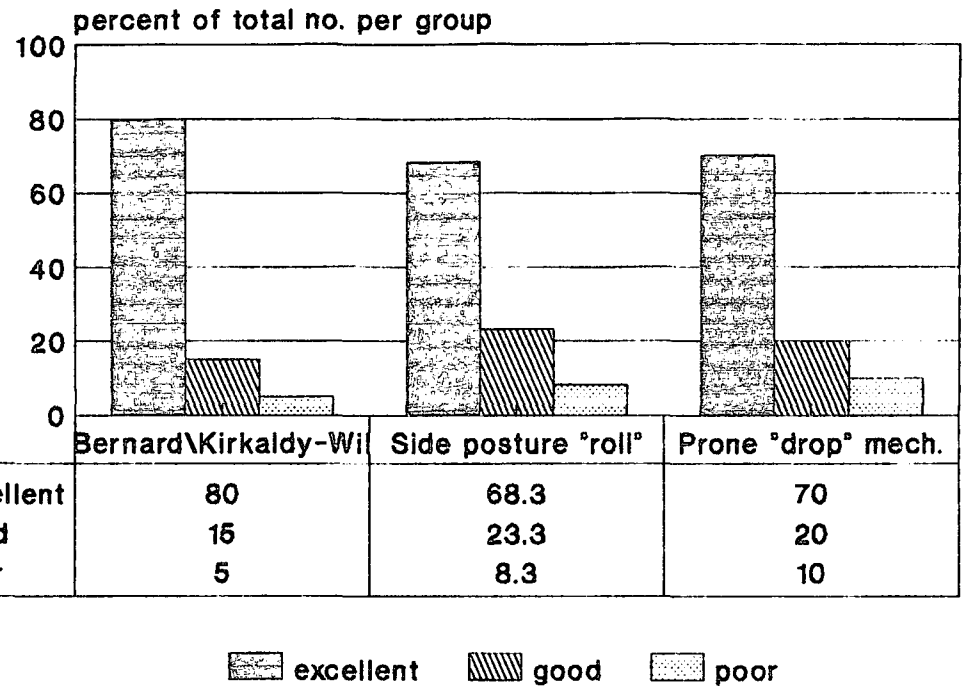
Median values. Kilograms per square cm

APPENDIX M A comparison of the average number of treatments for each group.



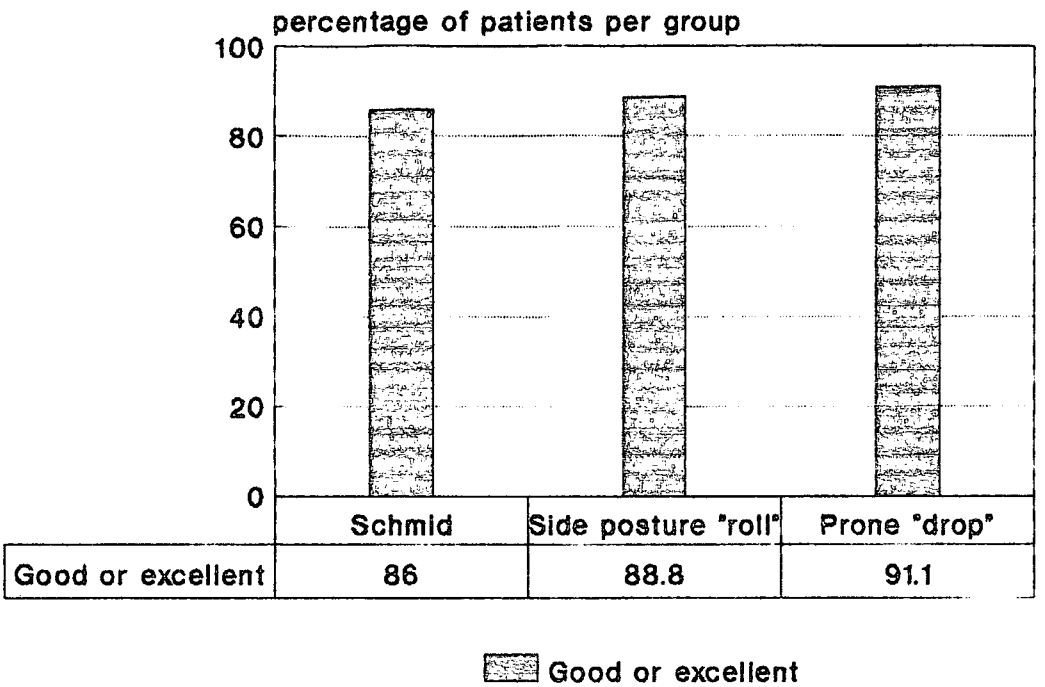
median values

APPENDIX N Comparison of the control and experimental groups with the results from Bernard and Kirkaldy-Willis (1987).

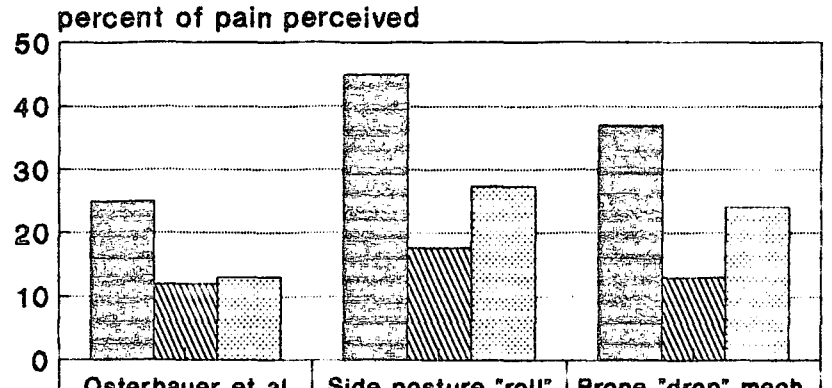


	Bernard\Kirkaldy-Wi	Side posture "roll"	Prone "drop" mech.
excellent	80	68.3	70
good	15	23.3	20
poor	5	8.3	10

APPENDIX O Comparison of the control and experimental groups with the subjective results of the study done by Schmid (1984).



APPENDIX P Comparison of the Numerical pain rating scale of a study done by Osterbauer et al (1993) to this study.

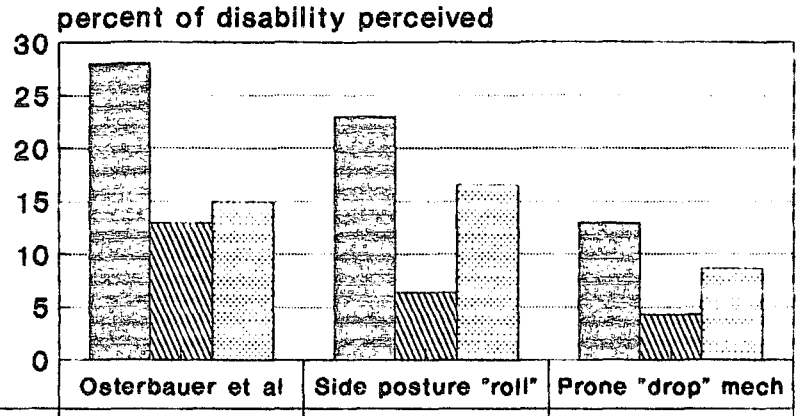


	Osterbauer et al	Side posture "roll"	Prone "drop" mech.
initial reading	25	45.06	37
final reading	12	17.7	13.1
average decrease	13	27.3	24.1

initial reading
final reading
average decrease

median values

APPENDIX Q Comparison of the Oswestry back disability index of a study done by Osterbauer et al (1993) to this study.



	Osterbauer et al	Side posture "roll"	Prone "drop" mech
Initial reading	28	23	13
final reading	13	6.4	4.3
average % improved	15	16.6	8.7

Initial reading final reading
average % improved

Median values