THE RELIABILITY OF MOTION PALPATION VERSUS A TRADITIONAL CHIROPRACTIC METHOD FOR THE ANALYSIS OF CHRONIC MECHANICAL SACROILIAC JOINT SYNDROME.

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FEBRUARY 2000

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DEDICATION

First and foremost I dedicate this research to God, my strength and direction, through which all of this was possible.

I also dedicate this research to my parents, Neill and Lorraine, thank-you for many years of constant love and support. You are both truly a perpetual inspiration for me.

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ABSTRACT

Sacroiliac joint syndrome represents a common cause of lower back pain (Cassidy and Burton 1992:3). However, much controversy exists regarding the most reliable method used to diagnose and determine sacroiliac joint dysfunction (Wiles and Faye 1992).

Until recently the sacroiliac joints were not considered mobile enough to suffer from detectable restricted motion (Gatterman 1995:453). Thus the traditional diagnostic regimens centered around identifying static changes concerning the sacroiliac joints. Bergmann (1993:477-498) emphasizes static alteration as playing a major role in the diagnosis of sacroiliac joint dysfunction.

Motion palpation also represents a common method used to analyze sacroiliac joint dysfunction. Wiles (1980) and Carmichael (1987) have demonstrated significant levels of inter-examiner reliability with regards to motion palpation. However Haas (1991) warns that research presented in chiropractic literature up until 1991 cannot substantiate claims concerning the reliability of any diagnostic instrumentation or palpatory procedure employed by chiropractic physicians. Gatterman (1995:60-64) also states that motion palpation studies need to be viewed with caution and that further studies need to be done. This study attempts to determine whether motion palpation or traditional chiropractic approaches (using static palpation) is more reliable means of analyzing sacroiliac joint dysfunction. It exists with the aim of providing information on which approach yields the best patient response in terms of subjective and objective clinical findings. This study

seeks to provide some clarity amongst the confusion, to assist in standardizing diagnostic regimens and improving the quality of care received by patients.

Thirty patients participated in the study. There were two groups of fifteen patients. Each of whom received four consultations. Group 1 received spinal manipulative therapy (SMT) based on motion palpation findings and group 2 received SMT based on traditional chiropractic analysis findings. All patients were examined using both methods before and after two treatments. The patient's response to treatment was monitored for four consultations within a one-week period by NRS-101 questionnaire, Oswestry disability index questionnaire, right and left algometer readings and orthopedic tests test scores.

The subjective and objective data represented the continuous variables. They were analyzed at the 95% confidence level using parametric testing. The pre and post-treatment findings of both the analysis systems represented the categorical variables and were analyzed using non-parametric testing.

The results of analysis of both subjective and objective data indicated that there was a significant improvement within each group. There was no significant difference between groups 1 and 2. Analysis of the data collected from the pre and post-treatment findings indicated that there was no difference between intra-examiner reliability of group 1 and 2.

Thus it is apparent that both groups responded favorably to treatment based on both analysis systems. However it did not matter which system was used. The researcher is of the opinion that a combination of results from both techniques would provide the most effective information regarding the nature of sacroiliac joint dysfunction.

For future studies a larger sample size may show more subtle differences between groups. Individual patient characteristics such as age, gender and duration of symptoms should be taken into account in future studies.

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LIST OF ABBREVIATIONS

ALG-L	=	Left algometer reading
ALG-R	=	Right algometer reading
ASIS	=	Anterior superior iliac spine
Gr 1	=	Group 1 (Adjusted according to motion palpation findings
Gr 2	=	Group 2 (Adjusted according to traditional analysis findings
NRS-101	=	Numerical Rating Scale 101 Questionnaire
LBP	=	Lower back pain
OTS	=	Orthopedic test scores
OSW	=	Oswestry Low Back Disability Index
L1-L5	=	First lumbar to fifth lumbar spinal segment
PSIS	=	Posterior superior iliac spine
SIJ	=	Sacroiliac joint
SIJS	=	Sacroiliac joint syndrome
SMT	=	Spinal Manipulative Therapy

DEFINITION OF TERMS

Adjustment.	The chiropractic adjustment is a specific form of direct articular manipulation using either long or short lever techniques with specific contacts and is characterized by a dynamic thrust of controlled velocity, amplitude and direction.
Biomechanics.	The study of structural, functional and mechanical aspects of human motion. It is concerned mainly with external forces either of static or dynamic nature dealing with human movements.
Chiropractic practice.	Chiropractic is a discipline of the scientific healing arts concerned with the pathogenesis, diagnostic, therapeutics and prophylaxis of functional disturbances, patho-mechanical states, pain syndromes, and neurophysiological effects related to the statics and dynamics of the locomotor system, especially of the spine and pelvis.
Chiropractic science.	Chiropractic science is concerned with the investigation of the relationship between structure and function of the human body that leads to the restoration and the preservation of health.

End feel.	Discrete, short range movements of a joint independent of the action of voluntary muscles, determined by springing of each vertebra at the limit of its passive range of motion.
Fixation.	The state whereby articulation has become temporarily immobilized in a position that it may normally occupy during any phase of physiological movement. The immobilization of an articulation in a position of movement when the joint is at rest, or in a position of movement of rest when the joint is in movement.
Hyper.	Beyond excessive.
Hypo.	Under or deficient.
Joint play.	Discrete, short-range movements of a joint independent of voluntary muscle action, determined by springing each vertebrae in the neutral position.
Listing (dynamic).	Designation of the abnormal movement characteristic of one vertebra in relation to sub-adjacent segments.

Listing (static). Designation of the spatial orientation of one vertebra in relation to adjacent segments.

Manipulation. Therapeutic application of manual force. Spinal manipulative therapy broadly defined includes all procedures where the hands are used to mobilized, adjust, manipulate, apply traction, massage, stimulate, or otherwise influence the spine and paraspinal tissues with the aim of influencing the patients health.

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 the head. Counter-nutation. Motion of the sacrum about a caronal axis in which the sacral base moves posteriorly and superiorly and the tip of the coccyx moves anteriorly and inferiorly, nodding as the head.

Palpation.

(1) The act of feeling with the hands ;

(2) The application of variable manual pressure through the surface of the body for the purpose of determining the shape, size, consistency, position, inherent mobility, and health of the tissues beneath.

Motion palpation. Palpatory diagnosis of passive and active segmental range of motion.

Static palpation. Palpatory diagnosis of somatic structures in a neutral static position.

Sacroiliac fixation. 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 inferior portion of the sacroiliac joint, or rarely a situation in which there is total joint locking with no axis of rotation.

Sacroiliac extension fixation (AS). A state of the sacroiliac joint in which the posterosuperior iliac spine is fixated in an anterosuperior position with the innominate bone on that side fixated in extension in relation to the sacrum. The axis of rotation then shifts inferior and the superior joint remains mobile.

Sacroiliac flexion fixation (PI). A state of the sacroiliac joint in which the posterosuperior iliac spine is fixed in posteroinferior position with the innominate bone on that side fixed in flexion in relation to the sacrum. The axis of rotation then shifts superiorly and the inferior joint remains mobile.

Subluxation. Subluxation is an aberrant relationship between two adjacent articular structures that may have functional or pathological sequelae, causing an alteration in the biomechanical and/or neurophysiological reflections of these articular structures, their proximal structures, and/or body systems that may be directly or indirectly affected by them.

Translation. Motion of a rigid body in which a straight line in the body always remains parallel to itself.

CHAPTER 1

1.1) Introduction

Cassidy and Burton (1992) state that 60-80% of the general population will suffer from lower back pain at some stage in their life. Sacroiliac joint dysfunction makes up a significant percentage of the cause of lower back pain. Bernard and Kirkaldy-Willis (1992) have reported that sacroiliac joint syndrome makes up 23% of all cases of lower back pain.

According to Frymoyer et al.(1980) lower back pain has a large socio-economic impact. They report that in America, 217 million workdays are lost annually due to lower back pain. Each episode of lower back pain in the United States of America causes an average of 12 days of bed disability annually (Burton and Cassidy 1992:2-3). Each episode has a direct cost of $1500 and an indirect cost of $5000 (Burton and Cassidy 1992:2-3). Lower back pain also affects the most economically productive age group causing dramatic economic loss to the countries concerned.

The sacroiliac joints have a rather unique anatomical make-up. This unique make-up is responsible for the poorly understood biomechanics of the joint. According to Gatterman (1995:453), until recently the sacroiliac joints were not considered mobile enough to suffer from detectable restricted motion. Thus previously diagnostic regimens centered on identifying static changes within the joints.

However, in the last few years the importance of sacroiliac joint syndrome has gained increasing recognition. This is partly due to radiological studies by Schmid (1980) which showed a greater range of motion within the joints than were originally supposed. Gatterman (1995:453) states that the sacroiliac joints like other diarthodial joints are subject to reversible blockages that occur within their range of motion.

Much controversy exists with regards to the reliability of sacroiliac joint examination techniques. Many studies have recently revealed conflicting results. Thus many authors disagree on the approach used to diagnose and determine sacroiliac joint syndrome. Gatterman (1995) says that future research needs to be conducted and standardization of techniques needs to follow.

1.2) The Statement of the Problem

The purpose of this study was to investigate the reliability of motion palpation versus a traditional chiropractic method of analysis of sacroiliac joint dysfunction, in order to determine which is the more effective means of analysis of sacroiliac joint syndrome.

1.2.1) Objective one

The first objective was to determine the inter-examiner reliability of motion palpation versus a traditional chiropractic means of analysis of sacroiliac joint dysfunction in terms of subjective measures.

1.2.2) Objective two

The second objective was to determine the inter-examiner reliability of motion palpation versus a traditional chiropractic means of analysis of sacroiliac joint dysfunction in terms of objective measures.

1.2.3) Objective three

The third objective was to determine the intra-examiner reliability of motion palpation versus a traditional chiropractic means of analysis of sacroiliac joint dysfunction in terms of objective measures.

1.2.4) Objective four

The fourth objective was to integrate the subjective and the objective data from the two sacroiliac joint diagnostic regimens in order to determine which is the more reliable method of analysis of sacroiliac joint syndrome.

1.3) Need for a Solution for the Problem

A review of the related literature reveals that much controversy exists regarding the use of manual examination procedures for the sacroiliac joint. Haas (1991) states that research presented in the chiropractic literature cannot substantiate claims concerning the reliability of any diagnostic instrumentation or palpatory procedures employed by chiropractic physicians.

Potter and Rothstein (1985) concluded that 11 out of 13 sacroiliac joint pain provocation tests were found to be unreliable. Dreyfuss et al.(1996) evaluated 12 sacroiliac joint examination tests and concluded that none of the tests proved to be diagnostically sound. However amongst all the unfavourable reports regarding the sacroiliac joint tests, Bond and Broadhurst (1998) and Laslett and Williams (1994) demonstrated reliability of certain diagnostic tests.

The effectiveness of spinal manipulative therapy (SMT) in the treatment of sacroiliac joint dysfunction has been clearly established (Cassidy et al. 1985). Cassidy et al.(1985) reported that over 90% of patients that were disabled by sacroiliac joint dysfunction responded to manipulation. However it seems that with the effectiveness of SMT in the treatment of sacroiliac joint dysfunction established, when, where, and how to specifically adjust the sacroiliac joint needs to be made clear through reliable diagnostic regimens.

Pain alone cannot be used as a reliable determinant of where to adjust. Its seems sensible to suggest that a painful joint may be caused by an opposite dysfunctional joint, due to compensation mechanisms. It is also important for the physician to determine in which plane the dysfunction occurs. This can be only be achieved by careful analysis. Thus manual examination techniques provide important information regarding the nature of the joint dysfunction in order for the correct application of forces to be applied in order to correct the dysfunction.

This study attempts to assist in bridging the gap between accurate diagnosis and treatment of sacroiliac joint dysfunction. It has already been established that much controversy exists regarding the reliability of sacroiliac joint examination techniques (Hertzog et al. 1989; Haas 1991; Potter and Rothstein 1995; Broadhurst and Bond 1998.) This study attempts to provide some clarification on whether motion palpation or a traditional means of analysis is more reliable in the analysis of sacroiliac joint dysfunction.

1.4) Benefits of the study

If as a result of this study, it was found that one or other analysis system was more reliable than the other, this would enable the chiropractor to be more efficient with regard to determining when, where and how to administer SMT in patients with sacroiliac joint dysfunction. This would assist in the standardization of methods used amongst chiropractors. The standardization of methods would in turn lead to improved care for all patients concerned.

This study will pave the way for future research into this field. It will help show specific areas that need to be further researched with regards to static and dynamic palpatory procedures. It will provide some clarity amidst the confusion regarding the validity of such procedures. As a result thereof improving our understanding of sacroiliac joint dysfunction and competency as doctors.

CHAPTER TWO

2) REVIEW OF THE RELATED LITERATURE

2.1) Prevalence

Many conventional manual examination tests exist with the aim of determining sacroiliac joint syndrome. However amongst a wide range of conflicting reports regarding the reliability of these examination tests it is difficult to determine the true prevalence of sacroiliac joint pain.

April (1992) says that sacroiliac joint syndrome appears to be an overlooked condition not even considered by many clinicians involved in the diagnosis and treatment of mechanical back pain. According to Frymoyer (1991:2114) sacroiliac joint syndrome is a common but frequently overlooked source of lower back pain. Cassidy and Burton (1992) state that 60-80% of the general population will suffer from back pain at some stage in their lifetime. Newton et al.(1997) performed a study in order to evaluate the prevalence of subtypes of low back pain in a defined population. Through a process of critical evaluation through interviews and physical assessment it was concluded that 10% of the 213 patients had sacroiliac joint syndrome.

Other authors have reported a considerably higher prevalence of sacroiliac joint syndrome amongst lower back pain suffers. Schwarzer et al.(1995) used relief of pain in response to a sacroiliac joint block in order to determine the prevalence of sacroiliac joint pain amongst a given population of lower back pain suffers. The authors concluded that under these conditions the prevalence of sacroiliac joint pain would appear to be at least 13% and perhaps as high as 30%.

Aprill (1992) suggests that 25-30% of patients with non-specific low back pain have symptomatic sacroiliac joints in conjunction with other defined lesions. Bernard and Cassidy (1991) state that 33.5% of the 1293 lower back pain patients had co-existing causes of lower back pain. The authors state that determining the relative contributions of the co-existing conditions to the pain experienced by the patient with sacroiliac joint dysfunction may be extremely difficult. From these studies it would appear reasonable to suggest that that the prevalence of sacroiliac joint dysfunction existing as a lesion on its own would appear to be less.

Bernard and Kirkaldy-Willis (1987) performed a retrospective review of 1293 patients with lower back pain treated over a 12-year period. They reported that the primary diagnosis of sacroiliac joint syndrome was made in 23% of all cases.

From the above evidence it is clear that sacroiliac joint dysfunction is a common cause of lower back pain. Therefore, although frequently overlooked (Aprill 1992), sacroiliac joint dysfunction evidently establishes itself as an important clinical entity.

2.2) Anatomy

The two auricular shaped sacroiliac joints are formed by articulations between the right and left articular portions of the sacrum and the right and left iliac bones. The two sacroiliac joints make up an integral part of and add considerable stability to the pelvic ring (Giles and Crawford 1997).

Typical synovial joints consist of two joint surfaces lined by hyaline cartilage, a fibrous joint capsule, a joint cavity, synovial membrane lining the joint cavity and synovial fluid within the joint cavity nourishing the joint surfaces (Norkin and Levangie 1990). It has been demonstrated that there are clear observable differences in the cartilage lining the sacral side and the cartilage lining the iliac side of the sacroiliac joint.

Vleeming et al.(1990) demonstrates that the sacral cartilage is thicker, whiter and also smoother than the cartilage on the iliac side. The iliac cartilage has a bluish and striped appearance. The iliac cartilage is also coarser than the cartilage on the sacral side. It is also noted that multiple ridges and depressions are present that fit congruently into one another.

It is also possible to demonstrate the difference between the cartilage lining the joint surfaces by microscopic evaluation. Bowen and Cassidy (1981) describe the histological make-up of both cartilage surfaces. On the sacral side the chondrocytes occur in lacunae. These lacunae exist within homogenous matrix. These findings are consistant with those of hyaline cartilage. The iliac side contains chondrocytes clumped together in groups. The groups of chondrocytes are separated from one another by bundles of collagen fibers. These findings are more consistant with the findings of fibrocartilage.

It is therefore apparent that through macroscopic observation and microscopic evaluation the sacral articular cartilage appears to be hyaline cartilage and the iliac articular cartilage appears to be fibrocartilage. The sacroiliac joint does therefore not fit all criteria for a synovial joint as laid down by Norkin and Levangie (1992). Thus the sacroiliac joint has been recently classified as a atypical synovial joint (Giles and Crawford 1997).

A fibrous capsule surrounds the sacroiliac joint like all other synovial joints. The capsule and its lining of synovial membrane attaches to the articular margins of the sacroiliac joint. The capsule is thin and poorly developed anteriorly and thick and well developed posteriorly. The anterior sacroiliac ligament is a thikening of the anterior part of the fibrous capsule (Walker 1992). The anterior sacroiliac ligament is well developed at the level of the arcuate line and inferiorly at the level of the posterior inferior iliac spine. Inferiorly it connects the third piece of the sacrum to the lateral margin of the preauricular sulcus (Williams and Warwick 1980).

The interosseus ligament covers the posterior aspect of the sacroiliac joint. The interosseus ligament has been described as the strongest ligament in the body (Williams and Warwick 1980). The interosseus ligament consists of superficial and a deep part. The deep part consists of cranial and caudal bands which pass from the auricular surface of the sacrum to the iliac tuberosity (Williams and Warwick 1980). Fasiculi of the deep part of the interosseus ligament have been said to extend into the joint (Cassidy and Mierau 1992). The deep part of the interosseus ligament may also account for the inter-articular ligament described by Illi (1951). Vleeming et al. (1990) also reports that the interosseus ligament extends into the joint and becomes intra-articular. The superficial part of the interosseus ligament forms a fibrous sheet connecting the cranial and dorsal sacrum to the iliac tuberosity. The cranial one is sometimes termed the short posterior iliac ligament (Williams and Warwick 1980).

The posterior sacroiliac ligament overlies the stronger interosseus ligament and is separated from it by blood vessels and sacral nerves (Cassidy and Mierau 1992). The sacroiliac joint has also got accessory ligaments in the form of the iliolumbar, sacrotuberous and sacrospinous ligaments.

The outer layer of the fibrous capsule of synovial joints is innervated by joint receptors. These receptors are able to detect rate and direction of movement, compression and tension, vibration and pain (Norkin and Levangie 1992:63). Wyke (1982) states that the synovial joint capsule of the sacroiliac joint contains a dense plexus of unmyelinated nerve fibers. These are comparable to nociceptor receptor system present in other synovial joints. The sacroiliac joint receives a wide range of segmental innervation. According to Cassidy and Mierau (1992) this can extend from L2 - S4.

Branches from the obturator nerve (L2 - L4), supply the anterior aspect of the sacroiliac joint. Branches from the sacral plexus innervate the anterior sacroiliac joint ligament (Rickenbacher 1985). There is a dense network of nerves that covers the posterior aspect of the joint. This network is embedded within the ligamentous mass covering the posterior aspect of the joint. The posterior aspect of the joint, the posterior sacroiliac ligament and the interosseus ligament are supplied by the posterior rami of S1 and S2 and also branches from the superior gluteal nerve (L4-S1) (Walters 1993).

The sacrotuberous and the sacrospinous ligaments are innervated by nerve fibers from S1-S3. The sacrotuberous ligament also receives additional branches from the anterior division of L4, the inferior gluteal nerve (L5-S2) and from branches to the piriformis muscle (S1-S2) and the lateral head of the biceps femoris muscle (S1-S2). The posterior primary division of L1 supplies the iliolumbar ligament (Walters 1993).

Thus the sacroiliac joint receives a range of innervation effectively extending from L1-S4. Cassidy and Mierau (1992) state that the wide range of segmental innervation could be responsible for the wide range of referred pain patterns from this joint.

2.3) Developmental Anatomy

Bowen and Cassidy (1981) state that during embryonic life, the articular surfaces are smooth and flat. A large amount of gliding movement is possible as a result of this. The posterior sacroiliac ligament offers the most stability in embryonic life with the anterior structures contributing little to the support of the joint.

The first decade sees the development of the joint capsule. Colour differences between the sacral and the iliac cartilage are observable. Considerable amounts of gliding movements between the joint surfaces, remain possible during this time (Bowen and Cassidy 1981).

Between the second and the third decades uneven articular surfaces develop. The iliac surface is reported to have developed a convex ridge running down the entire joint surface. Due to the thickening of the joint capsule and development of irregularities in the joint surfaces, motion at the sacroiliac joints is limited to postero-superior and antero-inferior movements (Bowen and Cassidy 1981). Vleeming et al.(1990) reported the development of ridges and depressions in most specimens. Nearly all male specimens had prominent changes, which were observed more on the iliac surfaces than the sacral articular surface.

Many authors concur that the sacroiliac joint has a tendency to develop osteoarthritis. Bowen and Cassidy(1981) state that fibrillation, crevice formation and clumping of the chondrocytes occurs on the iliac side of the joint by the third decade in men and soon after in women. Sacral degeneration occurs at a much later stage than the changes occurring at the iliac side. Sacral changes occur during the fourth and fifth decades. After fifty years of age the joint frequently undergoes extra-articular ankylosis (Cassidy and

Mierau 1992). Intra-articular ankylosis of the sacroiliac joint has only been observed in cases of ankylosing spondylitis (Walker 1992). Fibrous adhesions do occur in the joint and although they were found in younger specimens they were more commonly observed in older specimens (Vleeming et al. 1990).

2.4) Biomechanics

There have been numerous investigations into the biomechanics of the sacroiliac joints. However, Wang and Dumas (1998) state that we still lack a precise understanding of the kinematics of the sacroiliac joint.

For centuries there was disagreement on the possibility of motion existing in the sacroiliac joints. According to Gatterman (1995:453) until recently the sacroiliac joints were not considered mobile enough to suffer from detectable restricted motion. It is now believed that small movements in the form of nutation and counter-nutation exist (Vleeming et al. 1990).

Walter (1992) states that sacroiliac joint rotation averages less than 4 degrees. A maximum rotation of 20 degrees was reported. Translation movements in the antero-posterior plane range between 0.5 and 7mm, with a mode of 3mm existing. Several authors (Weisl 1955, Colachis 1963) have reported that the maximal motion occurs in rising from the sitting to a standing position.

Forward flexion of the trunk causes the sacral base to pivot anteriorly and inferiorly, while the sacral apex moves posterioly and superiorly. The posterior superior iliac spines (PSIS) move postero-inferiorly and medially relative to the sacrum. This motion is referred to as flexion or nutation (Norkin and Levangie 1992). The opposite or reverse motion is called counter-nutation. During the movement of nutation the antero-posterior diameter of the pelvic outlet is increased and the antero-posterior diameter of the pelvic brim is decreased. The reverse holds true for for counter-nutation (Norkin and Levangie 1992).

During normal erect standing the weight of the head, arms and trunk is transmitted from L5 vertebra to the L5 disc to the first sacral segment. This transmission of forces tends to cause sacral nutation.

Sacroiliac joint motion is affected by motion in the trunk and also by motion in the lower extremities. Hip flexion in the back lying position tilts the ilia posteriorly in relation to the sacrum. This movement induces nutation in the sacroiliac joints (Norkin and Levangie 1992:158). Hip extension in the supine position causes counter-nutation in the sacroiliac joints. During sitting, the weight of the body is transmitted to the ischial tuberosities. This causes them to separate and this induces nutation at the sacroiliac joints (Walker 1993).

In the early stages of a delivery of a child counter-nutation with the corresponding enlargement of the pelvic brim is preferred. This aids the transmission of the fetus into the pelvis. However, during the final stages of the delivery, nutation induced by hip flexion in the back lying position, increases the antero-posterior diameter of the pelvic outlet and this facilitates the delivery of the fetus head (Norkin and Levangie 1992).

Stability of the sacroiliac joints is provided mainly by the posterior elements i.e. the fibrous capsule, the interosseus ligament and the posterior sacroiliac ligament. Irregularities in the articular surfaces also assist in providing stability. According to Wang and Dumas (1998) the anterior and posterior sacroiliac ligaments are more effective in preventing lateral and forward rotation at the sacrum than preventing joint gliding.

During pregnancy there is a softening of the ligaments associated with the sacroiliac joint and as a result increased motion of the sacroiliac joints is possible.
According to Cassidy and Mierau (1992) the sacroiliac joint is crossed by some of the largest and the most powerful muscles in the body. However none of these muscles are known to have any direct influence on the sacroiliac joint motion.

Considerable differences in opinions exist as to the axis of rotation of the sacroiliac joint. Kapanji(1970) states that the axis of rotation is immediately posterior to the sacroiliac joint. Weisl (1980) reports that the sacroiliac joint does not rotate on a fixed axis but on a dynamic angular axis. This is reported to be 5-10 cm vertically below the sacral promontary. This axis was reported to vary amongst different movements for the same individual. White and Panjabi (1990) state that rotation is coupled with side-bending in the movement of the sacrum. They state that this coupled motion is responsible for the change in the axis of rotation. They therefore conclude that only an instantaneous axis of rotation (existing only at one moment) can exist.

The sacroiliac joint can resist six times more medially directed force and seven times more lateral bending force than a lumbar vertebra. However a lumbar vertebra can withstand twenty times more axial compression and twice as much axial torsion than a sacroiliac joint (Cassidy and Mierau 1992). It therefore seems likely that sacroiliac joint strain would result from a combination of axial compression and rotation.

2.5) Pathogenesis of Sacroiliac Joint Syndrome

Sacroiliac joint dysfunction appears to be overlooked condition which is not even considered a possibility by many clinicians involved in the diagnosis and treatment of mechanical lower back pain (April 1992). Frymoyer et al.(1991:2114) state that sacroiliac joint syndrome is frequently overlooked source of lower back pain.

Sacroiliac joint syndrome is a collection of symptoms and signs that is thought to result from a mechanical derangement of the joint (Burton and Cassidy 1992). Until more recently the sacroiliac joints were not considered mobile enough to suffer from detectable restricted motion (Gatterman 1995:453). However in the last few years the importance of sacroiliac joint syndrome in the cause of lower back pain has gained increasing recognition (Giles and Singer 1997:178). Radiological studies by Schmid (1980) showed a greater range of motion than was originally supposed, have aided in increasing the clinical importance of sacroiliac joint syndrome.

Gatterman (1995:453) states that the sacroiliac joints along with other diarthrodial joints are subject to reversible blockages that occur within their limited range of motion. Vleeming et al.(1990) state that abnormal loading may force the joint into a new position where the joint surfaces are no longer symmetrically aligned. This abnormal position may be regarded as a blocked joint. The resultant restriction of motion may cause a change in the axis of rotation. The change in the normal biomechanics and the development of abnormal biomechanics results in sacroiliac joint syndrome.

White and Panjabi (1990:112-115) state that because motion of the sacroiliac joint occurs mainly in the sagittal plane, the resultant blocked motion of the sacroiliac joint is in flexion or extension, with the accompaning malposition in this plane. However, the movements of the sacroiliac joint are small therefore it is difficult to detect and define sacroiliac joint motion restriction. Sturrenson et al.(1989) report that it is difficult to demonstrate any difference in mobility between asymptomatic and symptomatic joints.

Mierau et al.(1992) noted that there was an increase in sacrum radionuclide uptake on the painful side of 58 patients with unilateral posterior sacroiliac pain. The authors postulated that an increase in metabolic activity as shown by the increase in sacrum radionuclide uptake, may indicate that inflammation may be a factor in patients with sacroiliac pain.

2.6) Diagnosis

Cassidy and Mierau (1992) state that the diagnosis of sacroiliac syndrome is based almost entirely on history and clinical examination. The history is that of mechanical backache. Pain may be referred into the groin or referral may be absent. Gatterman (1995:454) says that pain is located over the ipsilateral buttock and may extend down the ipsilateral lateral and posterior calf. Occasionally the pain may extend down to the ankle, foot and toes. Pain may be described as dull in nature and may be aggravated by sitting. Posteriorly, pain may be referred into the L5, S1 and S2 dermatomes. Pain that is referred from the anterior aspect of the joint may radiate to the L2 and L3 dermatomal areas. A hypermobile sacroiliac joint may cause pain in the ipsilateral hip. This may be due to abnormal piriformis muscle contraction often associated with sacroiliac joint syndrome (Gatterman 1995).

A limping gait is often seen in attempt to minimize weight-bearing pain on a dysfunctional joint.

Clinical examination of the sacroiliac joint should include inspection, assessment of leg length inequalities and pelvic torsion, palpation of the iliacus, adductor, gluteus major and piriformis muscles (Rickenbacher et al. 1985). Palpation should include the PSIS', sacrotuberous ligaments as well as origins and insertions of the gluteal, piriformis and adductor muscles. These areas should be palpated for tenderness and increased tension

(April 1992). Several pain provocative tests have also been advocated for use in the detection of sacroiliac joint dysfunction.

According to Cassidy and Mierau (1992) unilateral lumbar muscle spasm and hamstring tightness may be present in this syndrome. There may be associated back pain and hamstring tightness. Nerve root tension signs and neurological signs are not present. Sensory changes in the form of parathesias may occur in the ipsilateral lower extremity (Gatterman 1995:454). Palpation of the ipsilateral sacroiliac joint produces localized tenderness (Gatterman 1995:455). Keating et al.(1990) demonstrated that palpation for localized tenderness has a higher degree of inter-examiner reliability than other palpatory indicators such as motion palpation, misalignment palpation and muscle tension palpation. However Gatterman (1995:455) warns that pain alone cannot be considered the major criteria for the detection of subluxations.

Although it seems reasonable to think that leg-length inequality (LLI) could have an impact on the sacroiliac joint in the form of altered load distribution and altered biomechanics, Cassidy and Mierau (1992) state that the relationship of sacroiliac joint pathology to LLI is unknown. Aprill (1992) maintains that pelvic obliquity and LLI are important in the evaluation of sacroiliac joint syndrome. Jenner and Barry (1995) postulated that people that have a LLI of >2cm are more prone to develop backache. However there appears to be widespread disagreement as to the degree of LLI that would be considered clinically significant.

Until more recently the sacroiliac joints were not considered mobile enough to suffer from detectable restricted motion (Gatterman 1995:453). Therefore diagnostic regimens centered mainly on static palpatory procedures. Bergman (1993:477-498) outlines palpatory characteristics of flexion and extension malpositions. An ilium fixated in the flexed position is termed a postero-inferior ilium (PI) ilium. In a PI ilium, the posterior superior iliac spine (PSIS) on the ipsilateral side is more prominent and located inferior relative to the contralateral PSIS. At the same time the ipsilateral anterior superior iliac spine (ASIS) is positioned superiorly relative to the opposite ASIS. While standing, the iliac crest on the fixated side is said to be lower in relation to the opposite side. An ilium fixated in the extended position is termed an antero-superior (AS) ilium. In this type of fixation, the PSIS is less prominent and located superiorly relative to the non-fixated side. The ASIS is positioned inferiorly relative to the opposite side. While standing, the iliac crest on the fixated side is located higher up than on the opposite side. Bergman (1993:479-498) also says that these alterations in static alignment may assist greatly in making the diagnosis of sacroiliac joint dysfunction.

It is fundamental to assessment and treatment using localized manual pressure that bony landmarks be determined reliably and accurately (Walker 1992). Cibulka et al.(1988), Don Tigny (1989) and Smith et al.(1988) have all reported poor measurement reliability for landmark palpation. This poor reliability has also provided the basis for the poor reliability of the measurement of leg length inequality.

Dreyfuss et al.(1996) states that there are many categories of physical examination tests. These include: direct tenderness, soft tissue evaluation for zones of hyperirritability and tissue texture changes, evaluation of referral zones, associated fascial or musculotendinous restrictions, regional abnormal length/strength muscle relationships, postural analysis, true leg length determination, osteopathic evaluation including static and dynamic landmark palpation, osteopathic screening tests, traditional orthopedic tests, motion demand tests and ligament tension tests.

In a study on sacroiliac joint pain Schwarzer et al.(1995) reported that there has not previously been a satisfactory criterion standard by which the prevalence of sacroiliac joint pain can be measured and against which clinical examinations can be evaluated. The authors go on to say that diagnostic injections that are performed under fluoroscopic guidance for increased accuracy of needle placement, provide an attractive objective means of diagnosing sacroiliac joint syndrome.

Along with static palpatory procedures, numerous clinical orthopedic tests exist with the aim of assisting in diagnosing of sacroiliac joint syndrome. Kirkaldy-Willis (1992:123-126) states that two out of three of the following tests need to be positive in order the diagnosis of sacroiliac joint syndrome to be made; Patrick Faber's test, Yeomann's test and Gaenslen's test. Many of these pain provocative sacroiliac joint orthopedic tests put considerable stress on the ipsilateral hip joint, thus hip joint pathologies must be ruled out before these tests can be accurately interpreted. Cassidy and Mierau (1992) say that of the sacroiliac joint orthopedic tests, Gaenslen's test, Patrick Faber's test and the extension sacroiliac joint tests remain the most useful for diagnosing sacroiliac joint syndrome. However, according to Schwarzer et al.(1995) the problem with these tests is that they haven't been evaluated against any independent criterion standard and have merely been compared to other test that haven't established validity.

Haas (1991) states that research presented in chiropractic literature up until 1991 cannot substantiate claims concerning the reliability of any diagnostic instrumentation or palpatory procedures employed by chiropractic physicians.

In a study performed by Laslett and Williams (1994) the inter-examiner reliability of seven sacroiliac joint orthopedic tests namely; distraction/gapping test, compression test, posterior shear/thigh thrust test, right Gaenslen's test, left Gaenslen's test, sacral thrust test and cranial shear test, was determined. All tests provided an inter-examiner agreement of 78% or better, 51 patients were used and two independent examiners conducted the testing. Laslett and Williams (1994) concluded that the reliability of the distraction, compression tests, Gaenslen's tests and thigh thrust tests were clearly established. They also state that the sacral thrust test and cranial glide test are at least potentially reliable and could be considered to be adequately reliable to be used in the clinical setting.

Potter and Rothstein (1985) evaluated 13 tests of sacroiliac joint function on 17 patients. They found that the inter-examiner agreement was below 70% of test that used palpation.

These tests were classified as unreliable. However they did state that the pain provocation tests of distraction and compression exceeded 70% inter-examiner agreement.

Dreyfuss et al. (1996) conducted a prospective study with the aim of evaluating historically accepted sacroiliac joint tests. 12 Sacroiliac joint tests were evaluated against the criteria of 90% or greater pain relief, following an intraarticular injection into the sacroiliac joint. The patient had to experience 90-100% pain relief after the joint block in order for the diagnosis of sacroiliac joint syndrome to be made. The authors concluded that none of the 12 tests proved to be diagnostically sound. Dreyfuss et al.(1996) stated that it made no difference whether the tests were administered by a physician or a chiropractor. The results of the tests varied with respect to the specificity and the sensitivity of the diagnostic tests. None of the tests had a likelihood ratio of greater than 1:3. Four tests were more sensitive than the other eight. The sacral sulcus tenderness test was the most sensitive followed by pain over the sacroiliac joint, buttock pain and pointing to the PSIS as the main pain source. The diagnostic worth was not improved by using the combinations of the most specific tests, most reliable test (groin pain) and test with the best positive predictive value (PSIS pointing). Utilizing more tests with positive results did not improve the diagnostic power. The authors could offer little support for the proponents of the use of physical examination tests, for the diagnosis of sacroiliac joint syndrome. Although the study seems conclusive, the diagnostic criterion of 90-100% pain relief following an intra-articular sacroiliac joint injection, seems too strict. This is in light of the fact that the sacroiliac joint receives a wide range of segment innervation

(Cassidy and Mierau 1992) and the validity of the sacroiliac joint block to be used as a gold standard still needs to be established.

Broadhurst and Bond (1998) performed a double-blinded clinical trial in order to determine the sensitivity and the specificity of three commonly used pain provocation tests for sacroiliac joint dysfunction. They evaluated the Patrick Faber test, the posterior shear (POSH) test and the resisted abduction (REAB) test against a criterion of 70-100% pain relief following a sacroiliac joint block. They reported that Patrick Faber's test had a sensitivity of 77% and a specificity of 100%, POSH test had a sensitivity of 80% and specificity of 100% and REAB test had a sensitivity of 87% and a specificity of 100%. Broadhurst and Bond (1998) concluded that all the tests were reliable enough to be used in a clinical setting. They also concluded that these tests give the clinician a better understanding that the pain the patient experiences is likely to be of sacroiliac in nature and therefore capable of being assessed.

There seems to be much conflict regarding the usefulness of pain provocation tests in a clinical setting. However it seems that with careful selection and interpretation certain tests can be useful in determining the pain to be of sacroiliac in origin.

Conflicting views also seem to exist with regards to the validity of motion palpation and joint- play assessment procedures of the sacroiliac joint. Cassidy and Mierau (1992:220) describe Gillet's standing motion palpation assessment of the sacroiliac joint. According to Gatterman (1995:460-462), this is the most widely used of the sacroiliac joint examination procedures. In a study performed on 11 patients diagnosed as having sacroiliac joint dysfunction, Hertzog et al.(1989) attempted to determine the reliability of Gillet's test. The authors concluded that the intra-examiner reliability was found to be statistically significant for all agreement scores investigated. Inter-examiner reliability was found to be statistically significant for some of the agreement scores but not for others. Willis (1980) found that there was greater reliability of the Gillet's test for normal than for abnormal sacroiliac joint function. Carmichael (1987) however reported that the reliability of the Gillet's test increased with increased abnormality of the sacroiliac joint. However, both the above studies used a sample population different from those that would be found within a clinical setting. Wiles (1980) did not assess intra-examiner reliability of the standing Gillet's test.

In a prospective single-blinded study aimed at assessing the incidence of false screening tests used detecting for sacroiliac joint pathology, Dreyfuss et al. (1994) concluded that asymmetrical motion as determined by the Gillet's test and other tests, can occur in asymptomatic joints. Dreyfuss et al. (1994) state that further research documenting the relative specificity and sensitivity of sacroiliac joint motion examination tests needs to be conducted. Gatterman (1995:60-64) warns that motion palpation studies must be viewed with caution and that further studies need to be done.

Bergmann (1993:477-495) states that the sacroiliac joints may be evaluated by assessing joint play. Joint play movements are small passive movements that are produced entirely by the examiner. According to Bergmann (1993:477), the aim of assessing joint play movements is to detect specific areas of resistance to gliding movements or to detect the presence of pain, in order to identify potential sacroiliac joint dysfunction.

Gatterman (1995:462) states that sacroiliac joint motion may be complicated by aberrant motion caused by a shift of the axis of rotation due to a joint fixation. This would further complicate and influence the success of sacroiliac motion examination procedures. In a descriptive case series study conducted by Osterbauer et al.(1993), performed in order to evaluate the diagnostic and biomechanical correlates and treatment outcomes of manipulative care in patients with sacroiliac joint dysfunction, it was concluded that sacroiliac joint syndrome remains difficult to diagnose but may be possible through the judicious choice of screening tests.

Bernard and Cassidy (1991) state that the sacroiliac syndrome is diagnosed mainly by clinical examination and that radiographic evaluation rarely adds any useful information. A 30 degree cephalid view allows good visualization of the anterior and posterior joint lines. Kirkaldy-Willis (1988) states that degeneration does not correlate with sacroiliac joint dysfunction.

Radionucleide scanning of the sacroiliac joint is good for demonstrating infection, inflammation, stress fractures or neoplasms (Bernard and Cassidy 1991). Mierau (1989) demonstrated that there is significant increased uptake on the symptomatic sacroiliac side in patients diagnosed as having sacroiliac joint syndrome. This suggests that a low-grade inflammation is involved.

Computerized tomography is more useful in areas of infection, inflammation or trauma. According to Bernard and Cassidy (1991) computerized tomography demonstrates the soft tissue anatomy of the ligamentous and articular components of the sacroiliac joint. Magnetic resonance imaging reveals details of soft tissue anatomy and the articular surfaces of the sacroiliac joint.

Bernard and Cassidy (1991) say that radiographic evaluation of the sacroiliac joint is most useful in ruling out inflammation, infection, metabolic and traumatic conditions, but does not provide precise information about the sacroiliac joint syndrome.

2.7) Differential diagnosis

Infection, inflammatory arthropathy and neoplasms of the sacroiliac joints can be ruled out by radiographic examination of the lumbar spine and pelvis (Cassidy and Mierau 1992). Supplementary investigations for difficult cases should include haematology in the form of a full blood count (FBC), erythrocyte sedimentation rate (ESR), anti-nuclear factor, HLA B27 antigen and rheumatoid factor. Urinalysis should also be conducted in order to rule other conditions. Cassidy and Mierau (1992) suggest that bone scans can be useful in ruling out sacroilitis and neoplasms.

Lumbar facet syndrome, thoraco-lumbar and lower thoracic facet syndromes may mimic sacroiliac joint syndrome due to the similar nature of their pain referral patterns (Cassidy and Mierau 1992). Cassidy and Mierau (1992) also state that ankylosing spondylitis, rheumatoid arthritis, Reiter's syndrome, psoriasis and inflammatory bowel disease may lead to sacroilitis, which may be confused with sacroiliac joint syndrome. Kirkaldy-Willis and Hill (1979) are of the opinion that sacroiliac joint syndrome may be similar in pain referral as lateral nerve entrapment. Both conditions may refer pain to the buttock and down the leg. Pelvic metastasis must be considered when patients present with possible sacroiliac joint syndrome (Le France et al. 1987).

Bernard and Cassidy (1991) state that 33.5% of the 1293 low back pain patients had co-existing sources of back pain. The authors state that the most common combinations were posterior facet syndrome and sacroiliac joint syndrome, lateral recess stenosis and sacroiliac joint syndrome and herniated nucleus palposis and sacroiliac joint syndrome. Determining the relative contributions of the co-existing conditions to the pain experienced by the patient with sacroiliac joint syndrome may be extremely difficult (Bernard and Cassidy 1991).

2.8) Treatment

Manipulation is a first line of treatment for uncomplicated sacroiliac joint syndrome. Cassidy et al.(1995) reported that over 90% of patients that were disabled by sacroiliac joint syndrome, responded to manipulation. However, Cassidy and Mierau (1992) are of the opinion that successful treatment with manipulation alone does not prevent recurrence of the problem. Cassidy and Bernard (1991) state that joint mobilization followed by an

exercise program maintains mobility and improves physical fitness. This is thought to prevent recurrence of sacroiliac joint syndrome.
Cassidy and Mierau (1992) found that the side-posture method of adjusting the sacroiliac joint, was the most useful technique. They state that the goal of its treatment is to mobilize a stiff or fixated joint and not to reduce a misalignment.

Bergman (1993:497) states that in order to treat sacroiliac joint flexion/extension dysfunction, adjust contacts may be applied to the sacrum/ilium. Flexion dysfunction can be corrected by inducing posterior-inferior movement of the ilial articular surface relative to the ipsilateral sacral cartilage, by contacting the ilium. Bergman (1993:497) also says that this motion may also be achieved by contacting the sacrum and inducing anterior-superior movement of the sacral articular surface relative to the ipsilateral ilial articular surface.

Bergman (1993:497) suggest that extension dysfunction is corrected by contacting the ilium and inducing anterior superior movement of the ilial surface relative to the ipsilaterl sacral articular surface. A contact can be taken on the sacrum and inducing posterior superior movement of the sacral articular surface relative to the ilial articular surface. These adjustments are commonly applied in the side-posture position for one of the following fixations; right upper flexion, right lower flexion, left upper flexion, left lower flexion, left upper extension, left lower extension, right upper extension and right lower extension.

Cassidy and Bernard (1991) state that joint mobilization, manipulation, exercise and joint injection allow the reestablishing of normal muscle tone and joint kinematics. This causes the sacroiliac joint to function normally again and the arthro-kinetic reflex breaks the cycle of pain. Patients should also be given range-of-motion (ROM) exercises in order to promote trunk and hip flexibility. Cassidy and Bernard (1991) also state that stretching of the hamstrings may also be useful. By restoring normal muscle length the golgi-tendon mechanism is reset and pain is inhibited centrally.

Cassidy and Bernard (1991) say that a 1-2 week regimen of non-steroidal-anti-inflammatory-drugs (NSAIDS) medication may be beneficial and may compliment the use of other therapies.

Haldeman and Sato-Hall (1938) and Hendrix et al.(1982) amongst other authors advocate the injection of a local anasthetic and cortisone into the sub-ligamentous portion of the dysfunctional sacroiliac joint, in the treatment of sacroiliac joint syndrome. These authors reported good relief of sacroiliac joint pain following the injection. However Cassidy and Bernard (1991) state that sacroiliac joint injection should not be the primary treatment and should be reserved for cases in which manipulation, mobilization and exercise has failed. Cassidy and Bernard also state that the sacroiliac joint injection should be repeated in three months and should not be repeated more than three times a year.

However despite of the above, Cassidy and Mierau (1992) state that in most cases, acute sacroiliac joint syndrome is a benign self-limiting disorder. They state that after a short period of rest, most patients will return to normal activities without consulting a physician or a chiropractor. However it seems reasonable to suggest that predisposing biomechanical abnormalities need to be addressed in order to prevent recurrence of the problem.

2.9) Contra-indications to Spinal Manipulative Therapy

It is very important that chiropractors are aware of the contra-indications to SMT. The contra-indications to SMT are suspected on history and confirmed on examination and special investigations. According to Triano (1992:352) the contra-indications to SMT are:

1) Osteomyelitis
2) Vertebral malignancy
3) Osteoporosis
4) Tuberculosis of the spine
5) Infectious arthritis
6) Disc prolapse
7) Haemangioma
8) Advanced spondylolithesis

Geirenger et al. (1988:283) report the following additional contra-indications:

1) Abdominal aneurysm
2) Aseptic necrosis
3) Severe diabetes

4) Vertebral joint instability

5) Spinal deformity: severe kyphosis or scoliosis

6) Corda equina syndrome

7) Atherosclerosis

8) Ligamentous instability

2.10) Summary

The anatomy of the sacroiliac joints has recently gained increased attention. Many studies show the uniqueness of the articulations in comparison to other articulations. This unique anatomy is responsible for the confusion surrounding the biomechanics of the joint.

Still much controversy exists regarding the diagnosis of sacroiliac joint syndrome. There are conflicting opinions regarding the use of static and dynamic examination procedures. Many authors question the validity of such diagnostic procedures and their role in the diagnosis of sacroiliac joint dysfunction.

The effectiveness of spinal manipulative therapy in the treatment of sacroiliac joint dysfunction has already been clearly established. Although other therapies exist, spinal manipulative therapy has been described as the primary therapy for the treatment of uncomplicated sacroiliac joint dysfunction.

CHAPTER THREE

3.1) MATERIALS AND METHODS

The study was limited to patients from the province of Kwazulu-Natal who were referred by advertisements placed at the Technikon or Chiropractic clinic as well as local gyms, sports clubs, daily newspapers and radio.

Patients who present at the Chiropractic Clinic at Technikon Natal with mechanical lower back pain were considered for the study. Patients between the ages of eighteen and sixty years of age were included in the study, while pregnant females were excluded. Patients with contra-indications to any treatment offered in the study were excluded from the study. According to Triano (1992:352) contra-indications to spinal manipulation include the following:

1) osteomyelitis
2) osteoporosis
3) tuberculosis of the spine
4) infectious arthritis
5) disc prolapse
6) haemangioma
7) vertebral malignancy
8) advanced spondylolithesis

If contra-indications to spinal manipulative therapy were suspected then they were ruled out by a lumbar spine and pelvis radiographic examination.

This study was limited to patients suffering from sacroiliac joint syndrome. An initial screening consultation was conducted in order to make a diagnosis of sacroiliac joint syndrome. This was according to the Kirkaldy-Willis model (Kirkaldy-Willis and Burton 1992:124). According to these authors, the patients had to test positive for at least two of the three sacroiliac joint stress tests namely, Gaenslen's, Yeomann's and Patrick Faber's. If the diagnosis of sacroiliac joint syndrome was unable to be made, the patients were excluded from the study.

Each patient was accepted under the condition that they were not allowed to take pain or anti-inflammatory medication for the duration of the research period. Each patient was not permitted to receive any other treatment for the duration of the research period.

Convenience sampling was utilized to identify thirty eligible patients. Those thirty patients were randomly assigned into one of two groups using a fair die. A fair die was tossed and the number appearing on top of the die was recorded. If the number was odd, the patient was assigned into group one otherwise they were assigned into group two. This procedure was carried out until fifteen patients were selected for group one and group two respectively.

Thus group one consisted of fifteen patients that were adjusted according to the motion palpation findings and group two consisted of fifteen patients that were adjusted according to the traditional chiropractic means of analysis findings.

The patients selected for the study completed informed consent forms along with all the relevant questionnaires before undergoing the first consultation. Patients in both groups underwent an initial consultation consisting of a full case history, physical examination and low back regional examination. Once the diagnosis of sacroiliac syndrome was confirmed, both groups underwent a series of four consultations within a seven-day period.

All patients were required to fill out all the relevant questionnaires prior to commencing with all four of the consultations. The researcher also obtained objective clinical data prior to the commencement of these consultations in the form of algometer readings over both sacroiliac joints.

The same examination procedure was used for the first and third consultations. It consisted of (1) a traditional chiropractic analysis of the sacroiliac joints and (2) a motion palpation analysis of both sacroiliac joints. The above examinations were conducted on all patients before and after the first and third treatments were delivered.

Fifth and sixth-year chiropractic students that were working in the chiropractic clinic conducted the traditional chiropractic examination. The fact that fifth and sixth year students were used for the traditional examination may have negatively impacted the accuracy of the traditional findings, however no research exist documenting the importance of experience in static palpation.

The **traditional chiropractic method of analysis of sacroiliac joint syndrome** consisted of the following:

(1) identification of altered alignment of the posterior superior iliac spine (PSIS) which indicates a posterior innominate flexion malposition or anterior innominate extension malposition (Bergmann 1993:485);

(2) pelvic compression test designed to elicit pain if inflammation is present in the affected joint (Gatterman 1990:116);

(3) iliac compression test signifying a sacroiliac joint lesion in the affected side (Gerard 1993); and

(4) palpation for any swelling or temperature changes and observation for any signs of inflammation within the sacroiliac joint.

Bergmann (1993:477-498) outlines palpatory characteristics of flexion and extension malpositions. An ilium fixated in the postero-inferior position has been termed a postero-inferior (PI) ilium. With a PI ilium, the PSIS on the ipsilateral side is more prominent and located inferior relative to the contralateral PSIS. At the same time the ipsilateral ASIS is positioned superiorly relative to the contra-lateral ASIS. While standing the iliac crest on the fixated side is said to be lower in relation to the opposite side. An ilium fixated in the extended position is termed an antero-superior (AS) ilium. In this type of fixation, the PSIS is less prominent and located superior relative to the non-fixated side. The ASIS is positioned inferior relative to the non-fixated side. While standing, the iliac crest on the fixated side is located higher up than on the opposite side. Bergmann (1993:477-498) also says that these alterations in static alignment can greatly assist in the diagnosis of sacroiliac joint dysfunction.

Gatterman (1990) says that with a PI ilium the ipsilateral leg may appear longer in the seated position while appearing shorter in the recumbent positions.

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Gatterman (1990) says that with a PI ilium the ipsilateral leg may appear longer in the seated position while appearing shorter in the recumbent positions.

Secondly, both groups were examined according to a **motion palpation analysis**. Two independent examiners were responsible for conducting the motion palpation analysis. These examiners were chiropractic doctors out in the field that had had more than two years clinical experience. The examiners were briefed on the procedure that was to be used. The same doctor was maintained for the first and third consultation for each patient. This was important for consistency. The examiners were not aware of any treatment delivered (if any) during their examinations.

The motion palpation analysis consisted of the following: assessment of joint play (Bergmann 1992:485,495,496,) and standing sacroiliac tests (Gatterman 1990:117-122). Joint play movements are springing movements produced entirely by the examiner and aimed at detecting specific areas of resistance or pain. Abnormal joint pay movements could indicate dysfunction in that area. Gatterman (1990) describes standing sacroiliac joint testing. Each patient was asked to stand with arms outstretched towards the wall for stabilization. Each patient was asked to raise one leg at a time while the joints were palpated. According to Gatterman (1990) motion of the ipsilateral ilium relative to the sacrum or the contra-lateral ilium could be monitored. For detection of motion of the superior joint, one thumb was placed over the ipsi-lateral posterior superior iliac spine (PSIS) while the other thumb was placed over the second sacral tubercle. When the ipsi-lateral leg is flexed the PSIS should move posterior and inferior. If the superior part of the joint is fixated in flexion, the PSIS does not move posteriorly and inferiorly or will move with the second sacral tubercle posteriorly and inferiorly (Gatterman 1990). The superior joint was also examined for an extension fixation. While placing the thumbs in the same positions as outlined above, the contra-lateral leg was raised and the movement noted. If the corresponding movement does not take place then the superior joint is fixated in extension.

The inferior sacroiliac joints were also examined for flexion/extension fixations. For examination of the inferior joints, one thumb was placed on the ipsi-lateral ischial tuberosity while the other thumb was placed on the sacral apex. The same principles that applied for detection of superior joint fixations applied for detection of inferior joint fixations.

Based on the motion palpation examination procedures the examiner conducting the motion palpation examination was asked to determine a listing. The examiner conducting the traditional chiropractic analysis was asked to determine a listing based on their findings.

If the patient was designated a group one patient they were adjusted according to the listing as determined by the motion palpation findings. If the patient was designated a group two patient they were adjusted according to the listing as determined by the traditional chiropractic approach findings. The examiners were unaware of the area, side and technique used to adjust the sacroiliac joint.

The researcher manipulated the involved area according to the diversified technique (Schaefer an Faye 1989:283,284; Bergmann 1993:500,501). One of the following manipulations were applied to the involved area: Right upper flexion, right lower flexion, left upper flexion, left lower flexion, right upper extension, right lower extension, left upper extension and left lower extension adjustment.

The examiners conducting the motion palpation and the traditional chiropractic examination conducted the examinations after the patient received the adjustment and were asked to determine a listing as above.

The second and the forth consultations were the same for all patients. Having completed the Oswestry lower back disability questionnaire (Fairbank et al. 1980) and the NRS-101 questionnaire (Jenson et al. 1986), algometer readings were taken over both sacroiliac joints. The patient next underwent orthopedic sacroiliac joint testing. Patrick Faber's test, Yeomann's test and Gaenslen's test were conducted and the results recorded. If two or more sacroiliac joint tests were not positive then the diagnosis of sacroiliac joint syndrome could not be maintained and the patient received no further treatment for the remainder of the consultations. However all other examinations continued as normal.

3.2) The Subjective and Objective data

Subjective and objective data was collected by the following methods:

Subjective data:

A) **Numerical Pain Rating Scale** (NRS 101) (Jenson et al. 1986) The patient was required to indicate by means of a percentage the intensity of pain experienced prior to a treatment when (a) pain was at its worst, and (b) when was at its least. The average between these two figures gave an indication of the average pain intensity experienced by the patient.

According to Jenson et al.(1986) NRS-101 is useful because it is simple and practical to administer and score. It can also be administered in the verbal or the written form and is not associated with age.

B) **Oswestry Back Disability Index** (Fairbank et al. 1980) This questionnaire gave the researcher an indication of how the back pain affected the subject's ability to manage in everyday life. The questionnaire consisted of ten questions each scoring a maximum of five and a minimum of zero. The questionnaire was scored out of fifty and represented as a percentage disability (Haas and Nyendo 1992).

Objective data:

A) **Algometer readings.** Using the force dial push-pull algometer, a product of Wagner instruments, measurements were taken by applying a force to the most tender area overlying both the sacroiliac joints. The force readings were measured in kilograms per square centimeter. The higher the reading the less the 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. 'Localized 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.

B) **Pre and Post treatment findings.** The pre and post treatment findings of both the traditional chiropractic analysis system and the motion palpation analysis system also constituted objective clinical findings. For group one patients (the group adjusted according to motion palpation findings) the pre and post treatment findings of the traditional chiropractic means of analysis of sacroiliac joint dysfunction constituted objective clinical findings. For group two patients (the group adjusted according to traditional chiropractic approach findings) the pre and post treatment findings of the motion palpation means of analysis of sacroiliac joint dysfunction constituted objective clinical findings.

The pre and post treatment findings from the motion palpation analysis and the traditional chiropractic analysis, constituted the categorical data for this study. A coding system was used to score treatment 1 and 3 for both groups. For group 1, the traditional chiropractic means of analysis was tested. This was because the patients in: group 1 received an adjustment that was based on the motion palpation analysis. If the pre-treatment findings of the traditional means of analysis coincided with the adjustment delivered (motion palpation pre-treatment findings) then a change was expected in the post-treatment findings of the traditional analysis. This was based on the assumption that if the adjustment coincided with the findings, then a biomechanical change or correction would be noted. If this phenomenon was observed then a 1 was scored (1 indicating reliability/positive result), if not a 0 (0 indicating lack of reliability/negative result) was scored. This procedure was carried out for each patient within group 1 and for each consultation undergone.

If the pre-treatment findings of the traditional analysis did not coincide with the adjustment delivered then no observable change was expected in the post-treatment findings of the traditional analysis. If no change was observed a 1 was scored, otherwise a 0 was scored.

The same procedure was repeated for group 2 patients. However the motion palpation findings were scored based on observable change.

For the purpose of this study it was assumed that an adjustment directed at a specific area of the sacroiliac joint would alleviate or at least cause a change in the dysfunction of the joint in that area and for that plane of movement.

C) **Sacroiliac joint orthopedic test scores.** The following tests, Patrick Faber's test, Gaenslen's test and Yeomann's test, as outlined by Kirkaldy-Willis and Burton (1992) were conducted. These tests were given a percentage score. Each test constituted one/third of the overall percentage.

3.3) The location of the data

The primary data was obtained from the NRS-101 questionnaire (Jenson et al. 1986) and the Oswestry Low Back Disability Index questionnaire (Fairbank et al. 1980). These questionnaires were answered prior to all four treatments/consultations. Algometer readings were taken over both sacroiliac joints before all four treatments/consultations. Sacroiliac joint orthopedic test scores were taken during the second and the forth consultations. The pre and post treatment findings were taken before and after the first and the third treatments. All treatments/consultations took place at the Technikon Natal Chiropractic Day Clinic.

The secondary data was collected from current journals; textbooks and CD-ROM located through the Technikon Natal library.

3.4) The specific treatment of each objective

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

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

The first objective was to determine the inter-examiner reliability of motion palpation versus a traditional chiropractic means of analysis of sacroiliac joint dysfunction in terms of subjective measures.

The hypotheses for group one and group two were as follows:
Ho: there would be no significant difference between the inter-examiner reliability of motion palpation versus a traditional chiropractic means of analysis of sacroiliac joint dysfunction upon analysis of the subjective inter-group data.

The alternative hypotheses for group one and group two were as follows:
Ha: There would be a significant difference between the inter-examiner reliability of motion palpation versus a traditional chiropractic means of analysis of sacroiliac joint dysfunction upon analysis of the subjective inter-group data.

The second objective was to determine the inter-examiner reliability of motion palpation versus a traditional chiropractic means of analysis of sacroiliac joint dysfunction, in terms of objective measures.

The hypotheses for group one and group two were as follows:
Ho: there would be no significant difference between the inter-examiner reliability of motion palpation and a traditional chiropractic means of analysis of sacroiliac joint syndrome upon analysis of the objective data, showing both methods were equally reliable.

Ha: there would be a significant difference between the inter-examiner reliability of motion palpation versus a traditional chiropractic means of analysis of sacroiliac joint syndrome indicating that both methods were not equally reliable.

The third objective was to determine the intra-examiner reliability of motion palpation versus a traditional chiropractic means of analysis of sacroiliac joint dysfunction in terms of objective measures.

The hypotheses for group one and group two were as follows:

Ho: there would be no significant difference between the intra-examiner reliability of motion palpation versus a traditional chiropractic means of analysis of sacroiliac joint syndrome upon analysis of the objective data.

Ha: there would be a significant difference between the intra-examiner reliability of motion palpation versus a traditional chiropractic means of analysis of sacroiliac joint syndrome upon analysis of the objective data.

The fourth objective was to integrate the data from the two sacroiliac joint diagnostic regimens with reference to subjective and objective measures in order to determine which is the most reliable means of analysis of sacroiliac joint syndrome.

The hypotheses for groups one and two were as follows:

Ho: there would be no significant difference between the subjective and objective clinical findings on analysis of the inter-group and the intra-group data showing that the methods of analysis were equally reliable.

Ha: there would be a significant difference between the subjective and objective data on analysis of the inter-group and the intra-group data showing that the methods of analysis were not equally reliable.

3.5) The procedure for data analysis

The following experiments were conducted: NRS 101, OSW, ALG1, ALG2, OTS and TAMP. NRS 101, OSW, ALG1, ALG2 and OTS were continuous variables while TAMP was categorical. For the experiments NRS 101, OSW, ALG1, ALG2 there was 4 consultations. For the experiment: TAMP there were only 2 consultations.

Non-parametric tests were used to analyze the categorical variable irrespective of the sample size per group. Parametric tests were used to analyze the continuous variables irrespective of the sample size per group.

Procedure 1: Comparison between 2 unpaired (independent) samples

1.1) For categorical variables

The **Mann-Whitney unpaired U test** was used to compare 2 independent samples with respect to each categorical variable. In each test, the null hypothesis states that there was no significant difference between groups 1 and 2 with respect to the variable in charge, at the α=0.05 level of significance. The alternative hypothesis states that there was a significant difference.

1.2) For continuous variables

The **two-sample unpaired t-test** was used to compare 2 independent samples with respect to each continuous variable. In each test, the null hypothesis states that there was no significant difference between groups 1 and 2 with respect to the variable in charge, at the α=0.05 level of significance. The alternative hypothesis states that there was a significant difference.

Decision rule: The null hypothesis was rejected at the α level of significance if $p<\alpha$ where p was the observed significance level or P-value. Otherwise, the null hypothesis was accepted at the same level.

Procedure 2: Comparison between 2 related samples within the same group

2.1) For categorical variables

For each of the categorical variables, **Wilcoxon's signed rank tests** were used to compare results from related samples. In each test, the null hypothesis states that there was no significant improvement between the two related samples being compared, at the α level of significance. The alternative hypothesis states that there was a significant improvement.

2.2) For continuous variables

For each of the continuous variables, the two-sample paired t-test was used to compare results from related samples. In each test, the null hypothesis states that there was no significant improvement between the two related samples that were compared, at the α level of significance. The alternative hypothesis states that there was a significant improvement.

Decision rule: The null hypothesis is rejected at the α level of significance if $p<\alpha$ where p is the observed significance level or P-value. Otherwise, the null hypothesis is accepted at the same level

Procedure 3: Comparison between related samples within group 2

Procedure 2 is repeated within group 2 with the same decision rule.

Procedure 4: Summary statistics

4.1) Means and variances for continuous variables

Averages and variances were computed for continuous variables only, and were used for power analysis and the construction of bar charts. Power analysis was done for continuous variables only.

4.2) Frequencies and percentages for categorical variables

Frequencies and percentages were computed for categorical variables only.

Procedure 5: Comparison using barcharts

Visual summaries of analytical findings were given by the use of barcharts to compare groups 1 and 2 with respect to the continuous variables. Average (mean) readings were used to construct bar charts.

CHAPTER FOUR

4) THE RESULTS OF THE STUDY

The results of the study are tabulated for each of the variables of interest:

a) NRS 101 - NRS 101 questionnaire for groups 1 and 2 for four consultations

b) OSW - Oswestry Lower Back Disability Index for both groups and for 4 consultations

c) ALG1 - Algometer readings for left sacroiliac joint, for both groups for 4 consultations

d) ALG2 - Algometer readings for right sacroiliac joint, for both groups for 4 consultations

e) OTS - Orthopedic test scores for both groups, for consultations 2 and 4

f) TAMP - Traditional chiropractic analysis/motion palpation analysis for consultations 1 and 3. Group 1 represents the results for the traditional chiropractic analysis group. Group 2 represents the results for the motion palpation analysis.

4.1) The tabulated results for NRS 101:

The results for the two-sample unpaired t-test, which was used to compare the NRS 101 percentages for both groups for each consultation are as follows:

Step 1: The comparison of the mean, standard deviation and equality of the variances, at the $\alpha=0.05$ level of significance. P represents the observed significance level or P-value.

Table 4.1

Consultation No.	Group No.	Mean	Standard deviation	Equality of Variances (P-value)
(1)	1	37.5667	17.6036	0.021
	2	37.9667	16.4940	
(2)	1	33.6667	19.2230	0.389
	2	33.9	16.6457	
(3)	1	31.6	21.0019	0.389
	2	31.5667	13.6354	
(4)	1	28.6333	24.6992	0.359
	2	22.3667	15.6690	

The null hypothesis states that there is no significant difference between the variances for group 1 and 2. The alternative hypothesis states that there is a difference.

Decision rule: Reject H0 if $p<\alpha$, accept H0 if $p>=\alpha$

At $\alpha=0.05$

For all the above P-values $p>\alpha$ therefore we accept Ho that there is no difference between the variances.

Step 2: t-test for the equality of the means for group 1 and 2 for each of the consultations based on the equality of variances.

Step 3: Construction of a 95% confidence interval for the difference of the means for group 1 and 2, for each of the consultations.

Table 4.2

Consultation No.	Equal variances assumed	Equality of Means (P-value)	95% Confidence Interval of difference of Means	
			Upper limit	*Lower limit*
(1)	Yes	0.949	-13.1588	12.3588
(2)	Yes	0.972	-13.6823	13.2156
(3)	Yes	0.996	-13.2102	13.2769
(4)	Yes	0.414	-9.2036	21.7369

Step 2: Decision rule: Ho: $m1=m2$, Ha: $m1 \neq m2$ at $\alpha=0.05$

Accept Ho if $p>=\alpha$, reject Ho if $p>\alpha$

For all of the above consultations $p>\alpha$, therefore we accept the null hypothesis that states that there are equal means for both groups.

Step 3: On analysis of the upper and lower limits for the 95% confidence intervals (CI) constructed it is apparent that each of the above CI contains 0. This is confirmation that H0 was accepted for step 2.

The **two-sample paired t-test** compared each of the results from the NRS 101 questionnaires for group 1 for all four consultations with one another. The results are as follows:

Table 4.3

Pair	**Consultations compared:**	**Significance (P-value)**
1	1 and 2	0.318
2	1 and 3	0.138
3	1 and 4	0.045
4	2 and 3	0.436
5	2 and 4	0.229
6	3 and 4	0.148

Decision rule: Ho there is no significant improvement for the consultations concerned. Ha there is a significant improvement.

Reject Ho if $p<\alpha$, accept Ho if $p>=\alpha$ at $\alpha=0.05$

For pair 3 (treatment 1 and 4), $p<\alpha$ indicating that the null hypothesis is rejected and that the alternative hypothesis is accepted. This indicates that there was significant improvement in the NRS values between consultations 1 and 4. For all of the remaining pairs $p>=\alpha$ therefore the null hypothesis is accepted. This indicates that there is no significant improvement between the NRS values for all the treatments concerned.

The **two-sample paired t-test** was repeated for group 2 patients for all of the above consultations. The results are as follows:

Table 4.4

Pair	**Consultations compared**	**Significance (P-value)**
1	1 and 2	0.464
2	1 and 3	0.218
3	1 and 4	0.043
4	2 and 3	0.312
5	2 and 4	0.029
6	3 and 4	0.040

The same decision rule applies. Therefore for pair 3 $p<\alpha$ the alternative hypothesis is accepted indicating significant improvement in the NRS values between consultations 1 and 4. Significant improvement is also noted between consultations 2 and 4, and 3 and 4.

The average readings of the NRS scores (measured in percentages) for each given group, for each consultation is represented graphically in figure 1.

4.2) The tabulated results for the Oswestry Disability Index questionnaire:

The **two-sample unpaired t-test** was used to compare two independent samples (group 1 and 2) for each of the four consultations, with respect to the Oswestry Disability Index questionnaire. Step 1: tabulation of the mean, standard deviation and equality of variances (P-value) is as follows:

Table 4.5

Consultation No:	**Group No:**	**Mean**	**Standard deviation**	**Equality of variances (P-value)**
1	1	18.0667	10.1733	0.398
	2	8.5333	7.8364	
2	1	15.4667	10.1733	0.897
	2	10.4	9.1402	
3	1	14.2667	11.0807	0.390
	2	8.5333	7.8364	
4	1	12.3333	12.1401	0.202
	2	6.1333	7.1899	

The null hypothesis and decision rule is the same as outlined in step 1 earlier. For all of the above consultation $p>=\alpha$ therefore the null hypothesis is accepted and equal variance are assumed.

The results for Step 2: t-test for the equality of the means and step 3: construction of a 95% confidence interval for the equality of the means, are tabulated below.

Table 4.6

Consultation no:	**Equal Variances Assumed**	**Equality of Means (P-value)**	**95% confidence interval**	
			Lower limit	*Upper limit*
1	Yes	0.008	2.7415	16.3252
2	Yes	0.179	-2.4628	12.5961
3	Yes	0.113	-1.4447	12.9113
4	Yes	0.100	-1.2624	13.6624

For consultation 1 the null hypothesis is rejected because $P<\alpha$. The confidence interval for consultation 1 does not contain 0 because the null hypothesis is rejected at the $\alpha=0.05$ level. This indicates that there is significant difference in the means of group 1 and 2 with respect to the Oswestry Disability Index.

The **two-sample paired t-test** was used to compare each of the consultations with respect to the Oswestry Lower Back Disability Index. The results for group 1 comparisons are tabulated below:

Table 4.7

Pair	Consultations compared	Significance (P-value)
1	1 and 2	0.60
2	1 and 3	0.023
3	1 and 4	0.012
4	2 and 3	0.287
5	2 and 4	0.035
6	3 and 4	0.117

The null hypothesis states that there is no significant improvement between the consultations compared, with respect to the Oswestry Disability Index. The alternative hypothesis states that there is a significant improvement.

For pair 2 (consultation 1 compared with 3), pair 3 (consultation 1 compared with 4) and pair 5 (consultations 2 and 4), $P<\alpha$ therefore the null hypothesis is rejected and the alternative hypothesis is accepted. This states that there is significant improvement between those consultations within group 1.

The **two-sample paired t-test** was repeated within group 2. The tabulated results are as follows:

Table 4.8

Pair	Consultations compared	Significance (P-value)
1	1 and 2	0.446
2	1 and 3	0.342
3	1 and 4	0.105
4	2 and 3	0.446
5	2 and 4	0.077
6	3 and 4	0.105

The null hypothesis and the decision rule remain the same as for group 1. For all the above comparisons $P>\alpha$, therefore the null hypothesis is accepted for each pair. Thus stating that there is no significant difference between the consultations with respect to Oswestry Disability Index.

The average readings of the Oswestry Disability Index (measured in percentages) for each consultation and group is represented graphically in figure 2.

4.3) The tabulated results for the left algometer readings:

The **two-sample unpaired t-test** was used to compare groups 1 and 2, for each consultation with respect to the left algometer readings (measured in kg/cm^2).

Step 1 involved the tabulation of the mean, standard deviation and Equality of variances. The tabulated results are as follows:

Table 4.9

Consultation No:	Group No:	Mean	Standard deviation	Equality of variances (P-value)
1	1	6.4133	2.4585	0.783
	2	7.38	2.5493	
2	1	6.3867	2.7573	0.768
	2	6.8733	2.5381	
3	1	6.9067	3.1017	0.960
	2	7.2333	3.1633	
4	1	7.6133	2.2725	0.124
	2	8.9467	3.6243	

All of the above P-values $>\alpha$, this indicates that the null hypothesis is accepted and equality of variances is assumed, between each group, for each consultation.

The results for step 2: test for the equality of means and step 3: construction of 95% confidence interval for equality of mean, are tabulated below.

Table 4.10

Consultation No:	**Equal variances assumed**	**Equality of means (P-value)**	**95% confidence interval**	
			Lower limit	*Upper limit*
1	Yes	0.299	-2.4688	0.9065
2	Yes	0.619	-2.4688	1.4954
3	Yes	0.777	-2.6698	2.0165
4	Yes	0.237	-3.5968	0.9292

For each consultation the P-values $>\alpha$ indicating that the null hypothesis is accepted and there is no difference between the means for each group, for each of the above consultations, with respect to the algometer readings.

As confirmation of the null hypothesis being accepted for each case, 0 falls between the lower and upper limits of each confidence interval.

The **two-sample paired t-test** used to compare the left algometer readings within group 1. The tabulated results are as follows:

Table 4.11

Pair	**Consultations compared**	**Significance (P-values)**
1	1 and 2	0.008
2	1 and 3	0.103
3	1 and 4	0.484
4	2 and 3	0.001
5	2 and 4	0.063
6	3 and 4	0.008

The null hypothesis states that there is no significant improvement between the left algometer readings for the consultations of interest. For pair 1 (consultations 1 and 2), pair 4 (consultations 2 and 3) and pair 6 (consultations 3 and 4) $P<\alpha$ therefore the null hypothesis is rejected at the $\alpha=0.05$ level of significance. The alternative hypothesis is accepted stating that there is significant improvement in the algometer readings for the consultations of interest.

The **two-sample paired t-test** was also used to compare the Algometer readings within group 2. The tabulated results are as follows.

Table 4.12

Pair	Consultations compared	Significance (P-value)
1	1 and 2	0.018
2	1 and 3	0.029
3	1 and 4	0.015
4	2 and 3	0.000
5	2 and 4	0.018
6	3 and 4	0.001

The alternative hypothesis is accepted for all of the above pairs (1,2,3,4,5 and 6). This states that there is significant improvement in the left algometer readings, for the above pairs of group 2.

The average left algometer readings (measured in kg/cm^2) are represented graphically in figure 3.

4.4) The tabulated results for the Right Algometer Readings

The **two-sample unpaired t-test** was used to compare the results from group 1 and group 2, for each consultation with respect to the right algometer readings (measured in kg/cm^2). Step one involved the tabulation of the mean, standard deviation and equality of variances (P-value). The results are tabulated below:

Table 4.13

Consultation No.	Group No.	Mean	Standard deviation	Equality of variances (P-value)
1	1	6.3600	2.9281	0.541
	2	6.2400	2.5091	
2	1	6.4000	2.0976	0.732
	2	6.6733	2.3831	
3	1	6.0733	2.9461	0.152
	2	5.5467	1.7545	
4	1	6.5000	1.8974	0.099
	2	8.0667	2.9471	

For all of the above consultations the P-values are >α, therefore the null hypothesis is accepted and equal variances are assumed for each group for each consultation.

The tabulation of the results for step 2: equality of the means (P-value) and step 3: construction of a 95% confidence interval, are tabulated below:

Table 4.14

Consultation No:	Equal variances assumed	Equality of means (P-values)	95% confidence interval	
			Lower limit	*Upper limit*
1	Yes	0.905	-1.9195	2.1585
2	Yes	0.741	-1.9525	1.4058
3	Yes	0.557	-1.2869	2.3402
4	Yes	0.094	-3.4205	0.2871

For all of the above consultations the P-values are >α, therefore the null hypothesis is accepted that states that there is no significant difference between groups 1 and 2 with respect to the right algometer readings. As confirmation of the above result, all of the confidence intervals lower and upper limit, contain 0.

The **two-sample paired t-test** was used to compare the right algometer readings within group 1. The results are tabulated below.

Table 4.15

Pair	Consultations compared	Significance (P-value)
1	1 and 2	0.957
2	1 and 3	0.771
3	1 and 4	0.803
4	2 and 3	0.672
5	2 and 4	0.848
6	3 and 4	0.498

The null hypothesis states that there is no significant improvement between consultations compared within group 1. The alternative hypothesis states that there is a significant improvement. For all of the above comparisons the P-values are >α, therefore the null hypothesis is accepted.

The same procedure was repeated for group 2. The results are as follows:

Table 4.16

Pair	Consultations compared	Significance (P-value)
1	1 and 2	0.414
2	1 and 3	0.023
3	1 and 4	0.022
4	2 and 3	0.241
5	2 and 4	0.297
6	3 and 4	0.080

For pair 2 (consultations 1 and 3) and 3 (consultations 1 and 4) $P<\alpha$, therefore the null hypothesis is rejected. The alternative hypothesis, which states that there is significant improvement, is accepted for pair 2 and pair 3. The null hypothesis is accepted for the remaining pairs.

The average right algometer readings (measured in kg/cm^2) are represented graphically in figure 4.

4.5) The tabulated results of the Orthopedic Test Scores

The **two-sample unpaired t-test** was used to compare groups 1 and 2 for each consultation, with respect to the orthopedic test scores (measured in percentages). The results for step 1: the mean, standard deviation and equality of variances (P-values) are tabulated below.

Table 4.17

Consultation No.	Group No.	Mean	Standard deviation	Equality of variances (P-value)
2	1	82.2240	17.2115	0.526
	2	80.0020	16.9014	
4	1	33.3353	35.6359	0.011
	2	17.7807	21.3340	

For consultation 4, $P<\alpha$ therefore the null hypothesis is rejected and unequal variances is assumed. For consultation 2, $P>\alpha$ therefore the null hypothesis is accepted and equal variances is assumed.

The results for step 2: equality of means (P-value) and step 3: construction of a 95% confidence interval, are tabulated below.

Table 4.18

Consultation No.	Equal variances assumed	Equality of means (P-values)	95% confidence interval	
			Lower limit	*Upper limit*
2	Yes	0.724	-10.5363	14.9803
4	No	0.160	-6.6353	37.7447

For the above consultations, P>α therefore the null hypothesis is accepted, which states that there is no significant difference between groups.

The **two-sample paired t-test** was used to compare orthopedic test scores within group 1. The results are tabulated below.

Table 4.19

Pair	**Consultations compared**	**Significance (P-value)**
1	2 and 4	1.000

For group 1 the P-value >α therefore the null hypothesis is accepted. Which states that there is no significant improvement between consultations 2 and 4, with respect to orthopedic test scores.

The same test was conducted on group 2. The results are tabulated below.

Table 4.20

Pair	**Consultations compared**	**Significance (P-value)**
1	2 and 4	1.000

For group 2 the P-value is >α, therefore the null hypothesis is accepted, which states that there is no significant improvement between consultations.

The average reading for the orthopedic test scores are represented graphically in figure 5.

4.6) The tabulated results for the traditional analysis/motion palpation

The **Mann-Whitney unpaired U-test** was used to compare group 1 (results from the traditional analysis) and group 2 (motion palpation analysis results) for consultations 1 and 3. The null hypothesis states that there is no significant difference between groups and the alternative hypothesis states that there is a significant difference, at $\alpha=0.05$ level of significance.

The results are tabulated below:

Table 4.21

Consultation No.	Group	Sum of ranks	Exact significance (P-value)
1	1	270.00	0.126
	2	195.00	
3	1	249.50	0.486
	2	215.50	

The P-values for both groups >α therefore the null hypothesis is accepted indicating that there is no significant difference between groups.

The **Wilcoxon signed ranks test** was conducted to perform intra-group comparisons for the relevant consultations. The null hypothesis states that there is no significant change at the $\alpha=0.05$ level of significance.

The results for group 1 (traditional analysis) are tabulated below:

Table 4.22

Consultations compared	**Significance (P-value)**
1 and 3	0.414

$P>\alpha$ therefore there is no significant difference between the consultations.

The results for group two are tabulated below:

Table 4.23

Consultations compared	**Significance P-value**
1 and 3	0.166

$P>\alpha$ therefore the null hypothesis is accepted that there is no significant difference between consultations 1 and 3.

4.7) Age and Gender distribution

The average age for groups 1 and 2 are tabulated below:

Table 4.24

	Group 1	**Group 2**
Mean age	34.4	37.333

Group 1 consisted of 7 female patients and 8 male patients. Group 2 consisted of 6 female patients and 9 male patients.

CHAPTER FIVE

DISCUSSION

This chapter deals with the discussion of the results obtained from the NRS-101 pain intensity scale, the Oswestry back disability index, the left and right algometer readings, the orthopedic test scores and the motion palpation/traditional chiropractic analysis findings. The authors conclusions and recommendations for future studies are also included.

The unpaired t-test for comparison of both groups with respect to the average pain intensity (NRS-101 questionnaire readings) resulted in accepting of the null hypothesis that there was no significant difference between groups. However the paired t-test for group 1 (table 4.3) resulted in rejection of the null hypothesis. Significant improvement in the pain average intensity was noted between consultations 1 and 4. The paired t-test for group 2 (table 4.4) resulted in rejection of the null hypothesis for comparison between consultations 1 and 4, 2 and 4 and 3 and 4. This indicated that significant improvement was noted throughout the treatment period. However it is important to realize that both groups showed significant improvement between the first and the last consultations. The paired t-test confirm that no significant inter-group difference was noted.

The results from the paired t-test for groups 1 and 2 with respect to the Oswestry disability index showed a different trend. Group 1 (table 4.7) showed significant improvement between consultations 1 and 3, 2 and 4 and 1 and 4 with respect to the disability experienced. However group 2 (table 4.8) showed no significant improvement for any of the consultations. However conduction of the unpaired t-test for inter-group comparisons resulted in acceptance of the null hypothesis that no significant difference was noted between groups 1 and 2 (table 4.9).

Although significant improvement in both groups with respect to subjective clinical findings was evident, no inter-group was noted. Thus in terms of objective one, no statistical significant difference between group 1 and 2 could be noted in terms of subjective measures.

The paired t-test conducted for the analysis of the left algometer readings showed significant improvement for both groups (tables 4.11 and 4.12). For group 1 significant improvement was noted between consultations 1 and 2, 2 and 3 and 3 and 4. For both groups the improvement was maintained for the duration of the research period. However inter-group analysis using the unpaired t-test (tables 4.9 and 4.10) showed no significant difference between groups 1 and 2.

The paired t-tests conducted for group 1 (table 4.15) and group 2 (table 4.16) with respect to the right algometer readings yielded dissimilar results. Group 2 showed significant improvement between consultations 1 and 3, and 1 and 4. No significant improvement could be demonstrated for group 1. However although intra-group differences were evident, inter-group comparisons conducted by the unpaired t-test revealed that no significant difference was evident between groups 1 and 2.

Orthopedic test scores also constituted part of the objective data. Inter-group differences in the orthopedic test scores were noted by conduction of the unpaired t-test. Unequal variances were observed for the fourth consultation. However upon further analysis no difference was noted between the means for both groups. Thus in the end the null hypothesis was accepted and no significant difference was concluded. The paired t-test for group 1 (table 4.19) and group 2 (table 4.20) both showed no significant improvements between consultations 2 and 4.

It was evident that significant improvement was noted for both groups in terms of objective measures. However inter-group analysis revealed no significant difference. Thus in terms of objective two, no significant difference was noted between groups 1 and 2 in terms of objective clinical findings.

During the motion palpation/traditional chiropractic analysis of the sacroiliac joints the integrity of each system was analyzed and graded accordingly. Thus the results expressed by the TAMP variable represent the intra-examiner reliability of either the motion palpation (results from group 2) or the traditional chiropractic analysis (results from group 1).

The Wilcoxon (table 4.22 and 4.23) and Mann-Whitney tests both revealed no significant difference between groups 1 and 2. Thus it could be concluded that in terms of objective three no significant difference existed between the intra-examiner reliability of motion palpation and a traditional chiropractic means of analysis of sacroiliac joint dysfunction.

The results of the study seem conclusive. However a few points should be raised. Firstly, trends evident on intra-group comparison of objective data (indicating greater improvement in one group in comparison to the other) were found to be insignificant in terms of inter-group comparison. This could be due to the fact that the sample size was small. These trends may have been expressed in significant inter-group differences had the sample size been larger. Future studies in this area should make use of a larger sample size. This would assist in showing up subtle differences noted between groups.

Factors such as selection bias, psychological problems, natural history, stress levels, physical activity, work habits or insensitivity of measurement tools may have played a role in the outcome of results.

It was not the intention of this study to comment on inter-examiner reliability of each individual analysis system used. If this were the case more the one examiner using the same method would have examined each patient. The inter-examiner reliability expressed in this study represents the reliability between the motion palpation examiners and traditional chiropractic analysis examiners in terms of improvement noted in the patients treated according to one or the other analysis system.

Because of its unique nature, it is difficult to compare the results of this study to other studies. This is due to the fact that no comparative studies of this nature exist. Most other previous studies have aimed at determining the inter-examiner and intra-examiner of specific analysis systems.

Wiles and Faye (1992) state that due to the conflicting results in past motion palpation studies, each new study seems to only complicate our understanding of this area. This study does not shed light onto the to what degree each individual analysis system is reliable. This study shows that by offering treatment based on using either analysis system patients respond well. To what degree either system is effective was unable to be determined.

Both groups of patients responded favorably to being adjusted according to either analysis system. Thus it is fair to say that based on the results of this study it does not matter which system is used to analyze and determine sacroiliac joint dysfunction. I would suggest that a combination of both analysis systems be applied to patients suffering from sacroiliac joint dysfunction.

CHAPTER SIX

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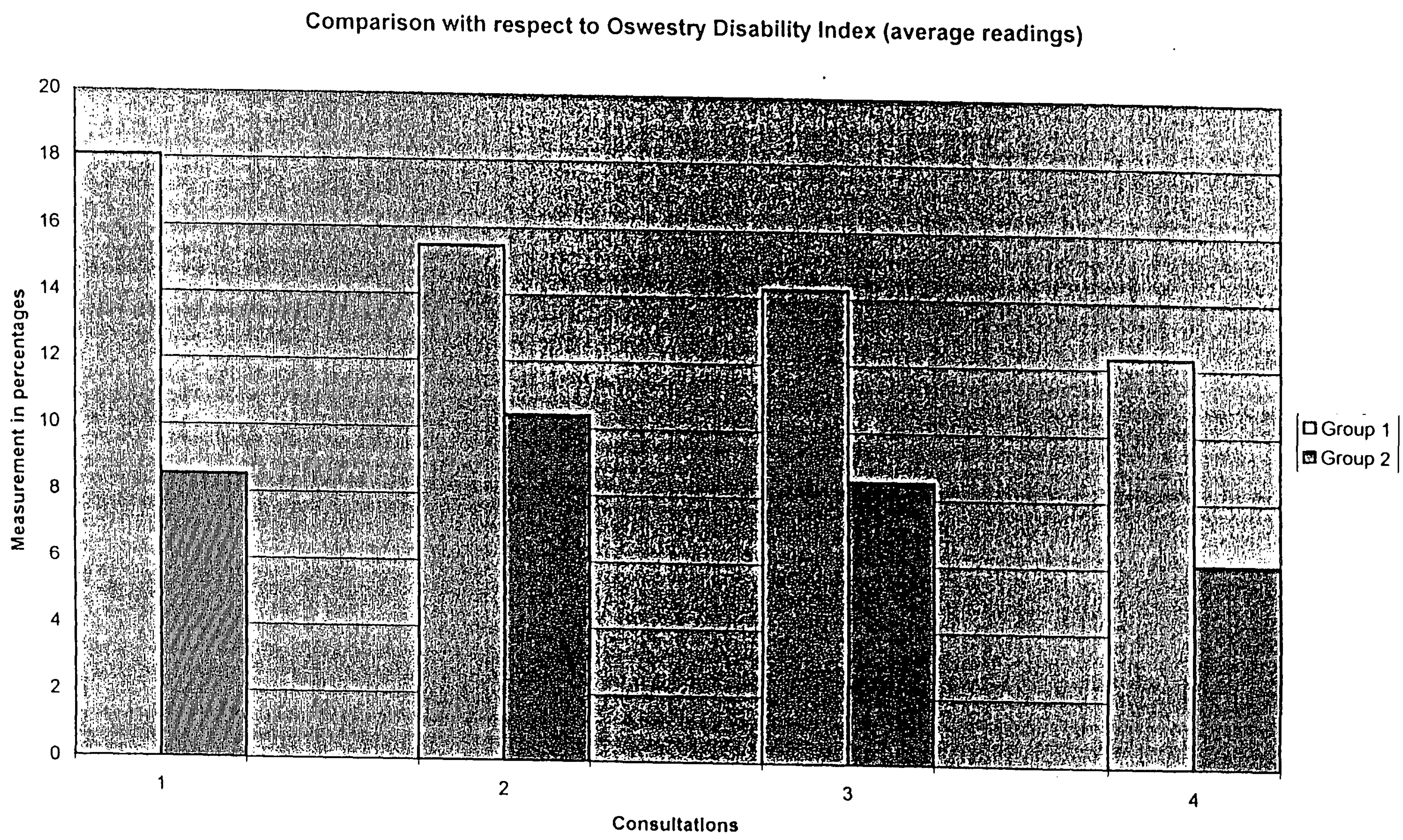
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Measurement in percentages
0
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4
6
8
10
12
14
16
18
20
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2
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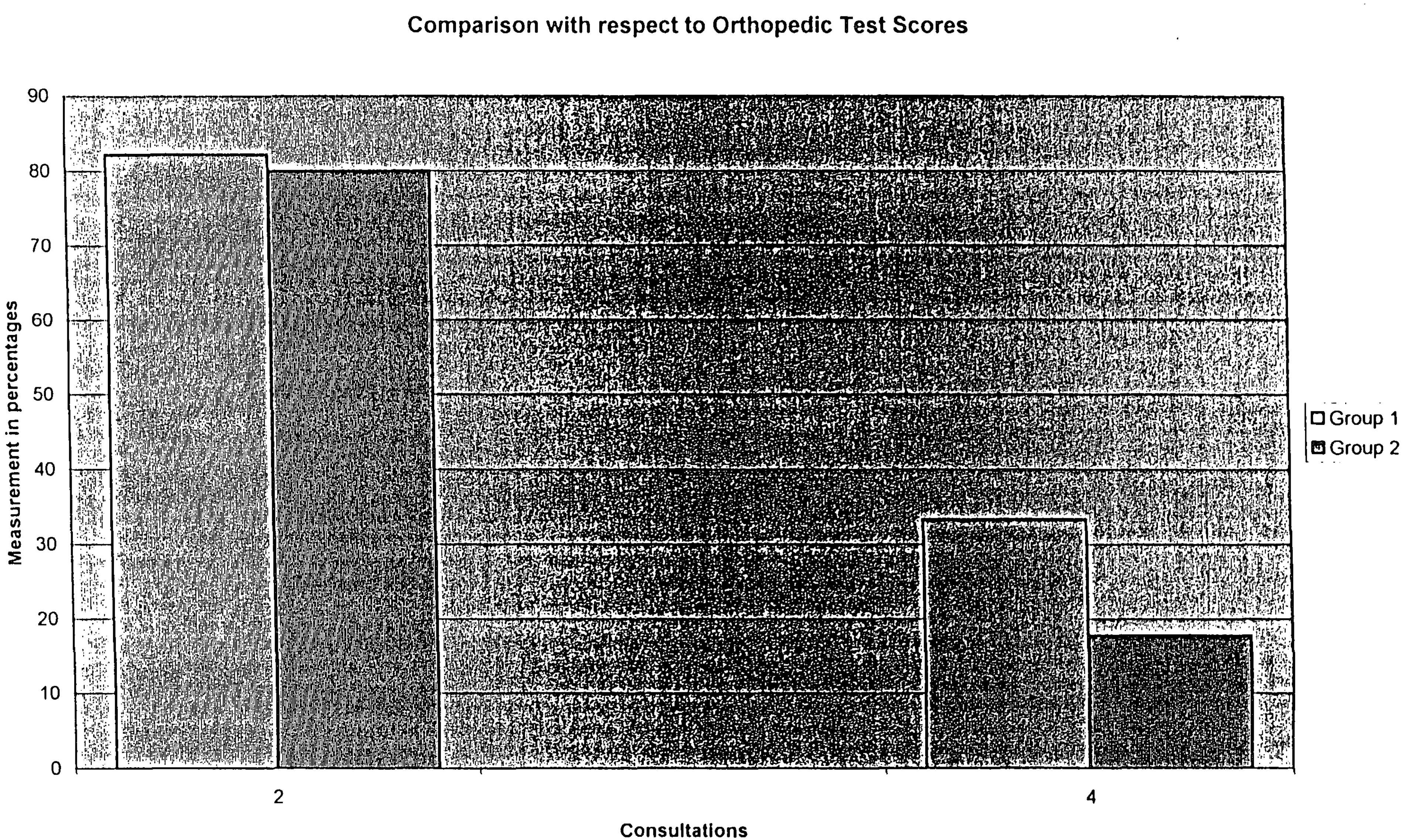
Consultations
Group 1
Group 2


Comparison with respect to Orthopedic Test Scores
Measurement in percentages
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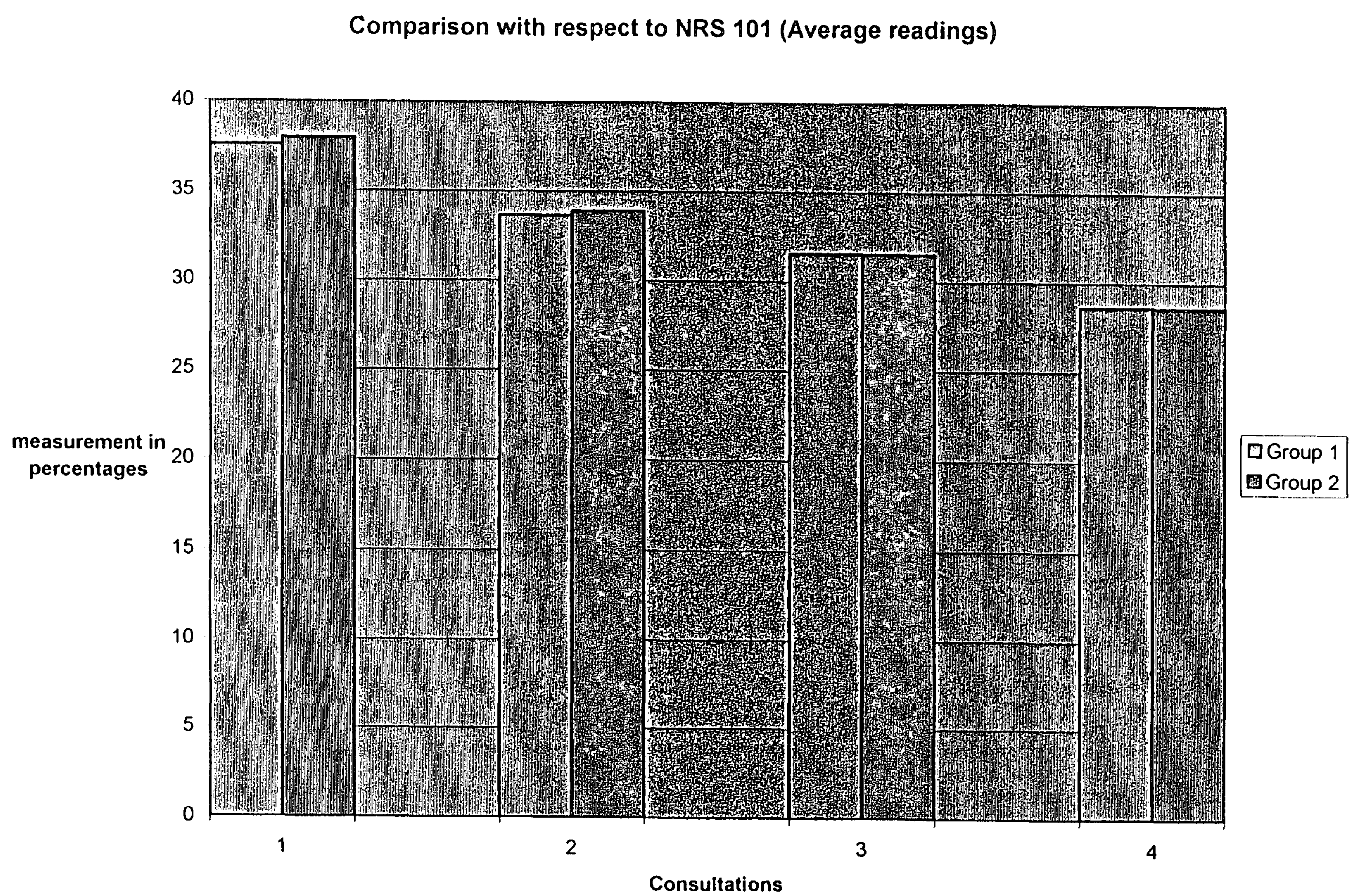
80
90
2
4
Consultations
Group 1
Group 2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measurement in percentages
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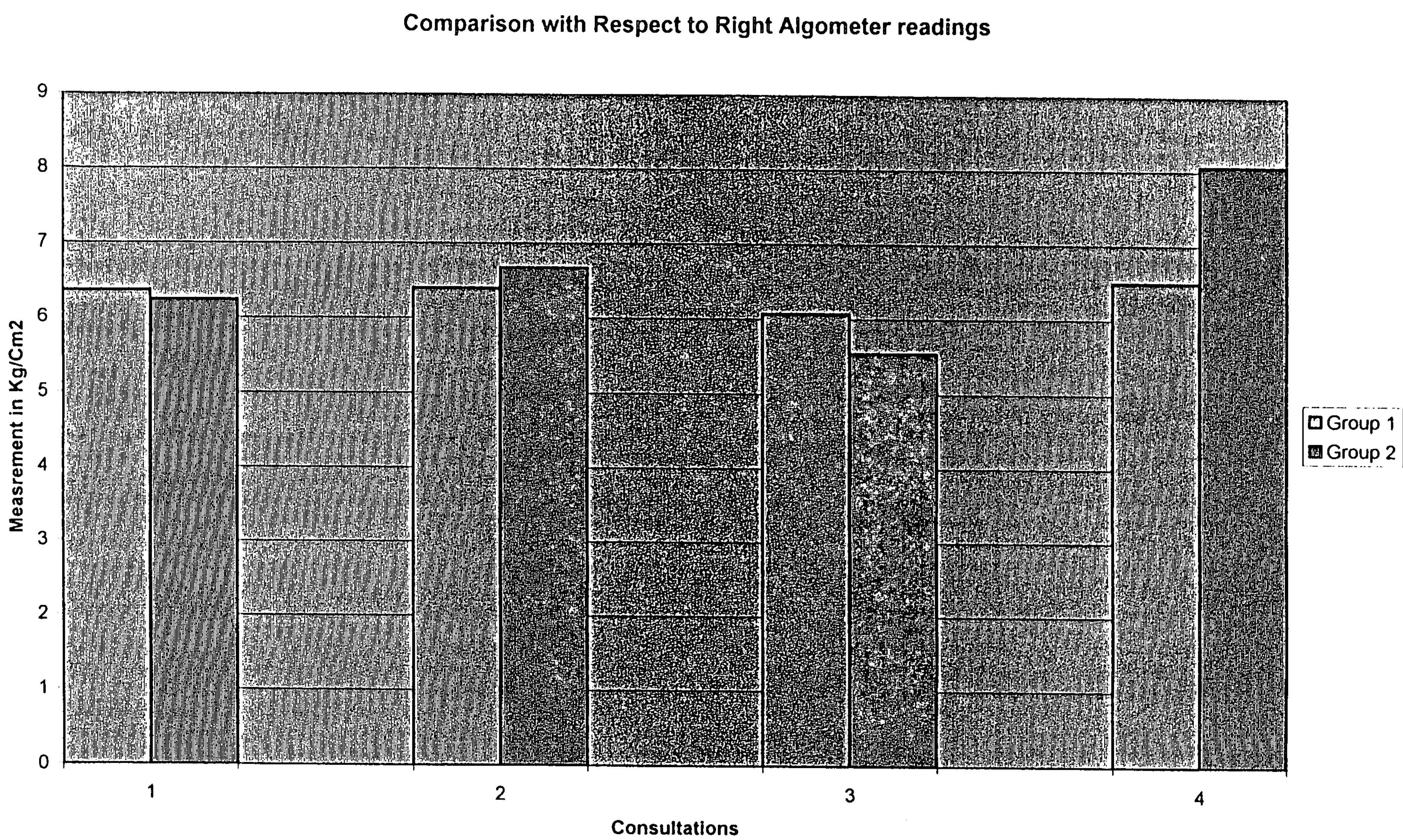
35
40
1
2
3
4
Consultations
Group 1
Group 2


Comparison with Respect to Right Algometer readings
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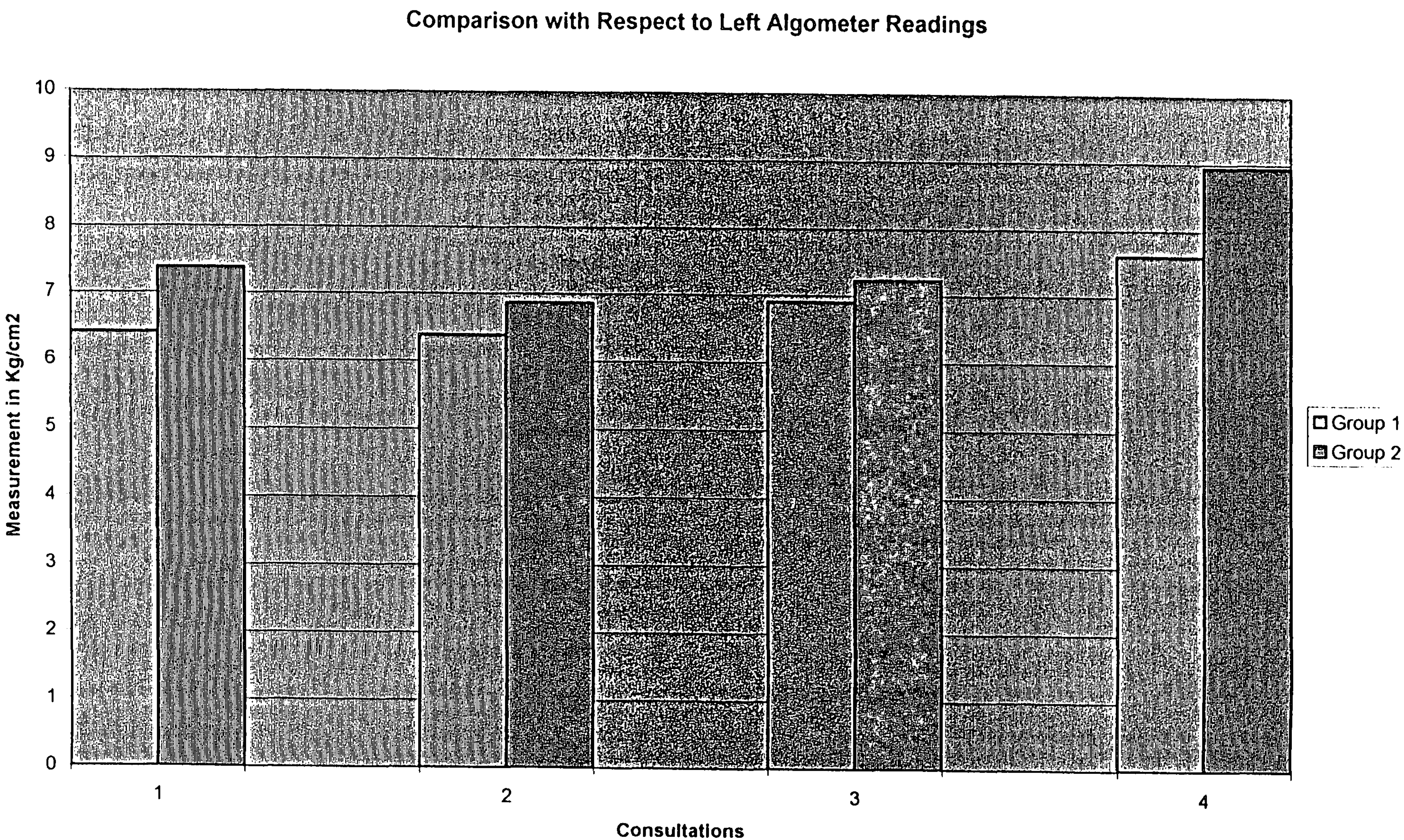
Consultations
Group 1
Group 2


Comparison with Respect to Left Algometer Readings
Measurement in Kg/cm2
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3
4
Consultations
Group 1
Group 2

APPENDIX A – OSWESTRY LOW BACK DISABILITY INDEX

Fairbank et al. (1980)

OSWESTRY BACK DISABILITY INDEX

Patient Name:______________________________ File no.:______________ Date:__________

This questionnaire has been designed to give the doctor information as to how your back pain has affected your ability to manage everyday life. Please answer every section and mark in each section only ONE box as it applies to you. We realize you may consider that two of the statements in any one section could 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 severe at the moment.
- ☐ The pain is the worst imaginable at the moment.

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

- ☐ 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 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 only 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 (2.2km).
- ☐ Pain prevents me walking more than ½ mile (1.1km).
- ☐ Pain prevents me walking more than 1/4 mile (0.5km).
- ☐ 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 sitting for more than 1 hour.
- ☐ Pain prevents me from sitting for more than ½ hour.
- ☐ Pain prevents me from sitting for 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 extra pain.
- ☐ Pain prevents me from standing for more than 1 hour.
- ☐ Pain prevents me from standing for more than ½ hour.
- ☐ 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 extra pain.
- ☐ My sex life is nearly normal but it is very painful.
- ☐ My sex life is severely restricted.
- ☐ My sex life is absent because of pain.
- ☐ Pain prevents any sex life at all.

Section 8 - Social life

- ☐ My social life is normal and gives no extra pain.
- ☐ My social life is normal but increases the degree of pain.
- ☐ Pain has no significant effect on my social life 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 6 hours sleep.
- ☐ Even when I take pills I have less than 4 hours sleep.
- ☐ Even when I take pills I have less than 2 hours sleep.
- ☐ Pain prevents me from sleeping at all.
- ☐

Section 10 - Traveling

- ☐ I can travel anywhere without extra pain.
- ☐ I can travel anywhere but it gives extra pain.
- ☐ Pain is bad but I manage trips over 2 hours.
- ☐ Pain restricts me to trips less than 1 hour.
- ☐ Pain restricts me to trips under 30 minutes.
- ☐ Pain prevents me from traveling, except to the doctor and / or hospital.

Adapted from Fairbanks (1980)

APPENDIX B – NUMERICAL RATING SCALE 101
Jenson et al. (1986)

Numerical Rating Scale - 101 Questionnaire

Date:____________ **File no:**____________ **Visit no:**________

Patient name:______________________________________

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

____

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

____

APPENDIX C – INFORMED CONSENT FORM

INFORMED CONSENT FORM

(To be completed in duplicate by patient /subject)

Date :______________

Title of Research Project :____

____

____

Name of Patient :____

Name of Supervisor :____

Name of Research Student :____

____

Please circle the appropriate answer

1.	Have you read the research information sheet?	Yes	No
2.	Have you had an opportunity to ask questions regarding this study?	Yes	No
3.	Have you received satisfactory answers to your questions?	Yes	No
4.	Have you had an opportunity to discuss this study?	Yes	No
5.	Have you received enough information about this study?	Yes	No
6.	Whom have you spoken to? ________________________________		
7.	Do you understand the implications of your involvement in this study?	Yes	No
8.	Do you understand that you are free to withdraw from this study?	Yes	No
	a) at any time	Yes	No
	b) without having to give any a reason for withdrawing, and	Yes	No
	c) without affecting your future health care.	Yes	No
9.	Do you agree to voluntarily participate in this study	Yes	No

Please Print in block letters:

Patient /Subject Name:______________________ Signature:____________________________

Parent /Guardian Name:______________________ Signature:____________________________

Witness Name:____________________________ Signature:____________________________

Research Student Name:_____________________ Signature:___________________________

APPENDIX D – INFORMATION SHEET

INFORMATION REGARDING LOWER BACK PAIN RESEARCH

Dear patient,

Thank-you for inquiring about the research being conducted into lower back pain. 60-80% of the general population suffer from lower back pain at some stage in their lifetime and 20-30% of the population are suffering from lower back pain at any one time. These statistics prove that lower back pain is common. A good understanding is vital in order to treat lower back pain effectively, efficiently and safely.

This research will attempt to improve the understanding of lower back pain. It will analyze two methods of determining the nature of the condition, seeing which is more effective. This research will therefore contribute largely to our competency as doctors, in this area.

If you are selected as a suitable candidate please be aware of the following: you are free to leave the research at any time. It is important that you undergo the full schedule of treatments.

The schedule of appointments will consist of four treatments within a one-week period. The first consultation involves a full case history, physical and regional examination, along with a treatment. If any contra-indications to the treatment offered are suspected you will undergo a lower back x-ray examination. During the x-ray examination you will be exposed to a small dose of radiation which may pose a minimal risk if you are suffering from certain medical conditions.

If you cannot make an appointment at any stage, please phone me and reschedule. Feel free to contact me at any time regarding any queries that you may have.

Thank-you for your participation in this project. Your role is vital and your contribution appreciated.

Sincerely yours,

Paul Birdsey

APPENDIX E – CASE HISTORY FORM

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC
CASE HISTORY

Patient:______________________ Date: ______________
file #:_______ X-Ray#:______________
Age:_______ Sex:_______ Occupation:______________
Intern:__________________ Signature:______________

FOR CLINICIAN'S USE ONLY
Initial visit clinician:______________Signature:______________

Case History:

Examination:
Previous: Current:

X-Ray Studies:
Previous: Current:

Clinical Path. lab:
Previous: Current:

Case Status:

PTT: Conditional: Signed Off: Final Sign out:

Recommendations:

Intern's Case History

1. Source of History:

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

6. Current health status and life-style:

- Allergies
- Immunizations
- Screening Tests
- Environmental Hazards (Home, School, Work)
- Safety Measures (seat belts, condoms)
- Exercise and Leisure
- Sleep Patterns
- Diet
- Current Medication
- Tobacco
- Alcohol
- Social Drugs

7. Immediate Family Medical History:

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

APPENDIX F – PHYSICAL EXAMINATION FORM

TECHNIKON NATAL

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Patient:______________________ File#: ______________________ Date:__________
Clinician:______________________ Signature:____________________
Intern:______________________ Signature:____________________

1. VITALS

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

2. GENERAL EXAMINATION

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

Urinalysis:

3. CARDIOVASCULAR EXAMINATION

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

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

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

- Masses (intra- or extramural)
- Aorta:

Percussion - Rebound tenderness:
- Ascites:
- Masses:

Auscultation - Bowel sounds:
- Arteries (aortic, renal, iliac, femoral, hepatic)

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

6. G.U.T EXAMINATION

External genitalia:
Hernias:
Masses:
Discharges:

7. NEUROLOGICAL EXAMINATION

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

Higher Mental Function
- Information and Vocabulary:
- Calculating ability:
- Abstract Thinking:

G.C.S.:
- Eyes:
- Motor:
- Verbal:

Evidence of head trauma:

Evidence of Meningism:
- Neck mobility and Brudzinski's sign:
- Kernigs sign:

Cranial Nerves:

I Any loss of smell/taste:
Nose examination:

II External examination of eye:
- Visual Acuity:
- Visual fields by confrontation:

- Forearm	= Supination & Pronation:	
- Fingers	= Extension (Interphalangeals & M.C.P's):	
- Thumb	= Opposition:	
- Hip	= Flexion & Extension:	
	= Adduction & Abduction:	
- Knee	= Flexion & Extension:	
- Foot	= Dorsiflexion & Plantar flexion:	
	= Inversion & Eversion:	
	= Toe (Plantarflexion & Dorsiflexion):	

b. Tone
- Shoulder:
- Elbow:
- Wrist:
- Lower limb - Int. & Ext. rotation:
- Knee clonus:
- ankle clonus:

c. Reflexes
- Biceps:
- Triceps:
- Supinator:
- Knee:
- Ankle:
- Abdominal:
- Plantar:

Sensory System:

a. Dermatomes
- Light touch:
- Crude touch:
- Pain:
- Temperature:
- Two point discrimination:

b. Joint position sense
- Finger:
- Toe:

c. Vibration:
- Big toe:
- Tibial tuberosity:
- ASIS:
- Interphalangeal Joint:
- Sternum:

Cerebellar function:

Obvious signs of cerebellar dysfunction:

= Intention Tremor:

= Nystagmus:

= Truncal Ataxia:

Finger-nose test (Dysmetria):
Rapid alternating movements (Dysdiadochokinesia):
Heel-shin test:
Heel-toe gait:
Reflexes:
Signs of Parkinsons:

8. **SPINAL EXAMINATION:**(See Regional examination)

Obvious Abnormalities:
Spinous Percussion:
R.O.M:
Other:

9. **BREAST EXAMINATION:**

Summon female chaperon.

Inspection - Hands rested in lap:
- Hands pressed on hips:
- Arms above head:
- Leaning forward:

Palpation - masses:
- tenderness:
- axillary tail:
- nipple:
- regional lymph nodes:

APPENDIX G – LUMBAR SPINE AND PELVIS REGIONAL EXAMINATION FORM

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC
REGIONAL EXAMINATION - *LUMBAR SPINE AND PELVIS.*

PATIENT: ____

FILE #: ____________________ DATE: ______________

INTERN/RESIDENT: ________________________________

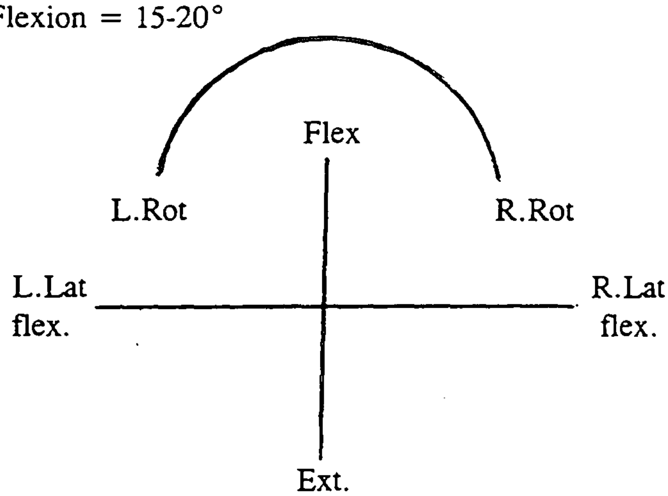
SUPERVISING CLINICIAN: ___________________________

STANDING:

Posture
Minor's Sign
Skin
Scars
Discoloration
Muscle Tone
Bony & Soft Tissue Contours
Spinous Percussion
Schober's Test (6cm)
Treadmill
Body Type
Attitude

RANGE OF MOTION

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



SUPINE:

Skin
Hair
Nails
Palpate Abdomen/groin
Pulses (abdomen)
Observe abdomen
Fasciculations
Abdominal Reflexes

NEUROLOGICAL EXAMINATION

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

Tripod
Kemp's Test

MOTION PALPATION and JOINT PLAY:

LEFT: Upper Thoracics:
Lumbar Spine:
Sacroiliac Joint:

RIGHT: Upper Thoracics:
Lumbar Spine:
Sacroiliac Joint:

Basic Exam: Hip
Case History:

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

Observ/Palpation:

Basic Exam: Thoracic Spine
Case History:

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

Observ/Palpation:

APPENDIX H – NRS-101 READINGS FOR GROUP 1

THE NRS-101 READINGS (GROUP 1)

Patient No	Consultation 1	Consultation 2	Consultation 3	Consultation 4
1	25	45	25	15
2	50	40	25	25
3	17.5	17.5	17.5	17.5
4	38.5	15	16.5	24
5	45	5	5	5
6	47.5	47.5	42.5	38
7	75	62.5	85	100
8	37.5	55	52.5	42.5
9	5	5	12.5	5
10	30	25	20	5
11	55	60	55	55
12	42.5	40	45	37.5
13	50	45	32.5	25
14	20	17.5	15	10
15	25	25	25	25

APPENDIX I – NRS-101 READINGS FOR GROUP 2

THE NRS-101 READINGS (GROUP 2)

Patient No.	Consultation one	Consultation two	Consultation Three	Consultation Four
1	20	0	10	0
2	42.5	40	37.5	30
3	50	45	37.5	35
4	17.5	17.5	15	20
5	56	55	50	32
6	40	27.5	25	35
7	35	40	17.5	6
8	65	45	35	20
9	25	17.5	16	30
10	51	18.5	30	22.5
11	50	45	40	40
12	47.5	20	20	0
13	5	57.5	50	0
14	25	50	50	50
15	40	30	40	15

APPENDIX J – OSWESTRY DISABILITY INDEX READINGS FOR GROUP 1

OSWESTRY DISABILITY INDEX READINGS (GROUP 1)

Patient No	Consultation one	Consultation two	Consultation Three	Consultation Four
1	20	10	4	4
2	12	10	2	2
3	22	18	18	20
4	12	10	10	5
5	28	22	16	16
6	12	10	8	8
7	22	18	22	22
8	35	28	28	14
9	4	2	4	4
10	10	8	8	0
11	40	46	44	48
12	10	8	14	10
13	8	16	8	8
14	16	6	8	4
15	20	20	20	20

APPENDIX K – OSWESTRY DISABILITY INDEX READINGS FOR GROUP 2

OSWESTRY DISABILITY INDEX READINGS (GROUP 2)

Patient no	Consultation one	Consultation Two	Consultation three	Consultation Four
1	6	0	4	0
2	4	0	0	0
3	12	4	0	0
4	16	8	10	12
5	18	18	16	6
6	28	6	8	12
7	8	18	6	6
8	36	24	24	22
9	10	4	2	2
10	26	18	20	18
11	14	12	12	10
12	18	4	4	0
13	28	30	0	0
14	4	4	4	4
15	18	6	18	0

APPENDIX L – LEFT ALGOMETER READINGS FOR GROUP 1

LEFT ALGOMETER READINGS (GROUP 1)

Patient no	Consultation One	Consultation Two	Consultation Three	Consultation Four
1	7.7	5.8	8	9.8
2	3.8	4.2	6.2	6.8
3	2	1.5	2.5	4.8
4	12	12	12	6.2
5	8.8	7.4	4.5	7.8
6	6.5	12	12	12
7	8.5	5	4	4.5
8	7.2	6.8	12	12
9	8.2	7.5	6	8.5
10	5.8	6.0	6.2	8.5
11	4	6.2	7.2	5.8
12	5.5	5.5	4.0	7.5
13	6.2	3.4	5	6
14	5.5	6.0	9.0	7.5
15	4.5	6.5	5	6.5

APPENDIX M – LEFT ALGOMETER READINGS FOR GROUP 2

LEFT ALGOMETER READINGS (GROUP 2)

Patient No	Consultation One	Consultation Two	Consultation Three	Consultation Four
1	4.5	5.2	3.4	3
2	4.9	5.8	3.7	5.2
3	9.5	10	13	12
4	6.9	5.4	6	12
5	7.8	10	12	12
6	8	4	5	9
7	6	3.6	6	8
8	3.5	6.2	4	7
9	7	7.9	7.9	9.5
10	4.5	3.5	4	4.5
11	12	7	7	12
12	8.5	9.2	9	7
13	5.5	6	7	7
14	12	12	12	12
15	6	7.3	8.5	9

APPENDIX N – RIGHT ALGOMETER READINGS FOR GROUP 1

RIGHT ALGOMETER READINGS (GROUP 1)

Patient No	Consultation One	Consultation Two	Consultation Three	Consultation Four
1	9.3	6.7	7.5	7.5
2	3.8	4.8	9.2	4.5
3	2.5	2.5	4.8	4
4	9	10	10	7.6
5	4.9	9.5	5	6.7
6	6.5	8.5	7	8
7	12	6	12	5.5
8	12	7.5	12	12
9	5.7	7.9	5.6	5.5
10	4.8	4.5	5	6
11	4.5	7	7.5	5.9
12	6	4.6	4	7
13	3.4	4.5	3.5	3.5
14	6	5	6	6.3
15	5	7	4	6

APPENDIX O – RIGHT ALGOMETER READINGS FOR GROUP 2

RIGHT ALGOMETER READINGS (GROUP 2)

Patient No	Consultation one	Consultation two	Consultation Three	Consultation Four
1	4	5	4.1	4.3
2	6.3	6.8	3.6	7.2
3	7	7.8	5	14
4	7.8	7.2	4.2	12
5	6.5	9	9	12
6	3.4	5	3.2	5.5
7	6	2.8	5.5	7.5
8	3	5.5	4	5.8
9	6.5	5.5	6.8	8.5
10	3.5	4.5	3.8	3.7
11	9	5	7	10
12	9	12	6	7.5
13	5.6	8	7	8
14	4	10	6	6
15	9	6	8	9

APPENDIX P – ORTHOPEDIC TEST SCORES FOR GROUP 1

ORTHOPEDIC TEST SCORES (GROUP 1)

Patient No	Consultation Two	Consultation Four
1	66.66	0
2	100	66.66
3	100	0
4	100	33.33
5	66.66	0
6	100	66.66
7	66.66	66.66
8	100	0
9	66.6	0
10	100	0
11	66.66	100
12	100	66.66
13	66.66	0
14	66.66	66.66
15	66.66	33.33

APPENDIX Q – ORTHOPEDIC TEST SCORES FOR GROUP 2

ORTHOPEDIC TEST SCORES (GROUP 2)

Patient No	Consultation Two	Consultation Four
1	66.66	0
2	66.66	33.33
3	66.66	0
4	66.66	0
5	66.66	0
6	66.66	33.33
7	100	0
8	100	33.33
9	66.66	0
10	66.66	33.33
11	100	33.33
12	100	0
13	66.66	0
14	100	66.66
15	100	33.33

APPENDIX R – MOTION PALPATION RESULTING CODES

MOTION PALPATION ANALYSIS - RESULTING CODES

Patient No	Codes – Consultation one	Codes – Consultation Three
1	1	0
2	0	0
3	0	0
4	1	1
5	1	0
6	1	1
7	1	0
8	1	0
9	1	0
10	1	0
11	0	1
12	0	0
13	0	1
14	0	1
15	1	0

APPENDIX S – TRADITIONAL ANALYSIS RESULTING CODES

TRADITIONAL CHIROPRACTIC ANALYSIS- RESULTING CODES

Patient no	Codes Consultation one	Codes Consultation three
1	1	1
2	1	1
3	1	1
4	1	1
5	0	1
6	0	1
7	0	1
8	0	1
9	1	0
10	1	1
11	0	0
12	0	0
13	1	1
14	1	1
15	1	0