THE RELIABILITY AND VALIDITY OF THE COMPOSITE ORTHOPAEDIC RATING SCALE AS A MEASUREMENT OF CLINICAL SEVERITY IN THE INVESTIGATION OF MECHANICAL LOW BACK PAIN

By

Lance Riggien

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I, Lance Riggien do declare that this dissertation is representative of my own work.

Signed:_____ Date: 24.03.2003

Approved for final submission:

Signed:_____ Date: 24.03.2003

Dr C. M. Korporaal M.Tech: Chiropractic (SA), CCFC, CCSP (USA), ICCSD (USA)
Supervisor

Signed:_____ Date: 25.3.2003

Dr C. Myburgh M.Tech: Chiropractic (SA), CCSP, CCFC
Co- supervisor

DEDICATION

I dedicate this to my parents for all their love and support.

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ABSTRACT

The aim of this investigation was to develop inter-examiner reliability as well as construct and concurrent validity of the Composite Orthopedic Rating Scale (CORS) so that it may be used as an applicable measurement instrument for use in clinical trials relating to mechanical low back pain.

This prospective, single – blinded construct and concurrent validity and inter-examiner reliability study consisted of 122 participants, all suffering from mechanical low back pain, specifically lumbar facet or sacro-iliac syndrome.

The participants were only required for 1 visit where they were assessed and diagnosed using standardized diagnostic criteria. Thereafter, both the researcher and a blinded, independent examiner applied the tests contained in the Composite Orthopedic Rating Scale (CORS) to the participants.

Subjective data was obtained using the Roland-Morris Disability Questionnaire and the Numerical Pain Rating Scale-101. Objective data was obtained from the results of the application of the provocative Orthopedic tests in the CORS.

The data was then transferred to spreadsheets and underwent statistical analysis. The Chi-squared test of independence was

used to evaluate the results of the study. There were also tests for proportions using various Binomial tests to determine which of the orthopaedic tests, if any, were different or better. Spearman's Rank Order correlation co-efficient was computed to measure the validity and reliability of the two sets of rating scales (researcher's and blinded, independent examiner). Pearson's product moment correlation coefficient was computed as a measure of reliability. The significance level was set at $\alpha = 0.05$. The appropriate p-values were used for decision making.

At a 5% level of confidence it was found that the tests contained in the Composite Orthopedic Rating Scale produced a very low success rate. Furthermore, it was noted that only Yeoman's, palpable muscle spasm and the facet challenge test were accurate more than 50% of the time. The other tests were significantly lower than 50% implying that their success rate was low. Thus, it seems that the tests contained in the CORS do not seem to be valid although three of them had a success rate that was not significantly less than 50%.

Analysis of the results revealed that Yeoman's test was the most accurate. The only significant difference discovered was that, in the lumbar facet tests, the facet challenge test and Kemp's test exhibited a significant difference in success rates.

In terms of the reliability of the tests, it was seen that only the palpable muscle spasm and Kemp's tests yielded significantly

different population proportion success rates i.e. less than 50% success rate.

One value from a run provided by the researcher and one value at each run provided by the Doctor did not yield significantly different results over the whole sample group. In terms of the results observed, all the tests seem to reliably produce the same or similar results. No significant difference was observed between the scores obtained from the Roland-Morris Disability Questionnaire and the Numerical Pain Rating Scale-101 as they both yielded very similar results. The Roland –Morris score also did not deviate greatly from the results obtained from all eight severity tests. This indicated that inter-instrument reliability between both subjective and objective measures was appropriate.

As pain severity levels increased, so did the accuracy of the location tests. One can see this by observing the proportions of correct locations or true positives as the severity levels increased and this was apparent across all the tests.

This study has demonstrated that there is a need for more studies, which focus on orthopaedic testing and its relevancy and usefulness, particularly in terms of mechanical low back pain. The results of this study indicate that the Composite Orthopedic Rating Scale, in its entirety, is not an appropriate instrument for assessing comparative levels of mechanical low back pain.

It is recommended that more research be undertaken in this area and that a larger sample group is used. Also, only 1 independent, blinded examiner should be utilised.

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DEFINITION OF TERMS

Acute mechanical low back pain

The duration of the complaint usually lasting less than six weeks (Koes et al., 1996:2861).

Chronic mechanical low back pain

The duration of the complaint having usually been present for more than six weeks (Koes et al., 1996:2861).

Durban Institute of Technology

The tertiary institute formed on the 1 April 2002 by the merging of Natal Technikon and M.L Sultan Technikon.

Efficacy

The ability of an intervention to produce the desired beneficial effect, in expert hands and under ideal circumstances (White, 2001).

Incidence

A rate which refers to the number of persons with new back pain occurring over a given time period among a known number of persons who were previously without back pain (Giles and Singer, 1997:18).

Mechanical low back pain

For the purposes of this study refers to posterior facet syndrome and sacroiliac syndrome or a combination of the two.

Motion palpation

Palpation of the human spine in the diagnosis of muscular, discal or articular mechanical changes used by some schools of osteopathy, chiropractic and occasionally medicine (Robert Alley, 1983:97).

Prevalence

The number of persons who have experienced back pain ever, even if they are not affected at present (Giles and Singer, 1997:18).

Sensitivity

A measure of the validity of a screening procedure, based on the probability that an individual with a condition/disease will test positive (Portney and Watkins, 1993:691).

Specificity

A measure of validity of a screening procedure, based on the probability that an individual who does not have a condition/disease will test negative (Portney and Watkins, 1993:692).

Validity

The degree to which an instrument measures that which it is intended to measure (Portney and Watkins, 1993:694).

CHAPTER

ONE

CHAPTER ONE: INTRODUCTION

1.1. Introduction

Back pain is defined as pain in the lower back, central, unilateral or bilateral, with or without radiation to the gluteal region and iliac crest (Ombregt et al.1995) and is the second leading cause of absenteeism, resulting in more lost productivity than any other medical condition.

The lifetime prevalence of back pain ranges from 60-90% in most industrialized countries (Kirkaldy-Willis and Burton, 1992; Masset and Malchaire, 1994; Riddle, 1998). In South Africa the lifetime incidence of low back pain in Coloured and Indian communities was found to be 76.6% and 78.2% respectively (Docrat, 1999). Van der Meulen (1997) ascertained that in the formal black settlement of Chesterville, South Africa, the prevalence of low back pain was 53.1%.

Although the causes are multifactorial, the aetiology of back pain could be ascribed to either pathological or mechanical origins amongst other potential causes. Posterior facet and SI syndromes are both mechanical in origin (Gardner and Mosby, 2000:22; Kirkaldy – Willis and Burton, 1992:123).

Posterior facet and sacro-iliac syndrome have both been described as a collection of signs and symptoms.

Posterior facet syndrome may be broadly defined as pain or dysfunction arising primarily from the zygopophyseal joints in the lumbar spine and their surrounding soft tissues.

Sacro-iliac syndrome may be defined as a condition resulting in pain overlying one or both sacro-iliac joints. This is as a result of joint dysfunction or sustained contraction of the muscles overlying the joint (Gardner and Mosby, 2000:22; Kirkaldy – Willis and Burton, 1992:123).

These conditions are usually diagnosed by means of information provided from the patient history and clinical presentation and the use of clinical tests applied specifically to reproduce the pain (Souza, 1997:321). Therefore the diagnosis is arrived at clinically by the agreement between the correlated sets (CORS and Orthopedic rating scale) of provocative tests applied to the structures thought to be involved in the pathophysiology of the respective syndromes.

Although unpublished, an orthopedic rating scale was developed at the Technikon Natal by Paton (2001) to provide an instrument for assessing the clinical severity of low back pain. The motivation was to provide improved diagnostic standardization and homogeneity, as well as facilitating inferential statistics. This provided a means of measuring the progress made by patients once they commenced treatment for their low back pain (Paton, 2001). Scores were allocated to each of the tests on production of a positive result. It has been used in studies since its inception e.g. Paton, 2001, White, 2001 and Login, 2001, yet the reliability and validity

of the scale has never been determined (specifically the allocation of scores to the tests).
The Composite Orthopedic Rating Scale therefore consists of the tests contained in orthopedic rating scale (Paton, 2001) as well as others that have shown to be useful.

As no one test can guarantee a diagnosis or rate the severity of the conditions consistently, each of the tests are equally weighted in the Composite Orthopedic Rating Scale, in order to make an informed decision regarding the clinical relevance of a particular test, its validity, reliability, specificity and sensitivity (Walsh, 1998).

Its scoring system is based on scientific and clinical evidence and subjective outcomes, with the tests are equally weighted in this assessment.

It should be noted that, due to the limitations of this study (small sample size and only single-blind), it should be considered as a pilot study that will provide scope for further investigation.

1.2. Objectives of the study

The aim of this investigation is to develop inter-examiner and to establish construct and concurrent validity of the Composite Orthopedic Rating Scale (CORS) so that it may become an acceptable measurement instrument for use in clinical trials relating to mechanical low back pain.

CHAPTER

TWO

CHAPTER 2: REVIEW OF THE RELATED LITERATURE

2.1 Introduction

Posterior facet and sacro-iliac syndrome have both been described as a collection of signs and symptoms.

> Posterior facet syndrome may be broadly defined as pain or dysfunction arising primarily from the zygopophyseal joints and their surrounding soft tissues while sacro-iliac syndrome may be defined as pain overlying one or both sacro-iliac joints as a result of joint dysfunction or sustained contraction of the muscles overlying the joint (Gardner and Mosby, 2000: 22; Kirkaldy – Willis and Burton, 1992: 123).

As these syndromes do not have pathognemonic clinical signs or specific second level investigations, which solidify the diagnostic process, clear identification of these problems has remained problematic. Although there are many orthopedic tests available to assist in the diagnosing of these conditions, the lack of standardization of these tests at the clinical level with regard to severity has complicated general practice as well as research studies although attempts at research standardization have been made (Walsh, 1998). Furthermore, many of the popular instruments currently being utilized are of limited use in establishing clinical severity as they rely on the patient pain perception, rather than the clinician to elicit information.

Patient perceptions of pain are classically complicated and influenced by:

- Pain threshold of the various patients
- Sensitivity of the patients
- Psychosocial background of the subjects.

2.2 Epidemiology: Incidence and prevalence

Low back pain is a major cause of disability, activity limitation and economic loss. Most studies have found that 60-90% of the population is affected with low back pain at one time or another in their lives (Massett and Malchaire 1994; Riddle, 1998). The lifetime incidence of low back pain in Coloured and Indian communities in South Africa was found to be 76.6% and 78.2% respectively (Docrat, 1999) while Van der Meulen (1997) ascertained that in the formal black settlement of Chesterville, South Africa, the prevalence of low back pain was 53.1%.

Lower back pain is common throughout adult years with the first episodes usually occurring during the second and third decades (Gemmell and Jacobson, 1990). Posterior facet and sacro-iliac syndromes are considered to be two of the most common mechanical conditions to give rise to low back pain (Cox, 1999; Bernard and Kirkaldy-Willis, 1987; Plaugher, 1993).

Low back pain also poses a problem clinically in that it is often associated with various risk factors such as smoking, exposure to vibration, heavy physical labour, psychosocial

factors, obesity and poor posture (McCulloch and Transfeldt, 1997: 240-244).

Chiropractors are trained to treat patients with musculo-skeletal dysfunction such as low back pain. Frequently these patients have unsuccessfully undergone conventional medical therapy such as analgesics and anti-inflammatory medication but researchers now suspect that their pain may be mechanical in origin.

Since there is no direct way to isolate the sacro-iliac joint during physical examination, the examiner must use various pain provocation tests that seem to be significant to the particular joint. A positive stress test is only significant if the clinical history and remaining physical examination support the diagnosis of sacro-iliac syndrome and discount other diagnoses (Vleeming et al., 1997).

2.3 The lumbar spine

2.3.1 Anatomy of the lumbar facet joints

The facet joints are typical synovial joints formed by articular processes arising from adjacent vertebrae. The inferior facets (convex and laterally facing) and superior facets (concave and medially facing) of the associated vertebra form a true diarthrodial joint together with a capsule (Giles and Singer 1997:72, Moore 2000:455).

The articulating surfaces are covered with hyaline cartilage as well as with a thick, fibrous capsule that covers the dorsal aspect of the joint. The ventral capsule is made of an extension of the ligamentum flavum. A fibrous rim fills the deltoid space, determined by the capsule or ligamentum flavum on one side and the junction of the rounded edges of the superior and inferior articular cartilaginous surfaces on the other. Fibro-adipose, adipose enlargements or meniscoids may be found on this rim, mainly at the proximal and distal poles (Plaugher, 1993:57).

The medial branch of the posterior primary ramus innervates these joints (Souza 1997:105-110). These arise from the lumbar nerves at each respective level, with each facet joint receiving innervation from both the nerve exiting at that level and the suprajacent nerves (Moore 2000:455).

These facet joint surfaces are slightly angulated. The angles vary from a mediolateral angulation at L1 to an anteroposterior position at L5 in the sagittal plane (Schafer and Faye 1990:198), with the articular processes projecting superiorly and inferiorly from the junction of the pedicles and laminae.

The primary function of these joints is to stabilise movement between the vertebrae in the lumbar spine, particularly torsion and shear forces, although they also play a role in compression (Yang and King, 1984). Yang and King (1984) observed that normal lumbar facets carry three to twenty-five percent of the axial load, with the arthritic joint bearing up to forty seven percent.

This anatomical constitution predisposes to the mechanism of facet loading with compression. The initial injury may predispose the lumbar spine to early degeneration, which in turn, leads to a decrease in the mechanical support offered by the posterior facet joints, as more support is provided by muscular and ligamentous structures. As an end result, these joints are now more susceptible to injuries from rotational and compressive forces (Plaugher 1993:130-131). This type of injury is commonly found at the L4/L5 and L5/S1 segments (Souza 1998:105-108).

2.3.2 Anatomy of the lumbar disc

A typical lumbar intervertebral disc consists of an outer fibrous casing, the annulus, and an inner gelatinous nucleus pulposis. The annulus consists of three concentric layers, an outer, middle and inner ring. The fibres of the annulus are securely attached to the vertebral bodies and are arranged in lamellae, with the fibres of one layer running at an angle to those of the deeper layers. The nucleus pulposis contains the nuclear material that distributes axial compression in a vertical and radial manner. An avascular hyaline cartilage end plate forms the superior and inferior surface of the disc and is ideal for transmitting weight to the nucleus pulposis due to its avascular nature (McCulloch and Transfeldt, 1997: 3-6).

2.3.3 Mechanism of injury to the facet joints

The injury process more commonly involves two mechanisms: rotational and compressive forces (Plaugher 1993:195-196). The rotational strain affects the L4/L5 joint primarily due to the alignment of the posterior facet elements (Souza 1998:105-108). The L5/S1 joint is excluded from rotational injury as strong ligaments, thoracolumbar fascia and the joint design and bony architecture often protect this joint (Moore, 2000:340-341; 549-550). Thus the strains and forces are directed at the L4/L5 joint (Souza 1998:105-108).

Compressive forces such as traumatic falls or blunt injury to the buttock region most commonly affect the L5/S1 joint as it has large transverse processes, short, strong ligaments and the disc is wedge-shaped (Moore, 2000:340-341). Changes in the posterior joints are mainly due to rotational stresses and compression in flexion is a common cause of the disc herniation (Kirkaldy-Willis 1992 and Plaugher 1993:19-23). Thus, it is clearly evident that the mechanisms of injury involve three primary structures, namely the intervertebral disc and the two posterior facet joints. These structures, together, form the three joint complex (Plaugher, 1993:14).

2.3.4 The three joint complex

This consists of the intervertebral disc between two adjacent vertebrae and the two relevant posterior facet joints (Plaugher, 1993:13). The centre of rotation for both the disc and the facet joints is near to the disc's centre. This centre shifts position when there is a segmental restriction, ligamentous laxity or adhesion formation in the disc or posterior facet joints. This change in the position of the axis in turn causes asymmetrical loading of the three joint complex, which could result in segmental restriction (Plaugher, 1993:14).

The changes that affect the posterior joints also affect the disc and vice versa (Plaugher, 1993:13-14). The rotational and compressive forces in flexion commonly produce injury to all three parts (Miller, Haderspeck and Schultz, 1983; Yang and King, 1984).

Initially alterations in the height and volume of the disc due to compressive forces may result in positional changes of the facet joints. It may also result in compressive fractures of the disc end plates. Slow degeneration of the disc ensues following this, resulting in further stress to the posterior joints at a later stage (Souza, 1997:105-110).

This may eventually result in the individual being predisposed to re-injury, even with symmetrical loading of these joints. The aberrant movement of these joints, from damage to the disc alone, will eventually lead to further injury and thus degeneration at the posterior facet joints. This is thought to explain why posterior facet degeneration in the lumbar spine rarely occurs prior to disc degeneration (Plaugher, 1993:12-15).

2.3.5 The posterior facet syndrome

2.3.5.1 Introduction

The patient usually presents having hurt his back during a particular movement, commonly hyperextension (Adams and Dolan, 1995) but alternatively hyperextension accompanied by lateral flexion (Vleeming et al. 1997:79). The reported pain is localized and strictly unilateral, sometimes with slight pain referral to the upper buttock or trochanteric area on the ipsilateral side (Vleeming et al. 1997:79). As a facet joint is a lateral structure it cannot give rise to a central pain. In the cases of a bilateral lesion there may be bilateral pain

(Moore, 2000:455, Plaugher, 1993:217; Hourigan and Basset, 1989).

Pain usually appears during extension with standing and lying prone with extension of the lumbar spine is also likely to reproduce the pain. Sitting does not usually stimulate pain as the spine is kept in the mid-position, thus placing little strain on the facet joints (Transfeldt and McCulloch, 1997:463). The pain is generally due to articular capsule stretching or as a result of bone-to-bone contact leading to periosteal pain, as a result of inflammation (Yang and King, 1984; Plaugher, 1993; Kanner, 1994; Adams and Dolan, 1995, Seaman, 1997).

The following synopsis outlines the signs and symptoms of posterior facet syndrome:

Symptoms:

- Hip and buttock pain (Plaugher, 1993: 216-217; Kanner; 1994; Vleeming et al., 1997; Travell and Simons, 1999:150-151, 168-169 and 133-134).

- Cramping leg pain, primarily above the knee (Plaugher, 1993: 216-217; Kanner, 1994; Travell and Simons, 1999:28-84,133-134,150-151 and 168-169; McCulloch and Transfeldt, 1997:462).

- Low back stiffness, especially in the morning or with inactivity (Plaugher, 1993: 216-217, McCulloch and Transfeldt, 1997: 463; Seaman, 1997).

- Absence of neurological deficits (Plaugher, 1993:216-217).

Physical signs:

- Local paralumbar tenderness (Plaugher, 1993:216-217). Localised pain in the lumbar spine is indicative of muscular strain or ligamentous sprain (Gerard and Kleinfield, 1993:340).

- Pain on hyperextension of the lumbar spine (Plaugher, 1993:216-217; Adams and Dolan, 1995). This is due to the compaction of the facet joints (Gerard and Kleinfield, 1993:340).

- Absence of neurological deficits (Plaugher, 1993:216-217).

- Absence of root tension signs (Plaugher, 1993:216-217).

- Hip, buttock or back pain on straight leg raising (Plaugher, 1993:216-217). Pain at approximately 90 degrees indicates lumbar spine involvement (Gerard and

Kleinfield, 1993:350). Facet joint pain commonly refers to the proximal sacro-iliac joints and buttocks, when this test is applied (McCulloch and Transfeldt, 1997:462).

2.4 The sacro-iliac joint

2.4.1 The anatomy of the sacro-iliac joint

The sacro-iliac joint is unique. It is classified as a true diarthrodial joint (Moore, 1985:251, Walker, 1992; Daum, 1995). The sacrum can be considered as a wedge that fits in vertically between the two iliac bones. The sacrum also fits between these two bones in the transversal plane (DonTigny, 1983; Vleeming et al. 1997; Moore 2000:518). The articular surfaces are auricular or C-shaped in design and exhibit irregular ridges and depressions that fit into each other. The joint surfaces are lined with cartilage that is thicker and smoother on the sacral side (Walker 1992).

A tight articular capsule is attached to the articular surfaces Vleeming et al. 1997). Extremely powerful ligaments delimit movement and protect the joints (Vleeming et al. 1997; Moore 2000:518 and 340).

These ligaments may be divided into:

1. The huge interosseous sacro-iliac ligament,
2. The anterior sacro-iliac ligaments
3. The posterior sacro-iliac ligaments,
4. Three accessory ligaments:
   a. the sacrospinous,
   b. sacrotuberous,
   c. and iliolumbar ligaments.
   (Moore, 2000:339-341)

The sacro-iliac joint is also splinted and surrounded by some of the most powerful muscles in the body e.g. erector spinae and quadratus lumborum yet none of these directly control movement at the joints (Ombregt et al., 1995).

It should be noted that the inferior portion of the joint is synovial in nature but does not allow increased mobility, as the joint only allows approximately 2-3 degrees of movement in all directions (Potter and Rothstein, 1985; Transfeldt and McCulloch, 1997). However, with an increase in age a correlating decrease in movement in the joint can be observed. This aging process usually begins by the age of thirty (Transfeldt and McCulloch, 1997).

2.4.2 Mechanism of injury

The patient commonly presents after falling or injuring him or herself in an action that involves torsional stress. Such events might include a fall onto the buttocks or a slip whilst moving a heavy object (Daum, 1995).

The injury mechanism is attributed to the jamming or stressing of the joint at the end of its normal range of motion, either in the sagittal or horizontal plane (DonTigny, 1983; Vleeming et al. 1997; Moore 2000:518). Turek (1977) believes that this occurs when an irregular prominence of one articular surface becomes wedged upon a prominence of the apposed surface. As a result of this action the ligaments are taut and the reflex muscle spasm may be very intense and painful. This state can persist until the lesion is reduced

or normalised. He (Turek, 1977) further states that the irregular anatomical shape and design of the sacro-iliac joints pre-dispose it to jamming even though, the two articular surfaces must work in conjunction with each other to produce normal movement (Gatterman 1990:115).

2.4.3 The sacro-iliac syndrome

The sacro-iliac syndrome consists of a number of aspects. Just as in simple vertebral motion segment lesions, sacro-iliac syndrome can take the form of joint locking or joint locking with compensatory hypermobility in adjacent articulations (DonTigny, 1985, Daum, 1995). There may also be a sacro-iliac sprain with unilateral or bilateral hypermobility without joint locking (DonTigny, 1985; Daum, 199; Vleeming et al., 1997).

Acuteness of pain in a sacro-iliac joint is not always indicative of the site of causation. A fixated sacro-iliac joint may result in increased motion requirements on the opposite joint leading to pain and inflammation in that joint (DonTigny, 1985). Commonly, the most acute tenderness is that which is located in the sacro-iliac joint contralateral to the side that is jammed or fixated (Gatterman 1990:114).

The following synopsis outlines the signs and symptoms of sacro-iliac syndrome:

- Pain over the sacro-iliac joint (McCulloch and Transfeldt, 1997:180-181). The usual presentation of sacro-iliac pain consists chiefly of deep-seated pain in the distribution of the first and second sacral nerve roots with some localisation to the medial quadrant of the buttock and possible radiation toward the hips and posterior aspects of the thigh (Broadhurst and Bond, 1998).

- The sacro-iliac joint is locally tender to palpation (McCulloch and Transfeldt, 1997:180-181; Vleeming et al. 1997).

- The pain may be referred to the groin, trochanter and buttock (Hendler et al., 1995; McCulloch and Transfeldt, 1997:180-181). The usual presentation of sacro-iliac pain consists chiefly of deep-seated pain in the distribution of the first and second sacral nerve roots with some localisation to the medial quadrant of the buttock and possible radiation toward the hips and posterior aspects of the thigh (Broadhurst and Bond, 1998).

- The pain is aggravated by provocation tests e.g. Gaenslens and Patrick Faber tests (McCulloch and Transfeldt, 1997:180-181). These tests cause extreme rotational stress at the sacro-iliac joints, which in turn

may aggravate any pain as a result of a fixation at that joint (Gerard and Kleinfeld, 1993:404).

- There is clinical evidence of increased movement or asymmetry of the sacro-iliac joint (McCulloch and Transfeldt, 1997:180-181; Dreyfuss et al., 1994).

- There is no other apparent cause of the patient's sacro-iliac joint pain localisation (Hendler et al., 1995; McCulloch and Transfeldt, 1997:180-181). A variety of pathological processes such as inflammatory spondyloarthropathies, infection, malignancy and crystal deposition diseases can affect the sacro-iliac joint and cause pain (Dreyfuss et al., 1994).

Summary table 2.1:

Based on the preceding cited references:

	FACET SYNDROME	SACROILIAC SYNDROME
Symptoms	Hip and buttock pain	Pain over the sacro-iliac joint The usual presentation of sacro-iliac pain consists chiefly of deep-seated pain in the distribution of the first and second sacral nerve roots with some localisation to the medial quadrant of the buttock and possible radiation toward the hips and posterior aspects of the thigh
	Cramping leg pain, primarily above the knee.	Not found in sacroiliac syndrome.
	Low back stiffness, especially in the morning or with inactivity	Rarely in sacroiliac syndrome.
	Absence of neurological deficits.	Absence of neurological deficits.
Physical signs:	Local paralumbar tenderness, Localised pain in the lumbar spine is indicative of muscular strain or ligamentous sprain.	The sacro-iliac joint is locally tender to palpation Pain may be referred to the groin, trochanter and buttock. The usual presentation of sacro-iliac pain consists chiefly of deep-seated pain in the distribution of the first and second sacral nerve roots with some localisation to the medial quadrant of the buttock and possible radiation toward the hips and posterior aspects of the thigh.

	Pain on hyperextension of the lumbar spine. This is due to the compaction of the facet joints.	The pain is aggravated by provocation tests e.g. Gaenslen's and Patrick Faber tests. These tests cause extreme rotational stress at the sacro-iliac joints, which in turn may aggravate any pain as a result of a fixation at that joint.
	Absence of neurological deficits.	Absence of neurological deficits.
	Absence of root tension signs.	Absence of root tension signs.
	Hip, buttock or back pain on straight leg raising. Pain at approximately 90 degrees indicates lumbar spine involvement. Facet joint pain commonly refers to the proximal sacro-iliac joints and buttocks, when this test is applied.	There is clinical evidence of increased movement or asymmetry of the sacro-iliac joint.
		There is no other apparent cause of the patient's sacro-iliac joint pain localisation. A variety of pathological processes such as inflammatory spondyloarthropathies, infection, malignancy and crystal deposition diseases can affect the sacro-iliac joint and cause pain.

2.5 Orthopedic Testing

Orthopedic testing is designed to re-create the patient's complaint by introducing a mechanical disadvantage or external stress into the region being tested and is used to finalise a doctor's diagnostic procedure (Weiner and McCulloch, 2000; Gerard and Kleinfeld, 1993:preface; Walsh, 1998). Although, classically the patient's response to such testing is designated positive or negative, clinically the interpretation of the patient's response is not always clear-cut (Gerard and Kleinfeld, 1993:preface).

There are many tests available for lumbar and pelvic (sacro-iliac joints included) joints (Potter and Rothstein, 1985, Plaugher, 1993; Gerard and Kleinfeld, 1993:preface; Laslett and Williams, 1994; Vleeming et al., 1995; Daum, 1995; McCulloch and Transfeldt, 1997:180-181; Cibulka and Koldehoff, 1999) and as a result of this, Paton (2001) developed an orthopedic rating scale at Technikon Natal. Although unpublished, this scale sought to provide an instrument for assessing the clinical severity of low back pain, however it only included the assessment of mechanical sacroiliac joint pathology and not that of posterior facet syndrome.

The scale provided improved diagnostic standardization and homogeneity, as well as facilitating inferential statistics. Therefore it provided a means of measuring the progress made by patients once they commenced treatment for their low back pain (sacroiliac joint syndrome) (Paton, 2001).

Paton (2001) allocated the relevant scores to these tests based on several studies:

Laslett and Williams (1994) found that in their study to assess the inter-reliability of seven pain provocation tests for pain of sacro-iliac origin that Gaenlens' test was found to have substantial inter-therapist reliability (88.2% with a $p<0.001$ level of significance). In addition they also ascertained that the posterior shear test showed the greatest inter-examiner reliability of the tests assessed (94.1% with a $p<0.001$ level of significance) (Laslett and Williams, 1994).

However, Kirkaldy-Willis et al. (1992) stated that in their study they found that Yeomans test was the most reliable and specific test for the diagnosis of sacro-iliac syndrome.

And Broadhurst and Bond (1998) found that in their study when using three pain provocation tests, viz. the Patrick Faber, posterior shear and the resisted abduction test, that the resisted abduction test had 87% sensitivity and 100% specificity with respect to sacro-iliac syndrome.

However, in contrast to all of the abovementioned studies, Dreyfuss et al. (1995) concluded that no sacro-iliac test that was currently in use had any predictive value. Their (Dreyfuss et al., 1995) criteria of 90%

resolution of pain was very demanding though and possibly too exclusive for clinical purpose (Vleeming et al., 1997).

Thus we see that the results of research into the reliability of pain provocation tests are mixed (Vleeming et al., 1997).

Even though it (orthopedic rating scale) has been used in studies since its inception e.g. White, 2001, and Login, 2001, the reliability and validity of the scale has never been determined (specifically the allocation of scores to the tests).

Therefore the Composite Orthopedic Rating Scale has been developed by the researcher to test the orthopedic rating scale developed by Paton (2001).

2.6 The Composite Orthopedic Rating Scale (CORS):

The Composite Orthopedic Rating Scale contains the same tests and will be used to determine the reliability and validity of the orthopedic rating scale (Paton, 2001; White, 2001). The Composite Orthopedic Rating Scale scoring system is based on scientific and clinical evidence and subjective outcomes. Unlike the tool used by Paton (2001), the tests in the CORS are equally weighted in this assessment.

The tests in this scale were chosen, by Paton (2001) and White (2001), as current literature deemed them to be the most useful, although there were some who disagreed (Potter and Rothstein, 1985, Plaugher, 1993; Gerard and Kleinfeld, 1993:preface; Laslett and Williams, 1994; Vleeming et al., 1995; Daum, 1995; McCulloch and Transfeldt, 1997:180-181; Cibulka and Koldehoff, 1999; Paton, 2001). Research studies have provided conflicting reports as to which of the tests are the most suitable (Laslett and Williams 1994).

The following tests were chosen in this research to confirm the presence of posterior facet syndrome:

- Kemp's test (Schafer and Faye 1990:208-209).
- Facet joint challenge (Gatterman 1990:162).
- Hyperextension in the prone position (Gatterman 1990:162).
- Palpable muscle spasm with focal tenderness over the affected joint (Helbig and Casey 1988:61-64).

It is postulated that the kemp's, facet challenge and hyperextension tests will cause an approximation of the joint surfaces of an inflamed posterior facet joint and therefore yield a positive test (Plaugher, 1993:216-217; Adams and Dolan, 1995; Gerard and Kleinfield, 1993:340). The muscle spasm is thought to limit movement at the affected joint, thereby causing a degree of inflammation and henceforth, pain (Plaugher, 1993:216-217, McCulloch and Transfeldt, 1997:463; Seaman, 1997; Travell and Simons, 1999: 150-

151, 168-169 and 133-134).

The following orthopedic tests were performed to confirm the presence of sacro-iliac syndrome:

- The Posterior shear or "thigh thrust test" (Laslett and Williams 1994).
- Patrick Faber test (Magee 1992:343).
- Gaenslen's test (Magee 1992:319).
- Yeoman's test (Schafer and Faye 1990:271).

These tests are presumed to cause an increased amount of shear stress (and pain) on the relevant sacro-iliac joint and the ligaments spanning it by directing a force or pressure to the opposing sacral and iliac surfaces (Schafer and Faye 1990:271).

Current literature reveals that although these tests are deemed to be specific for their conditions, there is some discrepancy as to which individual test is the most accurate (Laslett and Willams 1994; Dreyfuss et al., 1994; Schafer and Faye 1990).

This problem is further compounded by anecdotal evidence that the tests for one of the conditions on occasion test positive for the other.

Thus it is necessary to establish the relevant validity, specificity and reliability of the tests to produce an effective rating scale.

The composite orthopedic rating scale consists of the tests that have shown to be useful, but no one test guarantees a diagnosis or rates severity consistently, thus, in order to make an informed decision regarding the clinical relevance of a particular test, its validity, reliability, specificity and sensitivity should ideally be known (Walsh, 1998).

CHAPTER

THREE

CHAPTER THREE: MATERIALS AND METHODS

3.1 Introduction

This chapter is concerned with the study design, primary and secondary data, the subjects, interventions and methodology used in this study. A brief explanation of the statistical procedures utilized in this study is also provided in this chapter.

The study design chosen was a methodological, prospective, single – blinded construct and concurrent validity and inter-examiner reliability study.

It involved one group of patients who were initially assessed by the researcher and, having met the inclusion criteria, were further examined by the same researcher and a blinded, independent examiner, both of which also applied the provocative tests contained in the Composite Orthopedic Rating Scale to these patients. No treatment was provided at this time and each patient included in the study was entitled to three free chiropractic treatments from a fifth year intern at the Durban Institute of Technology Chiropractic Day Clinic following their assessment.

3.2 Timeframe/ Outline of the study

Advertising for 2 weeks (pamphlets, newspaper advertisements and word of mouth)

↓

Initial telephonic/personal screening of interested participants by researcher (questions as to their age, language preference, medication usage and location of their pain and natural history of their complaint. The nature of the study was also explained to them at this point)

↓

120 participants who met criteria were included in the study sample group: → Participants who did not meet criteria were excluded from the study.

↓

They underwent a case history and physical assessment. The researcher then made a diagnosis based on this case history and clinical picture. Participants completed subjective measurements (NRS-101 and RM questionnaire). The researcher applied tests in CORS to participants to measure clinical severity.

↓

Independent, blinded examiner applied CORS to participants. The independent examiner was not privy to the researcher's diagnostic criteria, diagnosis or CORS results.

The patient consultations were completed in approximately 5 weeks.

↓

Participants were entitled to 3 free treatments from a 5th year intern following their initial consultation.

↓

Data collation and completion of documentation by researcher. Construct and concurrent validity and inter-examiner reliability were statistically calculated by researcher.

↓

Marking – 6-8 weeks

3.3 The data

The data consisted of primary and secondary data.

3.3.1 The primary data

Subjective measurements were obtained via the following documents that were completed by the participants prior to their examination:

- Roland-Morris Disability Questionnaire (Appendix C) for measuring spinal disability.
- Numerical Pain Rating Scale-101 (NRS-101)(Appendix D1 and D2) in order to measure pain intensity.

Clinical severity was determined through the application of the Composite Orthopedic Rating Scale with its unique scoring system (See appendix F).

3.3.2 The secondary data

This included information and material obtained from a variety of sources such as books, journal articles and the Internet.

3.4 The Sample

A sample size of 122 patients was selected by means of convenience sampling. During the year of 2002,the public was informed by means of the Durban Institute of Technology intra-net and word of mouth, as well as advertisements (Appendix E) placed around campus and pamphlet distributions that were done in various residential suburbs of the greater Durban area.

Prospective participants underwent a brief telephonic interview with the researcher to establish their eligibility for the study. A face-to-face interview occurred in some cases where the subject had already presented him or herself to the Chiropractic Day Clinic.

This interview included questions as to their:

- age,
- language preference,
- medication usage,
- location of their pain and
- the natural history of their complaint.

The nature of the study was also explained to them at this point.

At the initial consultation the participants were provided with a letter of introduction and an informed consent form. All

participants were required to read and sign the attached letter of information (Appendix A) and informed consent form (Appendix B) in order to protect their interests and ensure that they understood the research completely.
The participants also had an opportunity to ask any questions pertaining to the research.

The participants then underwent a medical case history examination from the examiner in order to arrive at a diagnosis.

The following criteria were used in this process:

SYMPTOMS

Sacro-iliac joint syndrome diagnostic criteria:

- Pain over the sacro-iliac joint (McCullach and Transfeldt, 1997: 180-181).

- The pain may be referred to the groin, trochanter and buttock (McCullach and Transfeldt, 1997: 180-181).

Posterior facet syndrome diagnostic criteria:

- Hip and buttock pain (Plaugher, 1993: 216-217).

- Cramping leg pain, primarily above the knee (Plaugher, 1993: 216-217).

- Low back stiffness, especially in the morning or with inactivity (Plaugher, 1993: 216-217).

Following this, the same examiner (researcher) performed a relevant physical examination and low back regional examination. Tests contained in the Composite Orthopedic Rating Scale were not applied to the patient at this time.

This process screened participants for compliance with the inclusion and exclusion criteria as outlined on page 40 in this chapter.

PHYSICAL SIGNS

Sacro-iliac joint syndrome diagnostic criteria:

- The sacro-iliac joint is locally tender to palpation (McCullach and Transfeldt, 1997: 180-181).

- The pain is aggravated by provocation tests e.g. Gaenslens and Patrick Faber tests (McCullach and Transfeldt, 1997: 180-181).

- There is clinical evidence of increased movement or asymmetry of the sacro-iliac joint (McCullach and Transfeldt, 1997: 180-181).

- There is no other apparent cause of the patient's Sacro-iliac joint pain localization i.e. infection (McCullach and Transfeldt, 1997:180-181).

Posterior facet syndrome diagnostic criteria:

- Absence of neurological deficits (Plaugher, 1993: 216-217).

- Local paralumbar tenderness (Plaugher, 1993: 216-217).

- Pain on hyperextension of the lumbar spine (Plaugher, 1993: 216-217).

- Absence of neurological deficits (Plaugher, 1993: 216-217).

- Absence of root tension signs (Plaugher, 1993: 216-217).

- Hip, buttock or back pain on straight leg raising (Plaugher, 1993: 216-217).

Thus, the diagnosis was made on the strength of the case history and clinical picture (Souza, 1998: 321).

3.5 Inclusion and exclusion criteria

Inclusion Criteria:

- Only participants between the ages of 18 and 59 years of age were included in this study to avoid the need for parental consent and the possibility of the development of fibrous ankylosis in the sacro-iliac joint after the sixth decade (Kirkaldy-Willis and Burton, 1992).

- Only participants diagnosed with mechanical low back pain, specifically posterior syndrome of the lumbar spine (Kirkaldy-Willis, 1992: 203) and sacro-iliac syndrome (Cox, 1998: 225-227) were included. This ruled out any organic or systemic pathology.

Exclusion Criteria:

- Any persons currently taking either anti-inflammatory or analgesic medication were required to cease this intake 48 hours prior to consultation. Haldeman (1992) explains that these drugs are able to provide pain relief and may thus confound the results obtained from this study.

- Any person found to demonstrate signs or symptoms of organic pathology were excluded from this study e.g. Kirkaldy-Willis and Burton (1992) state that an abdominal aortic aneurysm can produce chronic nagging low back pain.

- Anyone with clinical indications necessitating X-rays was excluded.

3.6 Ethical considerations

- Informed consent was obtained from the subject.
- The rights and welfare of the subject were protected.
- The subject participated voluntarily.
- The information was presented and explained to the subject in an understandable language.
- The subject was exposed to minimal risk.
- Strict confidentiality was maintained.
- There was no financial benefit to the researcher.
- The subject was free to withdraw from the study at any time.

3.7 Measurements

3.7.1 Subjective measurements

Subjective measurements were obtained from two questionnaires that the subjects completed in writing:

1. The Roland-Morris Disability Questionnaire (Appendix C) for measuring spinal disability and

2. The Numerical Pain Rating Scale-101 (NRS-101)(Appendix D1 and D2)(Jenson et. al.) in order to measure pain intensity.

3.7.1.1 Roland-Morris Disability Questionnaire

This is a commonly utilized instrument for measuring spinal disability. The Roland-Morris Questionnaire was derived from Bergner et al. (1980) Sickness Index Profile (SIP). The SIP is a lengthy questionnaire from which Roland and Morris extracted 24 items (from 136) relevant to low back pain in an attempt to improve its utility and practicality. Each item was qualified with the phrase "because of my back pain" to differentiate back pain disability from disability as a result of some other causative factor. It was determined that patients were generally able to make this distinction without much difficulty (Roland and Fairbank, 2000).

The statements in the questionnaire primarily focus on physical function or dysfunction with only one question pertaining to mood or emotion. However, some aspects of physical action such as lifting and twisting or turning are not included.

The limited focus of the questionnaire is both beneficial and negative in its content validity. The questions only address a small amount of problems that an individual with back pain may face and notably does not take social or psychological issues into contention. Obviously these are important and in situations where these measures are deemed necessary the questionnaire should be combined with specific measures of these functions. The limited focus of the RM questionnaire is, however, beneficial from the point of view that it covers certain domains thoroughly and makes the analysis of the scores easily comprehensible (Roland and Fairbank, 2000).

The reliability of this scale was determined although the validity was initially tested only by comparing it to a small number of clinical observations rather than to the entire SIP or smaller sections thereof.

Because the RM Questionnaire consists of only 24 questions it allows for an easier scoring system of 1 point per circled item giving a maximum total of 24. The Roland and Morris study was referred to as the best single study of assessing short-term outcomes of primary care subjects with low back pain (Von Korff and Saunders, 1996; Yeomans, S. G., 2000). Roland and Fairbank (2000) stated that the RM questionnaire was ideal for use in settings where patients had mild to moderate disability.

3.7.1.2 Numerical Pain Rating Scale-101

The Numerical Pain Rating Scale-101, a numerical pain intensity scale was used to measure the subjective response of subjects to treatment in terms of their perception of their pain's intensity. The questionnaire instructed the subjects to rate their pain at it's worst and at it's least on a numerical scale of zero to one hundred, with zero indicating no pain at all and one hundred implying pain as bad as it could be (Jensen et al. 1986).

Jensen et al. (1986) found that the 101-point rating scale was the most practical index in comparison with six other methods of measuring clinical pain intensity. Furthermore Bolton and Wilkinson (1998) stated that the results of their study of three well-established pain measures to detect changes in pain levels in patients following chiropractic treatment indicated that the NRS-101 was easy to use and as sensitive to the pain levels as the more complicated measures. However, they also discovered that in studies where pain was assessed on multiple occasions that there was a possibility of the patients memorizing the report using the NRS-101. This does not affect this study though, as the patients were only required to complete the NRS-101 once.

3.7.2 Objective measurements

Objective measurements were obtained from the scores produced from the application of the tests in the Composite Orthopedic Rating Scale. The tests were performed on the subjects by both the researcher and the blinded, independent examiner.

3.8 Composite Orthopedic Rating Scale

The composite orthopedic rating scale consists of tests that have shown to be useful, but no one test guarantees a diagnosis or rates severity consistently (Laslett and Williams, 1994).

Thus, in order to make an informed decision regarding the clinical relevance of a particular test, its validity, reliability, specificity and sensitivity should ideally be known - see Definitions (Walsh, 1998).

The orthopedic rating scale developed at the Technikon Natal by Paton in 2001 (unpublished in journal format) to provide an instrument for assessing the clinical severity of low back pain, could only be utilized to provide improved diagnostic standardization and homogeneity, as well as facilitating inferential statistics. This provided a means of measuring the progress made by subjects once they commenced treatment for their low back pain (Paton, 2001).

The Composite Orthopedic Rating Scale contained the same tests and was used to determine the reliability and validity of the orthopedic rating scale. The tests (Composite Orthopedic Rating Scale) were equally weighted in this assessment whereas in the original (orthopedic rating scale) scale certain tests were awarded a higher score if they provided a positive result upon application to the subjects. This could have lead to inaccurate diagnoses being made by examiners in the past.

In this study, once the diagnosis had been reached, the researcher applied the tests contained in the Composite Orthopedic Rating Scale in order to assess clinical severity. Thereafter a blinded, independent examiner performed the same tests on the subject, enabling inter-examiner reliability to be tested. The researcher and examiner each graded the test results on separate Composite Orthopedic Rating Scales, awarding a score of one point for a mild subject response, two for moderate and three for severe. A score of 2 points was awarded for localised pain i.e. a true positive for the test and 1 point for non-localised pain.

3.8.1 Orthopedic tests

The orthopedic tests completed in this research where performed as follows:

1. Kemp's test:

   The subject is seated and supported by the examiner, who reaches around the subject's shoulders and upper chest from behind. The subject is then directed to lean forward to one side and then around to eventually bend obliquely backward by placing the palm on the buttock and sliding it down the back of the thigh and leg as far as possible. If this compression causes or aggravates local pain in the lumbar spine then the test is positive (Schafer and Faye 1990:208-209).

2. Facet joint challenge:

   The subject is placed in a prone position. The examiner then "springs" or stresses the individual joints by exerting a posterior to anterior force to each of the spinous processes. The subject is instructed to indicate when there is an increase in pain in the individual area being tested. This constitutes a positive result (Gatterman 1990:162).

3. Prone hyperextension:

The subject is placed in the prone position. The subject is then requested to perform a "press-up" with their pelvis still maintained on the table. Reproduction of the pain would constitute a positive result (Gatterman 1990:162).

4. Muscle spasm with focal tenderness over the affected joint:

The subject is positioned prone. Palpation over the affected facet revealing muscle spasm and eliciting pain and localised tenderness would be a positive result (Helbig and Casey 1988:61-64).

5. Posterior shear or "thigh thrust" test:

The subject is positioned supine. The examiner is positioned on the right side for a suspected left sacro-iliac syndrome. The left knee and hip is flexed and slightly adducted. The examiner then places their right hand under the left sacro-iliac joint while exerting an anterior to posterior shearing force downward on the left knee through the femur. The examiner uses their opposite hand to feel for excessive joint motion during this process. A positive result would be pain over the region of the left sacro-iliac joint during this test (Laslett and Williams 1994).

6. Gaenslen's test:

The subject is positioned supine. The subject's knee and hip on one side are flexed while the examiner then applies pressure over the opposite side thigh to hyperextend the hip on that side (Magee 1992:319).

7. Patrick Faber test:

The subject is positioned supine. The examiner places the subject's left ankle above their right knee. The examiner then places his right hand over the medial aspect of the subject's left knee and stresses it downwards while at the same time placing his left hand over their right iliac crest. A positive result would be pain in the region of the left sacro-iliac joint (Magee 1992:343).

8. Yeoman's extension test:

The subject is positioned prone. The examiner places one hand under the left thigh above the knee on the affected side in order to extend the left hip. The examiner's other hand presses downward over the crest of the left ilium to stabilise the pelvis on the examining table. A positive result would be pain over the left joint during the test (Schafer and Faye 1990:271).

The tests were performed bilaterally and negative results were scored as zero when the subject reported "no pain".

3.9 Interventions

The participants were entitled to 3 free chiropractic treatments from a fifth year intern at the Durban Institute of Technology Chiropractic Day Clinic following their assessment. The interns and participants determined the times and dates of these treatments.

3.10 Validity and reliability

Validity pertains to the extent to which an instrument (Composite Orthopedic Rating Scale) is able to measure that which it is intended to measure and places emphasis on the objectives of the tests and the ability to derive inferences from these measures or test scores.

Thus, it is apparent that validity addresses what one is able to do with a study's test results (Portney and Watkins, 1993: 69).

Construct validity was established to determine the ability and degree to which the measurement instrument reflected its' theoretical components and concurrent validity was established when two measures were taken at relatively the same time (Portney and Watkins, 1993: 71-79).

Validity implies that a measurement instrument exhibits a degree of accuracy or success and thus it can be derived that a valid instrument or test is reliable (Portney and Watkins, 1993: 69).

Reliability is the extent to which a measurement is consistent. Thus by testing inter-examiner reliability the consistency of the factors in the Composite Orthopedic Rating Scale was also measured (Portney and Watkins, 1993: 69-70).

3.11 Statistical analysis of the data

Statistical Analysis was conducted using the SPSS (version 11.5) software suite. This Statistical software program is manufactured by SPSS Inc, 444N. Michigan Avenue, Chicago, Illinois, USA.

Various Descriptive and Inferential Statistical techniques were used:

The Descriptive procedures used were various tables and graphs and a few summary statistics including but not limited to means, proportions and percentages.

Hypothesis testing and confidence intervals were two of the inferential procedures used. Due to the large sample sizes, parametric tests were used throughout the study. All Hypothesis tests set our type 1 error at 5%, or mentioned differently as $\alpha = 0.05$. If our p value, as reported, was less than 0.05 was declared a significant result and the Null Hypothesis was rejected.

3.11.1 Parametric Tests.

In Test 1 both the Researcher's and the Doctor's results of the eight location tests for both Posterior Facet and SI syndrome were grouped and two sets of Binomial tests were run.

The first was to see if the proportion of failures within each test was significantly different to 0.5. This would, in turn, imply the significance of the relationship between the proportion of successes versus the proportion of failures within each test.

Secondly, it was performed to see if any of the eight tests was significantly better than any of the others. This procedure lent to testing for the validity of the tests.

TEST 1a THE BINOMIAL TEST (USING ONE PROPORTION)

The structure of this test is outlined below:

H_o: $\pi_f = 0.5$

H_1: $\pi_f \neq 0.5$

Where π_f equals the true population proportion of failures.

$\alpha = 0.05$

Note: α = probability of rejecting H_o when is true (Type 1: error)

The test is two tailed.

The test statistic is:

$$z = \frac{p_f - \pi_{fo}}{\sqrt{\pi_{fo}(1 - \pi_{fo})/n}}$$

We get the tabulated value from Tables = Z.

Note: The p – value = The probability of H_o being true.

If the p-value is $< \alpha = 0.05$ we reject H_o.

TEST 1b THE BINOMIAL TEST (USING TWO PROPORTIONS)

The structure of this test is outlined below:

H_o: $\pi_1 = \pi_2$

H_1: $\pi_1 \neq \pi_2$

Where $\pi_1 = \pi_2$ equals the population proportion of successes from population 1 and population 2 respectively.

$\alpha = 0.05$

Note: α = probability of rejecting H_o when is true (Type 1: error).

The test is two tailed.

The test statistic is:

$$z = \frac{(p_1 - p_2) - (\pi_1 - \pi_2)}{\sqrt{\pi(1-\pi)(1/n_1 + 1/n_2)}}$$

where $\pi = (x_1 + x_2)/(n_1 + n_2)$

We get the tabulated value from Tables = Z.

Note: The p – value = The probability of H_o being true.

If the p-value is $< \alpha = 0.05$ we reject H_o. However, it should be noted that for purposes of simplicity of calculation that a confidence interval for the difference between both population proportions was done.

This test is very similar to the Hypothesis test in conclusion yielding the same p-value. However, in output, it looks a bit different.

Test 2 tested for inter- group reliability, running each location test for both measuring instruments, namely the researcher and the doctor against each other. This test was run in two different ways. Firstly, it was tested to ascertain if one of the measuring instruments had a significantly

different success rate. For this test a Binomial Distribution was used and tested for the significant difference between two population proportions.

TEST 2 THE BINOMIAL TEST (USING TWO PROPORTIONS)

The structure of this test is outlined below:

H_o: $\pi_1 = \pi_2$

H_1: $\pi_1 \neq \pi_2$

Where $\pi_1 = \pi_2$ equals the population proportion of successes from population 1 and population 2 respectively.

$\alpha = 0.05$

Note: α = probability of rejecting H_o when is true (Type 1: error).

The test is two tailed.

The test statistic is:

$$z = \frac{(p_1 - p_2) - (\pi_1 - \pi_2)}{\sqrt{\pi(1-\pi)(1/n_1 + 1/n_2)}}$$

where $\pi = (x_1 + x_2)/(n_1 + n_2)$

One gets the tabulated value from Tables = Z.

Note: The p – value = The probability of H_o being true.

If the p-value is $< \alpha = 0.05$ we reject H_o

However, it should be noted for purposes of simplicity of calculation that a confidence interval for the difference between both population proportions was done. This test is very similar to the Hypothesis test in conclusion yielding the same p-value. However, in output, it looks a bit different.

Secondly, it was examined whether both measuring instruments, namely the researcher and the doctor, produced significantly different results on each measure for all the location tests and this was again followed up for all the severity tests in Test 3. Again this test measures the reliability of all the tests concerned.

TEST 3 THE CHI SQUARE TEST

H_o: There is no association between both measuring instruments.

H_1: There is an association between both measuring instruments.

$\alpha = 0.05$

Note: α = probability of rejecting H_o when is true (Type 1: error).

The calculation of the test statistic is:

$$\chi^2 = \Sigma((O - E)^2)/E$$

where the observed frequencies are equal to (row total × column total)/ grand total.

One gets the tabulated value from Tables = χ^2.

Note: The p – value = The probability of H_o being true.

If the p-value is < α = 0.05 we reject H_o

Test 4 examined for similarity of both subjective measures of severity using the Pearson's Product Moment Correlation Coefficient on the median of the worst and least pain thresholds versus a "Modified Roland-Morris score".

This modified score is obtained by dividing the actual score by 24 and then multiplying the result by 100. Inter-instrument reliability of both subjective measures is tested here.

TEST 4 PRODUCT MOMENT CORRELATION COEFFICIENT

This test calculates the relationship between two sets of continuous variables. It calculates both the correlation coefficient and performs a hypothesis test to see if the correlation coefficient is significantly different from zero (i.e. that there is no relationship)

For the above test the population correlation coefficient is identified by ρ and the sample correlation coefficient is identified by γ.

The hypothesis test takes the following structure:

H_o: $\rho = 0$

H_1: $\rho \neq 0$

$\alpha = 0.05$

Note: α = probability of rejecting H_o when is true (Type 1: error).

The calculated test statistic:

If the p-value is $< \alpha = 0.05$ we reject H_o.

In test 5 the Roland-Morris Score was tested individually against all eight severity tests conducted by the researcher, thus testing for inter-instrument reliability between both a subjective and objective measuring instrument. Spearman's Rank Order Correlation coefficient was used to analyse this Data.

TEST 5 SPEARMANS RANK ORDER CORRELATION COEFFICIENT

This non-parametric test calculates the relationship between two sets of ranked variables. It calculates both the correlation coefficient and performs a hypothesis test to see if the correlation coefficient is significantly different form zero (i.e. that there is no relationship).

For the above test the population correlation coefficient is identified by ρ and the sample correlation coefficient is identified by γ.

The hypothesis test takes the following structure:

H_o: $\rho = 0$

H_1: $\rho \neq 0$

$\alpha = 0.05$

Note: α = probability of rejecting H_o when is true (Type 1: error)

The calculated test statistic:

If the p-value is $< \alpha = 0.05$ we reject H_o.

Test 6 examined whether the various Location Tests proved to be more accurate or (valid) for different levels of severity. Various Binomial Tests were conducted here.

TEST 6 THE BINOMIAL TEST (USING ONE PROPORTION)

The structure of this test is outlined below:

H_o: π_f = 0.5

H_1: $\pi_f \neq 0.5$

Where π_f equals the true population proportion of failures.

$\alpha = 0.05$

Note: α = probability of rejecting H_o when is true (Type 1: error).

The test is two tailed.

The test statistic is:

$$z = \frac{p_f - \pi_{fo}}{\sqrt{\pi_{fo}(1 - \pi_{fo})/n}}$$

The tabulated value from Tables = Z.

Note: The p – value = The probability of H_o being true.

If the p-value is $< \alpha = 0.05$ we reject H_o.

Test 7 ran a few descriptives statistics on the diagnosis of the patient. These descriptives were run for the full sample size and by both gender and age.

TEST 7 DESCRIPTIVE STATISTICS

IMPORTANT POINTS OF HYPOTHESIS TESTING

Confidence intervals are closely connected to another useful statistical decision-making technique called hypothesis testing. Hypotheses are just statements about parameters of probability distributions. The objective is to make decisions about these statements. Often these decisions can be made by examining the range of reasonable values for a parameter from a confidence interval.

CHAPTER

FOUR

CHAPTER FOUR: THE RESULTS

4.1 Introduction

This chapter is concerned with the demographic data of all the participants included in this study. It also contains a detailed statistical analysis of the subjective and objective data collated throughout the duration of the study.

Subjective measurements were obtained from the Roland-Morris Disability Questionnaire (Appendix C) for measuring spinal disability and the Numerical Pain Rating Scale-101 (NRS-101)(Appendix D1 and D2)(Jenson et. al) in order to measure pain intensity. Objective data was derived from the results of the separate Composite Orthopaedic Rating Scales completed by the researcher and independent, blinded examiner for each participant in the study.

4.2 Index

In order to simplify the statistical data the following abbreviations have been used in the statistical data analysis:

4.2.1 Statistical analysis of the data

4.2.1.1 Sample size

There was only one group of 122 patients.

4.2.1.2 Abbreviations

Diagnoses:

FL: Lumbar facet syndrome
SIL/SIS: Sacro-iliac syndrome

It should be noted that a prefix of L (researcher's initial) or D (doctor/independent, blinded examiner) refers to the test results of each respective examiner.

Orthopaedic tests:

Kemp's: Kemp's test
Facet: Facet joint challenge test
Hype: Hyperextension in prone position
MNS: Palpable muscle spasm with focal tenderness over affected joint

PS: Posterior shear test
PF: Patrick Faber test

G: Gaenslen's test

Y: Yeoman's test

Statistics:

p-value: observed level of significance

Ho: Null hypothesis

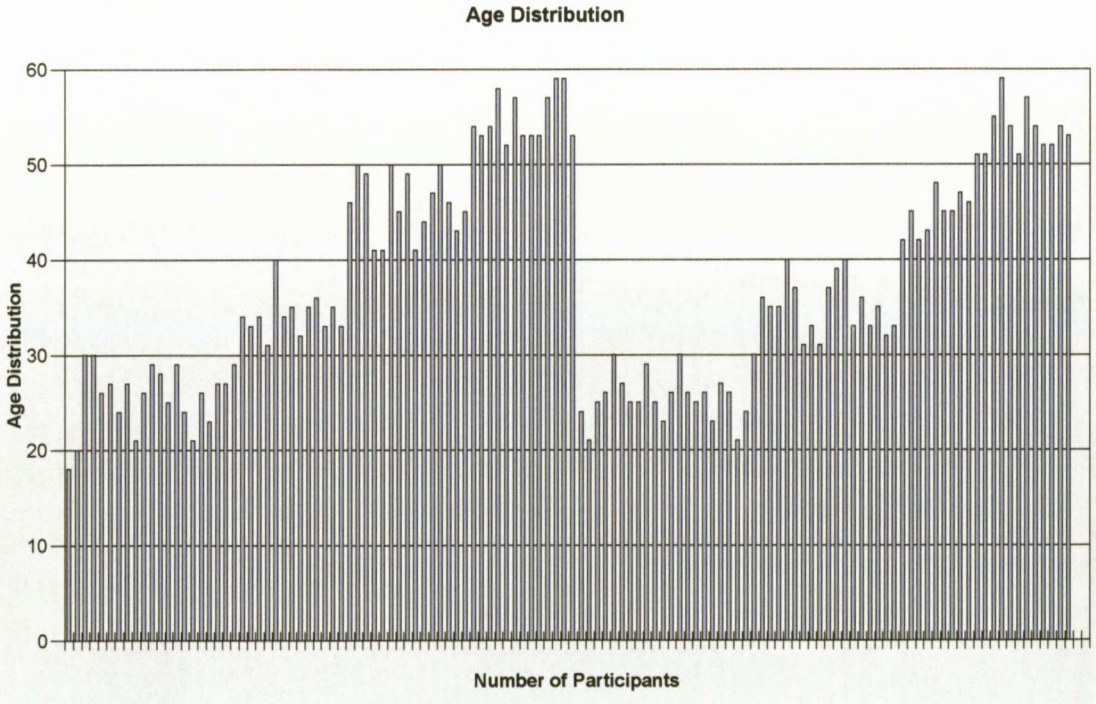
H1: Alternate hypothesis

α: level of significance

4.3 Demographic data

4.3.1Age distribution

Fig. 4.3.1



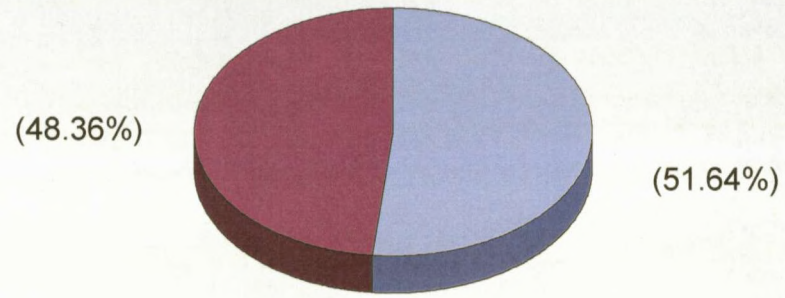
All charts from this point indicate:

Purple : Females / Sacro-iliac syndrome

Maroon : Males / Facet syndrome

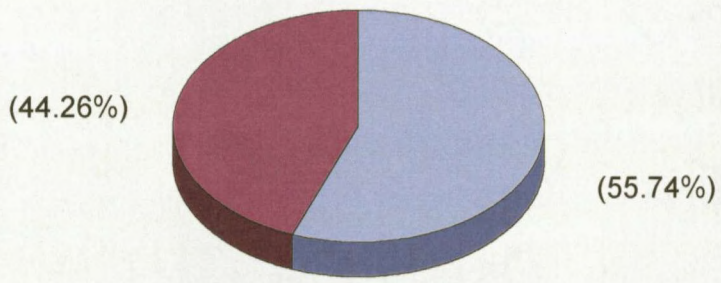
4.3.2Gender distribution

Fig 4.3.2



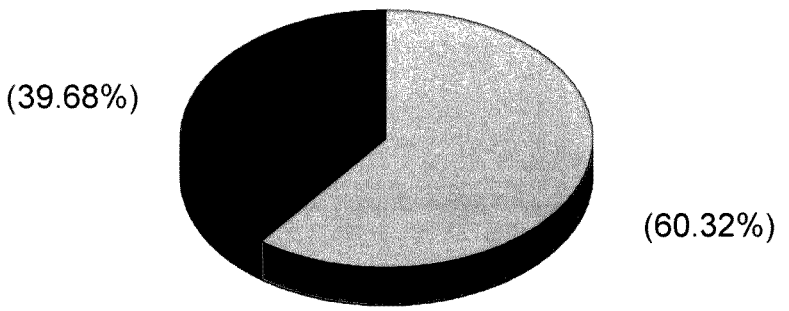
4.3.3 Diagnoses distribution

Fig 4.3.3



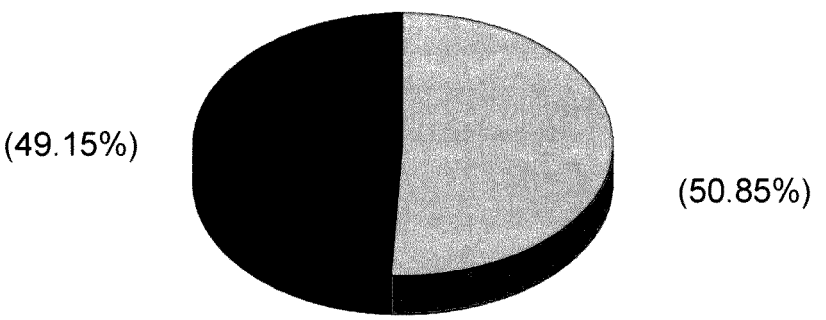
4.3.3.1 Distribution of diagnoses in female participants

Fig 4.3.3.1



4.3.3.2 Distribution of diagnoses in male participants

Fig 4.3.3.2



4.4 Testing

In Test 1 both the Researcher's and the Doctor's (blinded, independent examiner) results of the eight location tests for both FACET and SI syndrome were grouped and two sets of Binomial tests were run. Firstly, this was done to ascertain if the proportion of failures within each test was significantly different to 0.5. This, in turn, would determine the significance of the relationship between the proportion of successes versus the proportion of failures within each test.
Secondly, it was done to see if any of the eight tests was significantly better than any of the others. This procedure lent to testing for the validity of the tests.

TEST 1a THE BINOMIAL TEST (USING ONE PROPORTION)

Table 4.4.1 Results of Binomial Tests of all Participants

Binomial Test

		Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
FLKEMPS	Group 1	<= 1	155	.64	.50	.000[a]
	Group 2	> 1	89	.36		
	Total		244	1.00		
FLFACET	Group 1	<= 1	128	.52	.50	.481[a]
	Group 2	> 1	116	.48		
	Total		244	1.00		
FLHYPE	Group 1	<= 1	167	.68	.50	.000[a]
	Group 2	> 1	77	.32		
	Total		244	1.00		
FLMNS	Group 1	<= 1	126	.52	.50	.654[a]
	Group 2	> 1	118	.48		
	Total		244	1.00		
SILPS	Group 1	<= 1	184	.75	.50	.000[a]
	Group 2	> 1	60	.25		
	Total		244	1.00		
SILPF	Group 1	<= 1	191	.78	.50	.000[a]
	Group 2	> 1	53	.22		
	Total		244	1.00		
SILG	Group 1	<= 1	187	.77	.50	.000[a]
	Group 2	> 1	57	.23		
	Total		244	1.00		
SILY	Group 1	<= 1	118	.48	.50	.654[a]
	Group 2	> 1	126	.52		
	Total		244	1.00		

a. Based on Z Approximation.

TEST 1b THE BINOMIAL TEST (USING TWO PROPORTIONS)

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable              X        N   Sample p
FLKEMPS              89      244   0.364754
FLFACET             116      244   0.475410

Estimate for p(FLKEMPS) - p(FLFACET):   -0.110656
```

95% CI for p(FLKEMPS) - p(FLFACET): (-0.197686, -0.0236250)
Test for p(FLKEMPS) - p(FLFACET) = 0 (vs not = 0): Z = -2.49 P-Value = 0.013

Test and Confidence Interval for Two Proportions

Success = 2

Variable	X	N	Sample p
FLKEMPS	89	244	0.364754
FLHYPE	77	244	0.315574

Estimate for p(FLKEMPS) - p(FLHYPE): 0.0491803
95% CI for p(FLKEMPS) - p(FLHYPE): (-0.0347743, 0.133135)
Test for p(FLKEMPS) - p(FLHYPE) = 0 (vs not = 0): Z = 1.15 P-Value = 0.251

Test and Confidence Interval for Two Proportions

Success = 2

Variable	X	N	Sample p
FLKEMPS	89	244	0.364754
FLMNS	118	244	0.483607

Estimate for p(FLKEMPS) - p(FLMNS): -0.118852
95% CI for p(FLKEMPS) - p(FLMNS): (-0.205914, -0.0317914)
Test for p(FLKEMPS) - p(FLMNS) = 0 (vs not = 0): Z = -2.68 P-Value = 0.007

Test and Confidence Interval for Two Proportions

Success = 2

Variable	X	N	Sample p
FLKEMPS	89	244	0.364754
SILPS	60	244	0.245902

Estimate for p(FLKEMPS) - p(SILPS): 0.118852
95% CI for p(FLKEMPS) - p(SILPS): (0.0378132, 0.199892)
Test for p(FLKEMPS) - p(SILPS) = 0 (vs not = 0): Z = 2.87 P-Value = 0.004

Test and Confidence Interval for Two Proportions

Success = 2

Variable	X	N	Sample p
FLKEMPS	89	244	0.364754
SILPF	53	244	0.217213

Estimate for p(FLKEMPS) - p(SILPF): 0.147541
95% CI for p(FLKEMPS) - p(SILPF): (0.0680119, 0.227070)

```
Test for p(FLKEMPS) - p(SILPF) = 0 (vs not = 0):  Z = 3.64
P-Value = 0.000
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable            X       N   Sample p
FLKEMPS            89     244   0.364754
SILG               57     244   0.233607

Estimate for p(FLKEMPS) - p(SILG):  0.131148
95% CI for p(FLKEMPS) - p(SILG):  (0.0507323, 0.211563)
Test for p(FLKEMPS) - p(SILG) = 0 (vs not = 0):  Z = 3.20
P-Value = 0.001
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable            X       N   Sample p
FLKEMPS            89     244   0.364754
SILY              126     244   0.516393

Estimate for p(FLKEMPS) - p(SILY):  -0.151639
95% CI for p(FLKEMPS) - p(SILY):  (-0.238700, -0.0645782)
Test for p(FLKEMPS) - p(SILY) = 0 (vs not = 0):  Z = -3.41
P-Value = 0.001
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable            X       N   Sample p
FLFACET           116     244   0.475410
FLHYPE             77     244   0.315574

Estimate for p(FLFACET) - p(FLHYPE):  0.159836
95% CI for p(FLFACET) - p(FLHYPE):  (0.0742392, 0.245433)
Test for p(FLFACET) - p(FLHYPE) = 0 (vs not = 0):  Z =
3.66  P-Value = 0.000
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable            X       N   Sample p
FLFACET           116     244   0.475410
FLMNS             118     244   0.483607

Estimate for p(FLFACET) - p(FLMNS):  -0.00819672
95% CI for p(FLFACET) - p(FLMNS):  (-0.0968426, 0.0804492)
Test for p(FLFACET) - p(FLMNS) = 0 (vs not = 0):  Z = -
0.18  P-Value = 0.856
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
FLFACET          116     244   0.475410
SILPS             60     244   0.245902

Estimate for p(FLFACET) - p(SILPS):  0.229508
95% CI for p(FLFACET) - p(SILPS):  (0.146769, 0.312248)
Test for p(FLFACET) - p(SILPS) = 0 (vs not = 0):  Z = 5.44
P-Value = 0.000
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
FLFACET          116     244   0.475410
SILPF             53     244   0.217213

Estimate for p(FLFACET) - p(SILPF):  0.258197
95% CI for p(FLFACET) - p(SILPF):  (0.176936, 0.339458)
Test for p(FLFACET) - p(SILPF) = 0 (vs not = 0):  Z = 6.23
P-Value = 0.000
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
FLFACET          116     244   0.475410
SILG              57     244   0.233607

Estimate for p(FLFACET) - p(SILG):  0.241803
95% CI for p(FLFACET) - p(SILG):  (0.159675, 0.323932)
Test for p(FLFACET) - p(SILG) = 0 (vs not = 0):  Z = 5.77
P-Value = 0.000
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
FLFACET          116     244   0.475410
SILY             126     244   0.516393

Estimate for p(FLFACET) - p(SILY):  -0.0409836
95% CI for p(FLFACET) - p(SILY):  (-0.129629, 0.0476623)
Test for p(FLFACET) - p(SILY) = 0 (vs not = 0):  Z = -0.91
P-Value = 0.365
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
FLHYPE            77     244   0.315574
FLMNS            118     244   0.483607

Estimate for p(FLHYPE) - p(FLMNS):  -0.168033
95% CI for p(FLHYPE) - p(FLMNS):  (-0.253661, -0.0824050)
Test for p(FLHYPE) - p(FLMNS) = 0 (vs not = 0):  Z = -3.85
P-Value = 0.000
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
FLHYPE            77     244   0.315574
SILPS             60     244   0.245902

Estimate for p(FLHYPE) - p(SILPS):  0.0696721
95% CI for p(FLHYPE) - p(SILPS):  (-0.00982532, 0.149170)
Test for p(FLHYPE) - p(SILPS) = 0 (vs not = 0):  Z = 1.72
P-Value = 0.086
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
FLHYPE            77     244   0.315574
SILPF             53     244   0.217213

Estimate for p(FLHYPE) - p(SILPF):  0.0983607
95% CI for p(FLHYPE) - p(SILPF):  (0.0204033, 0.176318)
Test for p(FLHYPE) - p(SILPF) = 0 (vs not = 0):  Z = 2.47
P-Value = 0.013
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
FLHYPE            77     244   0.315574
SILG              57     244   0.233607

Estimate for p(FLHYPE) - p(SILG):  0.0819672
95% CI for p(FLHYPE) - p(SILG):  (0.00310598, 0.160828)
Test for p(FLHYPE) - p(SILG) = 0 (vs not = 0):  Z = 2.04
P-Value = 0.042
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
```

```
FLHYPE            77     244   0.315574
SILY             126     244   0.516393

Estimate for p(FLHYPE) - p(SILY):  -0.200820
95% CI for p(FLHYPE) - p(SILY):  (-0.286447, -0.115192)
Test for p(FLHYPE) - p(SILY) = 0 (vs not = 0):  Z = -4.60
P-Value = 0.000
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
FLMNS            118     244   0.483607
SILPS             60     244   0.245902

Estimate for p(FLMNS) - p(SILPS):  0.237705
95% CI for p(FLMNS) - p(SILPS):  (0.154934, 0.320476)
Test for p(FLMNS) - p(SILPS) = 0 (vs not = 0):  Z = 5.63
P-Value = 0.000
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
FLMNS            118     244   0.483607
SILPF             53     244   0.217213

Estimate for p(FLMNS) - p(SILPF):  0.266393
95% CI for p(FLMNS) - p(SILPF):  (0.185100, 0.347687)
Test for p(FLMNS) - p(SILPF) = 0 (vs not = 0):  Z = 6.42
P-Value = 0.000
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
FLMNS            118     244   0.483607
SILG              57     244   0.233607

Estimate for p(FLMNS) - p(SILG):  0.25
95% CI for p(FLMNS) - p(SILG):  (0.167839, 0.332161)
Test for p(FLMNS) - p(SILG) = 0 (vs not = 0):  Z = 5.96
P-Value = 0.000
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
FLMNS            118     244   0.483607
SILY             126     244   0.516393

Estimate for p(FLMNS) - p(SILY):  -0.0327869
95% CI for p(FLMNS) - p(SILY):  (-0.121463, 0.0558888)
```

```
Test for p(FLMNS) - p(SILY) = 0 (vs not = 0):  Z = -0.72
P-Value = 0.469
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N  Sample p
SILPS             60     244  0.245902
SILPF             53     244  0.217213

Estimate for p(SILPS) - p(SILPF):  0.0286885
95% CI for p(SILPS) - p(SILPF):  (-0.0461202, 0.103497)
Test for p(SILPS) - p(SILPF) = 0 (vs not = 0):  Z = 0.75
P-Value = 0.452
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N  Sample p
SILPS             60     244  0.245902
SILG              57     244  0.233607

Estimate for p(SILPS) - p(SILG):  0.0122951
95% CI for p(SILPS) - p(SILG):  (-0.0634550, 0.0880452)
Test for p(SILPS) - p(SILG) = 0 (vs not = 0):  Z = 0.32
P-Value = 0.750
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N  Sample p
SILPS             60     244  0.245902
SILY             126     244  0.516393

Estimate for p(SILPS) - p(SILY):  -0.270492
95% CI for p(SILPS) - p(SILY):  (-0.353263, -0.187720)
Test for p(SILPS) - p(SILY) = 0 (vs not = 0):  Z = -6.41
P-Value = 0.000
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N  Sample p
SILPF             53     244  0.217213
SILG              57     244  0.233607

Estimate for p(SILPF) - p(SILG):  -0.0163934
95% CI for p(SILPF) - p(SILG):  (-0.0905257, 0.0577388)
Test for p(SILPF) - p(SILG) = 0 (vs not = 0):  Z = -0.43
P-Value = 0.665
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable            X       N   Sample p
SILPF              53     244   0.217213
SILY              126     244   0.516393

Estimate for p(SILPF) - p(SILY):  -0.299180
95% CI for p(SILPF) - p(SILY):  (-0.380474, -0.217887)
Test for p(SILPF) - p(SILY) = 0 (vs not = 0):  Z = -7.21
P-Value = 0.000
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable            X       N   Sample p
SILG               57     244   0.233607
SILY              126     244   0.516393

Estimate for p(SILG) - p(SILY):  -0.282787
95% CI for p(SILG) - p(SILY):  (-0.364947, -0.200626)
Test for p(SILG) - p(SILY) = 0 (vs not = 0):  Z = -6.75
P-Value = 0.000
```

Test 2 determined Inter- Group reliability by running each location test for both measuring instruments, namely the Researcher and the Doctor (independent, blinded examiner), up against each other. This test was run in two different ways. Firstly, it tested if the one of the measuring instruments had a significantly different success rate in comparison to the other.

In order to achieve this a Binomial Distribution was utilised. This tested for the significant difference between two population proportions.

TEST 2 THE BINOMIAL TEST (USING TWO PROPORTIONS)

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable            X       N   Sample p
LFLKEMPS           52     122   0.426230
DFLKEMPS           37     122   0.303279

Estimate for p(LFLKEMPS) - p(DFLKEMPS):  0.122951
95% CI for p(LFLKEMPS) - p(DFLKEMPS):  (0.00314352,
0.242758)
Test for p(LFLKEMPS) - p(DFLKEMPS) = 0 (vs not = 0):  Z =
2.01  P-Value = 0.044
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable            X       N   Sample p
LFLFACET           64     122   0.524590
DFLFACET           52     122   0.426230

Estimate for p(LFLFACET) - p(DFLFACET):  0.0983607
95% CI for p(LFLFACET) - p(DFLFACET):  (-0.0263522,
0.223073)
Test for p(LFLFACET) - p(DFLFACET) = 0 (vs not = 0):  Z =
1.55  P-Value = 0.122
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable            X       N   Sample p
LFLHYPE            41     122   0.336066
DFLHYPE            36     122   0.295082

Estimate for p(LFLHYPE) - p(DFLHYPE):  0.0409836
95% CI for p(LFLHYPE) - p(DFLHYPE):  (-0.0755294,
0.157497)
```

```
Test for p(LFLHYPE) - p(DFLHYPE) = 0 (vs not = 0):  Z =
0.69  P-Value = 0.491
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
LFLMNS            68     122   0.557377
DFLMNS            50     122   0.409836

Estimate for p(LFLMNS) - p(DFLMNS):  0.147541
95% CI for p(LFLMNS) - p(DFLMNS):  (0.0235085, 0.271573)
Test for p(LFLMNS) - p(DFLMNS) = 0 (vs not = 0):  Z = 2.33
P-Value = 0.020
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
LFLMNS            68     122   0.557377
DFLMNS            50     122   0.409836

Estimate for p(LFLMNS) - p(DFLMNS):  0.147541
95% CI for p(LFLMNS) - p(DFLMNS):  (0.0235085, 0.271573)
Test for p(LFLMNS) - p(DFLMNS) = 0 (vs not = 0):  Z = 2.33
P-Value = 0.020
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
LSILPS            34     122   0.278689
DSILPS            26     122   0.213115

Estimate for p(LSILPS) - p(DSILPS):  0.0655738
95% CI for p(LSILPS) - p(DSILPS):  (-0.0421758, 0.173323)
Test for p(LSILPS) - p(DSILPS) = 0 (vs not = 0):  Z = 1.19
P-Value = 0.233
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable           X       N   Sample p
LSILPF            28     122   0.229508
DSILPF            25     122   0.204918

Estimate for p(LSILPF) - p(DSILPF):  0.0245902
95% CI for p(LSILPF) - p(DSILPF):  (-0.0788418, 0.128022)
Test for p(LSILPF) - p(DSILPF) = 0 (vs not = 0):  Z = 0.47
P-Value = 0.641
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable            X       N   Sample p
LSILG              24     122   0.196721
DSILG              33     122   0.270492

Estimate for p(LSILG) - p(DSILG):  -0.0737705
95% CI for p(LSILG) - p(DSILG):  (-0.179548, 0.0320075)
Test for p(LSILG) - p(DSILG) = 0 (vs not = 0):  Z = -1.37
P-Value = 0.172
```

Test and Confidence Interval for Two Proportions

```
Success = 2

Variable            X       N   Sample p
LSILY              69     122   0.565574
DSILY              57     122   0.467213

Estimate for p(LSILY) - p(DSILY):  0.0983607
95% CI for p(LSILY) - p(DSILY):  (-0.0264369, 0.223158)
Test for p(LSILY) - p(DSILY) = 0 (vs not = 0):  Z = 1.54
P-Value = 0.122
```

Secondly, it was determined whether both measuring instruments, namely the Researcher and the Doctor (independent, blinded examiner) produced significantly different results on each measure for all the location tests and this was again followed up for all the severity tests in Test 3. Once again, this test measures the reliability of all tests concerned.

TEST 3 THE CHI SQUARE TEST

Table 4.4.2 Cross-tabulation of results for the 2 variables listed below

LFSKEMPS * DFSKEMPS Crosstabulation

Count

	DFSKEMPS				Total
	.00	1.00	2.00	3.00	

LFSKEMPS	.00	27	6	4	1	38
	1.00	11	27	5	1	44
	2.00	4	5	15	5	29
	3.00	2	2	2	5	11
Total		44	40	26	12	122

Table 4.4.3 Results of Chi-Square tests for the variables above

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	73.639	9	.000
Likelihood Ratio	63.804	9	.000
Linear-by-Linear Association	35.310	1	.000
N of Valid Cases	122		

a 7 cells (43.8%) have expected count less than 5. The minimum expected count is 1.08.

Table 4.4.4 Cross-tabulation of results for the 2 variables listed below

LFSFACET * DFSFACET Cross-tabulation

Count

		DFSFACET				Total
		.00	1.00	2.00	3.00	
		.00	1.00	2.00	3.00	
LFSFACET	.00	16	6	5		27
LFSFACET	.00	16	6	5		27
	1.00	6	15	7	3	31

	2.00	4	10	16	8	38
	3.00		4	8	14	26
Total		26	35	36	25	122

Table 4.4.5 Results of Chi-Square tests for the variables

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	57.270	9	.000
Likelihood Ratio	58.455	9	.000
Linear-by-Linear Association	42.848	1	.000
N of Valid Cases	122		

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.33.

Table 4.4.6 Cross-tabulation of results for the 2 variables listed below

LFSHYPE * DFSHYPE Cross-tabulation

Count

	DFSHYPE				Total
	.00	1.00	2.00	3.00	
LFSHYPE .00	37	9	6		52
1.00	9	15	10		34

	2.00	3	9	12	3	27
	3.00	1	2	3	3	9
Total		50	35	31	6	122

Table 4.4.7 Results of Chi-Square tests for the variables above

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	55.974[a]	9	.000
Likelihood Ratio	52.878	9	.000
Linear-by-Linear Association	38.302	1	.000
N of Valid Cases	122		

a. 7 cells (43.8%) have expected count less than 5. The minimum expected count is .44.

Table 4.4.8 Cross-tabulation of results for the 2 variables listed below

LFSMNS * DFSMNS Crosstabulation

Count

		DFSMNS				
		.00	1.00	2.00	3.00	Total
LFSMNS	.00	4	4			8
	1.00	7	23	12	1	43
	2.00	3	15	19	10	47
	3.00	3		10	11	24
Total		17	42	41	22	122

Table 4.4.9 Results of Chi-Square tests for the variables above

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	45.151[a]	9	.000
Likelihood Ratio	54.639	9	.000
Linear-by-Linear Association	30.841	1	.000
N of Valid Cases	122		

a. 6 cells (37.5%) have expected count less than 5. The minimum expected count is 1.11.

Table 4.4.10 Cross-tabulation of results for the 2 variables listed below

LSISPS * DSISPS Crosstabulation

Count

		DSISPS					Total
		.00	1.00	2.00	3.00	32.00	
LSISPS	.00	61	12	2	2	1	78
	1.00	11	12	1			24
	2.00	4	5	2	1		12
	3.00	1		4	3		8
Total		77	29	9	6	1	122

Table 4.4.11 Results of Chi-Square tests for the variables above

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	65.722[a]	12	.000
Likelihood Ratio	48.519	12	.000
Linear-by-Linear Association	1.128	1	.288
N of Valid Cases	122		

a. 13 cells (65.0%) have expected count less than 5. The minimum expected count is .07.

Table 4.4.12 Cross-tabulation of results for the 2 variables listed below

LSISPF * DSISPF Crosstabulation

Count

		DSISPF				Total
		.00	1.00	2.00	3.00	
LSISPF	.00	60	15	4	1	80
	1.00	6	9	3		18
	2.00	2	5	8	2	17
	3.00	2	2		3	7
Total		70	31	15	6	122

Table 4.4.13 Results of Chi-Square tests for the variables Above

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	65.629[a]	9	.000
Likelihood Ratio	51.336	9	.000
Linear-by-Linear Association	36.670	1	.000
N of Valid Cases	122		

a. 11 cells (68.8%) have expected count less than 5. The minimum expected count is .34.

Table 4.4.14 Cross-tabulation of results for the 2 variables listed below

LSISG * DSISG Crosstabulation

Count

		DSISG				Total
		.00	1.00	2.00	3.00	
LSISG	.00	53	20	2	2	77
	1.00	6	8	1		15
	2.00	3	9	9	3	24
	3.00		1	2	3	6
Total		62	38	14	8	122

Table 4.4.15 Results of Chi-Square tests for the variables above

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	62.631[a]	9	.000
Likelihood Ratio	55.205	9	.000
Linear-by-Linear Association	45.082	1	.000
N of Valid Cases	122		

a. 9 cells (56.3%) have expected count less than 5. The minimum expected count is .39.

Table 4.4.16 Cross-tabulation of results for the 2 variables listed below

LSISY * DSISY Crosstabulation

Count

		DSISY				Total
		.00	1.00	2.00	3.00	
LSISY	.00	17	9	1	2	29
	1.00	7	14	6	1	28
	2.00	7	9	20	4	40
	3.00	2	1	7	15	25
Total		33	33	34	22	122

Table 4.4.17 Results of Chi-Square tests for the variables above

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	71.014[a]	9	.000
Likelihood Ratio	67.142	9	.000
Linear-by-Linear Association	40.906	1	.000
N of Valid Cases	122		

a. 1 cells (6.3%) have expected count less than 5. The minimum expected count is 4.51.

Table 4.4.18 Cross-tabulation of results for the 2 variables listed below

LFLKEMPS * DFLKEMPS Crosstabulation

Count

		DFLKEMPS			
		.00	1.00	2.00	Total
LFLKEMPS	.00	26	7	3	36
	1.00	6	25	3	34
	2.00	11	10	31	52
Total		43	42	37	122

Table 4.4.19 Results of Chi-Square tests for the variables above

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	66.452[a]	4	.000
Likelihood Ratio	62.815	4	.000
Linear-by-Linear Association	33.883	1	.000
N of Valid Cases	122		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.31.

Table 4.4.20 Cross-tabulation of results for the 2 variables listed below

LFLFACET * DFLFACET Crosstabulation

Count

		DFLFACET			
		.00	1.00	2.00	Total
LFLFACET	.00	14	8	3	25
	1.00	6	25	2	33
	2.00	9	8	47	64
Total		29	41	52	122

Table 4.4.21 Results of Chi-Square tests for the variables above

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	69.953[a]	4	.000
Likelihood Ratio	71.094	4	.000
Linear-by-Linear Association	35.771	1	.000
N of Valid Cases	122		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.94.

Table 4.4.22 Cross-tabulation of results for the 2 variables listed below

LFLHYPE * DFLHYPE Crosstabulation

Count

		DFLHYPE			Total
		.00	1.00	2.00	
LFLHYPE	.00	33	7	10	50
	1.00	8	23		31
	2.00	7	8	26	41
Total		48	38	36	122

Table 4.4.23 Results of Chi-Square tests for the variables above

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	67.239[a]	4	.000
Likelihood Ratio	68.956	4	.000
Linear-by-Linear Association	27.339	1	.000
N of Valid Cases	122		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.15.

Table 4.4.24 Cross-tabulation of results for the 2 variables listed below

LFLMNS * DFLMNS Crosstabulation

Count

		DFLMNS			
		.00	1.00	2.00	Total
LFLMNS	.00	6	1	4	11
	1.00	5	35	3	43
	2.00	10	15	43	68
Total		21	51	50	122

Table 4.4.25 Results of Chi-Square tests for the variables above

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	55.622[a]	4	.000
Likelihood Ratio	56.901	4	.000
Linear-by-Linear Association	16.584	1	.000
N of Valid Cases	122		

a. 3 cells (33.3%) have expected count less than 5. The minimum expected count is 1.89.

Table 4.4.26 Cross-tabulation of results for the 2 variables listed below

LSILPS * DSILPS Crosstabulation

Count

		DSILPS			
		.00	1.00	2.00	Total
LSILPS	.00	59	7	9	75
	1.00	3	9	1	13
	2.00	14	4	16	34
Total		76	20	26	122

Table 4.4.27 Results of Chi-Square tests for the variables Above

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	48.493[a]	4	.000
Likelihood Ratio	38.346	4	.000
Linear-by-Linear Association	19.313	1	.000
N of Valid Cases	122		

a. 2 cells (22.2%) have expected count less than 5. The minimum expected count is 2.13.

Table 4.4.28 Cross-tabulation of results for the 2 variables listed below

LSILPF * DSILPF Crosstabulation

Count

		DSILPF			Total
		.00	1.00	2.00	
LSILPF	.00	59	11	8	78
	1.00	5	11		16
	2.00	8	3	17	28
Total		72	25	25	122

Table 4.4.29 Results of Chi-Square tests for the variables Above

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	60.557[a]	4	.000
Likelihood Ratio	51.695	4	.000
Linear-by-Linear Association	29.767	1	.000
N of Valid Cases	122		

a. 2 cells (22.2%) have expected count less than 5. The minimum expected count is 3.28.

Table 4.4.30 Cross-tabulation of results for the 2 variables listed below

LSILG * DSILG Crosstabulation

Count

		DSILG			
		.00	1.00	2.00	Total
LSILG	.00	51	7	18	76
	1.00	4	17	1	22
	2.00	7	3	14	24
Total		62	27	33	122

Table 4.4.31 Results of Chi-Square tests for the variables Above

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	60.877[a]	4	.000
Likelihood Ratio	52.338	4	.000
Linear-by-Linear Association	13.479	1	.000
N of Valid Cases	122		

a. 1 cells (11.1%) have expected count less than 5. The minimum expected count is 4.87.

Table 4.4.32 Cross-tabulation of results for the 2 variables listed below

LSILY * DSILY Crosstabulation

Count

		DSILY			
		.00	1.00	2.00	Total
LSILY	.00	17	8	4	29
	1.00	2	18	4	24
	2.00	14	6	49	69
Total		33	32	57	122

Table 4.4.33 Results of Chi-Square tests for the variables above

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	64.917[a]	4	.000
Likelihood Ratio	61.940	4	.000
Linear-by-Linear Association	26.920	1	.000
N of Valid Cases	122		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.30.

TEST 4 PRODUCT MOMENT CORRELATION COEFFICIENT

Table 4.4.34 Table reflecting correlation results between the median (Worst vs Least) and the Roland Morris score (In percentage form)

Correlations

		MEDIAN	RMPERCEN
MEDIAN	Pearson Correlation	1	.601**
	Sig. (2-tailed)	.	.000
	N	122	121
RMPERCEN	Pearson Correlation	.601**	1
	Sig. (2-tailed)	.000	.
	N	121	121

**. Correlation is significant at the 0.01 level (2-tailed).

TEST 5 SPEARMAN'S RANK ORDER CORRELATION COEFFICIENT

In test 5 the Roland Morris Score was individually tested against all eight of the severity tests conducted by the Researcher, thus testing for inter-instrument reliability between both a subjective and objective measuring instrument. Spearman's Rank Order Correlation coefficient was used to analyse this data.

Table 4.4.35 Correlation results between the variables listed below

Correlations

			RM	LFSKEMPS
Spearman's rho	RM	Correlation Coefficient	1.000	.254**
		Sig. (2-tailed)	.	.005
		N	121	121
	LFSKEMPS	Correlation Coefficient	.254**	1.000
		Sig. (2-tailed)	.005	.
		N	121	122

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.4.36 Correlation results between the variables listed below

Correlations

			RM	LFSFACET
Spearman's rho	RM	Correlation Coefficient	1.000	.424**
		Sig. (2-tailed)	.	.000
		N	121	121
	LFSFACET	Correlation Coefficient	.424**	1.000
		Sig. (2-tailed)	.000	.
		N	121	122

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.4.37 Correlation results between the variables listed below

Correlations

			RM	LFSHYPE
Spearman's rho	RM	Correlation Coefficient	1.000	.196*
		Sig. (2-tailed)	.	.031
		N	121	121
	LFSHYPE	Correlation Coefficient	.196*	1.000
		Sig. (2-tailed)	.031	.
		N	121	122

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4.4.38 Correlation results between the variables listed below

Correlations

			RM	LFSMNS
Spearman's rho	RM	Correlation Coefficient	1.000	.376**
		Sig. (2-tailed)	.	.000
		N	121	121
	LFSMNS	Correlation Coefficient	.376**	1.000
		Sig. (2-tailed)	.000	.
		N	121	122

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.4.39 Correlation results between the variables listed below

Correlations

			RM	LSISPS
Spearman's rho	RM	Correlation Coefficient	1.000	.213*
		Sig. (2-tailed)	.	.019
		N	121	121
	LSISPS	Correlation Coefficient	.213*	1.000
		Sig. (2-tailed)	.019	.
		N	121	122

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4.4.40 Correlation results between the variables listed below

Correlations

			RM	LSISPF
Spearman's rho	RM	Correlation Coefficient	1.000	.321**
		Sig. (2-tailed)	.	.000
		N	121	121
	LSISPF	Correlation Coefficient	.321**	1.000
		Sig. (2-tailed)	.000	.
		N	121	122

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.4.41 Correlation results between the variables listed below

Correlations

			RM	LSISG
Spearman's rho	RM	Correlation Coefficient	1.000	.302**
		Sig. (2-tailed)	.	.001
		N	121	121
	LSISG	Correlation Coefficient	.302**	1.000
		Sig. (2-tailed)	.001	.
		N	121	122

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.4.42 Correlation results between the variables listed below

Correlations

			RM	LSISY
Spearman's rho	RM	Correlation Coefficient	1.000	.414**
		Sig. (2-tailed)	.	.000
		N	121	121
	LSISY	Correlation Coefficient	.414**	1.000
		Sig. (2-tailed)	.000	.
		N	121	122

**. Correlation is significant at the 0.01 level (2-tailed).

TEST 6 THE BINOMIAL TEST (USING ONE PROPORTION)

Table 4.4.43 The results below reflect the accuracy of each individual's pain location at the different levels of severity of that same condition

Binomial Test

LFSKEMPS			Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)	Exact Sig. (2-tailed)
.00	LFLKEMPS	Group 1	<= 1	36	.95	.50	.000[a]	
		Group 2	> 1	2	.05			
		Total		38	1.00			
1.00	LFLKEMPS	Group 1	<= 1	21	.48	.50	.880[a]	
		Group 2	> 1	23	.52			
		Total		44	1.00			
2.00	LFLKEMPS	Group 1	<= 1	12	.41	.50	.458[a]	
		Group 2	> 1	17	.59			
		Total		29	1.00			
3.00	LFLKEMPS	Group 1	<= 1	1	.09	.50		.012
		Group 2	> 1	10	.91			
		Total		11	1.00			

a. Based on Z Approximation.

Table 4.4.44 The results below reflect the accuracy of each individual's pain location at the different levels of severity of that same condition

Binomial Test

LFSFACET			Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
.00	LFLFACET	Group 1	<= 1	25	.93	.50	.000[a]
		Group 2	> 1	2	.07		
		Total		27	1.00		
1.00	LFLFACET	Group 1	<= 1	11	.35	.50	.150[a]
		Group 2	> 1	20	.65		
		Total		31	1.00		
2.00	LFLFACET	Group 1	<= 1	16	.42	.50	.418[a]
		Group 2	> 1	22	.58		
		Total		38	1.00		
3.00	LFLFACET	Group 1	<= 1	6	.23	.50	.009[a]
		Group 2	> 1	20	.77		
		Total		26	1.00		

a. Based on Z Approximation.

Table 4.4.45 The results below reflect the accuracy of each individual's pain location at the different levels of severity of that same condition

Binomial Test

LFSMNS			Category	N	Observed Prop.	Test Prop.	Exact Sig. (2-tailed)	Asymp. Sig. (2-tailed)
.00	LFLMNS	Group 1	<= 1	8	1.00	.50	.008	
		Total		8	1.00			
1.00	LFLMNS	Group 1	<= 1	22	.51	.50		1.000[a]
		Group 2	> 1	21	.49			
		Total		43	1.00			
2.00	LFLMNS	Group 1	<= 1	17	.36	.50		.079[a]
		Group 2	> 1	30	.64			
		Total		47	1.00			
3.00	LFLMNS	Group 1	<= 1	7	.29	.50	.064	
		Group 2	> 1	17	.71			
		Total		24	1.00			

a. Based on Z Approximation.

Table 4.4.46 The results below reflect the accuracy of each individual's pain location at the different levels of severity of that same condition

Binomial Test

LFSHYPE			Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)	Exact Sig. (2-tailed)
.00	LFLHYPE	Group 1	<= 1	50	.96	.50	.000[a]	
		Group 2	> 1	2	.04			
		Total		52	1.00			
1.00	LFLHYPE	Group 1	<= 1	18	.53	.50	.864[a]	
		Group 2	> 1	16	.47			
		Total		34	1.00			
2.00	LFLHYPE	Group 1	<= 1	11	.41	.50	.442[a]	
		Group 2	> 1	16	.59			
		Total		27	1.00			
3.00	LFLHYPE	Group 1	<= 1	2	.22	.50		.180
		Group 2	> 1	7	.78			
		Total		9	1.00			

a. Based on Z Approximation.

Table 4.4.47 The results below reflect the accuracy of each individual's pain location at the different levels of severity of that same condition

Binomial Test

LSISPS			Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)	Exact Sig. (2-tailed)
.00	LSILPS	Group 1	<= 1	76	.97	.50	.000[a]	
		Group 2	> 1	2	.03			
		Total		78	1.00			
1.00	LSILPS	Group 1	<= 1	6	.25	.50		.023
		Group 2	> 1	18	.75			
		Total		24	1.00			
2.00	LSILPS	Group 1	<= 1	5	.42	.50		.774
		Group 2	> 1	7	.58			
		Total		12	1.00			
3.00	LSILPS	Group 1	<= 1	1	.13	.50		.070
		Group 2	> 1	7	.88			
		Total		8	1.00			

a. Based on Z Approximation.

Table 4.4.48 The results below reflect the accuracy of each individual's pain location at the different levels of severity of that same

condition

Binomial Test

LSISPF			Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)	Exact Sig. (2-tailed)
.00	LSILPF	Group 1	<= 1	79	.99	.50	.000[a]	
		Group 2	> 1	1	.01			
		Total		80	1.00			
1.00	LSILPF	Group 1	<= 1	6	.33	.50		.238
		Group 2	> 1	12	.67			
		Total		18	1.00			
2.00	LSILPF	Group 1	<= 1	5	.29	.50		.143
		Group 2	> 1	12	.71			
		Total		17	1.00			
3.00	LSILPF	Group 1	<= 1	4	.57	.50		1.000
		Group 2	> 1	3	.43			
		Total		7	1.00			

a. Based on Z Approximation.

Table 4.4.49 The results below reflect the accuracy of each individual's pain location at the different levels of severity of that same condition

Binomial Test

LSISG			Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)	Exact Sig. (2-tailed)
.00	LSILG	Group 1	<= 1	76	.99	.50	.000[a]	
		Group 2	> 1	1	.01			
		Total		77	1.00			
1.00	LSILG	Group 1	<= 1	8	.53	.50		1.000
		Group 2	> 1	7	.47			
		Total		15	1.00			
2.00	LSILG	Group 1	<= 1	12	.50	.50		1.000
		Group 2	> 1	12	.50			
		Total		24	1.00			
3.00	LSILG	Group 1	<= 1	2	.33	.50		.687
		Group 2	> 1	4	.67			
		Total		6	1.00			

a. Based on Z Approximation.

Table 4.4.50 The results below reflect the accuracy of each individual's pain location at the

different levels of severity of that same condition

Binomial Test

LSISY			Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)	Exact Sig. (2-tailed)
.00	LSILY	Group 1	<= 1	28	.97	.50	.000[a]	
		Group 2	> 1	1	.03			
		Total		29	1.00			
1.00	LSILY	Group 1	<= 1	11	.39	.50	.345[a]	
		Group 2	> 1	17	.61			
		Total		28	1.00			
2.00	LSILY	Group 1	<= 1	10	.25	.50	.002[a]	
		Group 2	> 1	30	.75			
		Total		40	1.00			
3.00	LSILY	Group 1	<= 1	4	.16	.50		.001
		Group 2	> 1	21	.84			
		Total		25	1.00			

a. Based on Z Approximation.

TEST 7 DESCRIPTIVES OF THE DIAGNOSES

Table 4.4.51 Frequency of diagnosis of both the lumbar facet syndrome and sacro-iliac syndrome

DIAG

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	l	54	44.3	44.3	44.3
	si	68	55.7	55.7	100.0
	Total	122	100.0	100.0	

Table 4.4.52 Frequency of diagnosis of both the lumbar facet syndrome and sacro-iliac syndrome by gender

DIAG

GENDER			Frequency	Percent	Valid Percent	Cumulative Percent
f	Valid	l	24	38.7	38.7	38.7
		si	38	61.3	61.3	100.0
		Total	62	100.0	100.0	
m	Valid	l	30	50.0	50.0	50.0
		si	30	50.0	50.0	100.0
		Total	60	100.0	100.0	

Table 4.4.53 Frequency of diagnosis of both the lumbar facet syndrome and sacro-iliac syndrome by age group

DIAG

AGEGROUP			Frequency	Percent	Valid Percent	Cumulative Percent
.00	Valid	I	1	50.0	50.0	50.0
		si	1	50.0	50.0	100.0
		Total	2	100.0	100.0	
1.00	Valid	I	20	48.8	48.8	48.8
		si	21	51.2	51.2	100.0
		Total	41	100.0	100.0	
2.00	Valid	I	16	53.3	53.3	53.3
		si	14	46.7	46.7	100.0
		Total	30	100.0	100.0	
3.00	Valid	I	10	41.7	41.7	41.7
		si	14	58.3	58.3	100.0
		Total	24	100.0	100.0	
4.00	Valid	I	7	28.0	28.0	28.0
		si	18	72.0	72.0	100.0
		Total	25	100.0	100.0	

CHAPTER

FIVE

CHAPTER FIVE: DISCUSSION

5.1 Introduction

This chapter is a discussion of the results extracted from the output in Chapter 4.

Subjective data was obtained using the Numerical Pain Rating Scale 101 and the Roland-Morris Disability Questionnaire.

Objective data was derived from the results of the application of the provocative orthopedic tests in the Composite Orthopaedic Rating Scale.

This data was obtained from the participants during their consultation and later statistically analysed.

5.2 Result analysis

Test 1 grouped both the Researcher's and the Doctor's results of the eight location tests for both FACET and SI syndrome and two sets of Binomial tests were performed.

Firstly, this was done to see if the proportion of failures within each test was significantly different to 0.5. This in turn implied the significance of the relationship between the proportion of successes versus the proportion of failures within each test. Secondly, it was done to see if any of the

eight tests was significantly better than any of the others. This procedure lent to testing for the validity of the tests.

TEST 1a THE BINOMIAL TEST (USING ONE PROPORTION)

The results are summarized below:

Table 5.2.1 Proportion of successes of orthopaedic tests

TEST	PROPORTION OF SUCCESSES SAMPLE DATA	p VALUE
SIY	0.52	0.654
FMNS	0.48	0.654
FFACET	0.48	0.481
FKEMPS	0.36	0
FHYPE	0.32	0
SLPS	0.25	0
SLG	0.23	0
SPF	0.22	0

From the results above the proportion of successes seem low. Not only are they low but also the first three tests are not even significantly higher than 0.5 based on the p-value. Even worse, it can be observed that the last five tests are significantly less than a population proportion success rate of 0.5 implying that these tests have a significantly less than a 50% success rate.

The tests above do not seem to be valid even though the first three do not have a success rate significantly less than 50%.

TEST 1b THE BINOMIAL TEST (USING TWO PROPORTIONS)

Table 5.2.2 Differences in proportion of successes

TEST1 – TEST 2	(p1 - p2) DIFFERENCE IN PROPORTION OF SUCCESSES	p VALUE
SIY	0.032	0.469
FMNS	0.008	0.856
FFACET	0.11	0.013
FKEMPS	0.049	0.251
FHYPE	0.07	0.086
SLPS	0.012	0.75
SLG	0.02	0.665
SPF		

CONCLUSION:

In terms of whether any tests are significantly better than any others, in order of ranking of tests as outlined above; the only significant difference is between tests FFACET (facet joint challenge test) and FKEMPS (Kemp's test).

None of the other tests show any significant difference in comparison to each other, as outlined above, in ranking order, in Table 5.2.2.

Test 2 tested for Inter-Group reliability by running each location test for both measuring instruments, namely the Researcher and the Doctor, up against each other. This test was performed in two different ways:

Firstly it tested whether one of the measuring instruments had a significantly different success rate. In order to achieve this result a Binomial Distribution was used and it tested for the significant difference between two population proportions.

TEST 2 THE BINOMIAL TEST (USING TWO PROPORTIONS)

Table 5.2.3 Proportion of successes of researcher and doctor

TEST2	p : PROPORTION RESEARCHER	p : PROPORTION DOCTOR	p VALUE
SIY	0.57	0.47	0.12
FMNS	0.56	0.41	0.02
FFACET	0.52	0.43	0.122
FKEMPS	0.43	0.3	0.04
FHYPE	0.34	0.3	0.491
SLPS	0.28	0.21	0.233
SLG	0.2	0.27	0.172
SPF	0.23	0.2	0.641

Note: p = Proportion of success from sample data..

CONCLUSION:

In terms of the reliability of the tests, the only p-values which are less than 0.05 are for the tests FMNS (Palpable muscle spasm test) and FKEMPS, implying that both these tests yield significantly different population proportion success rates whereas none of the other tests do this.

Secondly, it was checked to see whether both measuring instruments, namely the researcher and the doctor, produced significantly different results on each measure for all the location tests and this was again followed up for all the severity tests in Test 3. Again, this test measures the reliability of all the tests concerned.

TEST 3 THE CHI SQUARE TEST

Table 5.2.4 Reliability of tests

TEST3

LOCATION TESTS CHI – SQUARED	p VALUE
SIY	0
FMNS	0
FFACET	0
FKEMPS	0
FHYPE	0
SLPS	0
SLG	0
SPF	0

SEVERITY TESTS	SPEARMANS RANK ORDER CORRELATION	p VALUE
SIY		0
FMNS		0
FFACET		0
FKEMPS		0
FHYPE		0
SLPS		0
SLG		0
SPF		0

CONCLUSION:

It can be seen from this type of test that all the tests do not yield significantly different values at each run. One value from a run provided by the researcher and one value at each run provided by the Doctor do not yield significantly different results over the whole sample group. In terms of the results observed in Table 5.2.4, all the tests seem to reliably produce the same or similar results.

Test 4 tested for the similarity of both the subjective measures of severity, using the Pearson's Product Moment Correlation Co-efficient on the "Median" of the worst and least pain thresholds (NRS-101) versus a "Modified Roland-Morris score". This modified score is obtained by dividing the actual score by 24 and then multiplying the result by 100.

Inter instrument reliability of both the subjective measures is tested here.

TEST 4 PRODUCT MOMENT CORRELATION CO-EFFICIENT

Table 5.2.5 Correlation co-efficient significance

Correlations

		MEDIAN	RMPERCEN
MEDIAN	Pearson Correlation	1	.601**
	Sig. (2-tailed)	.	.000
	N	122	121
RMPERCEN	Pearson Correlation	.601**	1
	Sig. (2-tailed)	.000	.
	N	121	121

**. Correlation is significant at the 0.01 level (2-tailed).

CONCLUSION:

The correlation coefficient in this case of 0.601 implies that both tests yield very similar results. A p-Value of 0.000 implies that the population coefficient between these two tests is not significantly different from zero. Therefore, both tests do not produce significantly different results.

Test 5 pitted the Roland-Morris Score individually against all eight severity tests conducted by the researcher, thus testing for inter-instrument reliability between both a subjective and objective measuring instrument. Spearman's Rank Order Correlation coefficient was used to analyse this data.

TEST 5 SPEARMANS RANK ORDER CORRELATION COEFFICIENT

Table 5.2.6 Inter-instrument reliability

TEST5

SEVERITY TESTS	SPEARMANS RANK ORDER CORRELATION	p VALUE
LFSFACET	0.424	0
LSISY	0.414	0
LFSMNS	0.376	0
LSISPF	0.321	0
LSISG	0.302	0.001
LFSKEMPS	0.254	0.005
LSISPS	0.213	0.019
LFSHYPE	0.196	0.031

CONCLUSION:

In all cases the correlation coefficient between both variables is not significantly different from zero, implying that both variables are related and producing similar results. Hence inter-instrument reliability between both subjective and objective tests proves to be true.

Test 6 determined whether the various Location Tests proved to be more accurate or (valid) for different levels of pain severity. This analysis was conducted against the researcher's tests. Various Binomial Tests were conducted here.

TEST 6 THE BINOMIAL TEST (USING ONE PROPORTION)

Table 5.2.7 Correlation between pain severity and orthopaedic testing

Binomial Test

LFSKEMPS			Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)	Exact Sig. (2-tailed)
.00	LFLKEMPS	Group 1	<= 1	36	.95	.50	.000[a]	
		Group 2	> 1	2	.05			
		Total		38	1.00			
1.00	LFLKEMPS	Group 1	<= 1	21	.48	.50	.880[a]	
		Group 2	> 1	23	.52			
		Total		44	1.00			
2.00	LFLKEMPS	Group 1	<= 1	12	.41	.50	.458[a]	
		Group 2	> 1	17	.59			
		Total		29	1.00			
3.00	LFLKEMPS	Group 1	<= 1	1	.09	.50		.012
		Group 2	> 1	10	.91			
		Total		11	1.00			

a. Based on Z Approximation.

Table 5.2.8 Correlation between pain severity and orthopaedic testing

Binomial Test

LFSFACET			Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
.00	LFLFACET	Group 1	<= 1	25	.93	.50	.000[a]
		Group 2	> 1	2	.07		
		Total		27	1.00		
1.00	LFLFACET	Group 1	<= 1	11	.35	.50	.150[a]
		Group 2	> 1	20	.65		
		Total		31	1.00		
2.00	LFLFACET	Group 1	<= 1	16	.42	.50	.418[a]
		Group 2	> 1	22	.58		
		Total		38	1.00		
3.00	LFLFACET	Group 1	<= 1	6	.23	.50	.009[a]
		Group 2	> 1	20	.77		
		Total		26	1.00		

a. Based on Z Approximation.

Table 5.2.9 Correlation between pain severity and orthopaedic testing

Binomial Test

LFSMNS			Category	N	Observed Prop.	Test Prop.	Exact Sig. (2-tailed)	Asymp. Sig. (2-tailed)
.00	LFLMNS	Group 1	<= 1	8	1.00	.50	.008	
		Total		8	1.00			
1.00	LFLMNS	Group 1	<= 1	22	.51	.50		1.000[a]
		Group 2	> 1	21	.49			
		Total		43	1.00			
2.00	LFLMNS	Group 1	<= 1	17	.36	.50		.079[a]
		Group 2	> 1	30	.64			
		Total		47	1.00			
3.00	LFLMNS	Group 1	<= 1	7	.29	.50	.064	
		Group 2	> 1	17	.71			
		Total		24	1.00			

a. Based on Z Approximation.

Table 5.2.10 Correlation between pain severity and orthopaedic testing

Binomial Test

LFSHYPE			Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)	Exact Sig. (2-tailed)
.00	LFLHYPE	Group 1	<= 1	50	.96	.50	.000[a]	
		Group 2	> 1	2	.04			
		Total		52	1.00			
1.00	LFLHYPE	Group 1	<= 1	18	.53	.50	.864[a]	
		Group 2	> 1	16	.47			
		Total		34	1.00			
2.00	LFLHYPE	Group 1	<= 1	11	.41	.50	.442[a]	
		Group 2	> 1	16	.59			
		Total		27	1.00			
3.00	LFLHYPE	Group 1	<= 1	2	.22	.50		.180
		Group 2	> 1	7	.78			
		Total		9	1.00			

a. Based on Z Approximation.

Table 5.2.11 Correlation between pain severity and orthopaedic testing

Binomial Test

LSISPS			Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)	Exact Sig. (2-tailed)
.00	LSILPS	Group 1	<= 1	76	.97	.50	.000[a]	
		Group 2	> 1	2	.03			
		Total		78	1.00			
1.00	LSILPS	Group 1	<= 1	6	.25	.50		.023
		Group 2	> 1	18	.75			
		Total		24	1.00			
2.00	LSILPS	Group 1	<= 1	5	.42	.50		.774
		Group 2	> 1	7	.58			
		Total		12	1.00			
3.00	LSILPS	Group 1	<= 1	1	.13	.50		.070
		Group 2	> 1	7	.88			
		Total		8	1.00			

a. Based on Z Approximation.

Table 5.2.12 Correlation between pain severity and orthopaedic testing

Binomial Test

LSISPF			Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)	Exact Sig. (2-tailed)
.00	LSILPF	Group 1	<= 1	79	.99	.50	.000[a]	
		Group 2	> 1	1	.01			
		Total		80	1.00			
1.00	LSILPF	Group 1	<= 1	6	.33	.50		.238
		Group 2	> 1	12	.67			
		Total		18	1.00			
2.00	LSILPF	Group 1	<= 1	5	.29	.50		.143
		Group 2	> 1	12	.71			
		Total		17	1.00			
3.00	LSILPF	Group 1	<= 1	4	.57	.50		1.000
		Group 2	> 1	3	.43			
		Total		7	1.00			

a. Based on Z Approximation.

Table 5.2.13 Correlation between pain severity and orthopaedic testing

Binomial Test

LSISG			Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)	Exact Sig. (2-tailed)
.00	LSILG	Group 1	<= 1	76	.99	.50	.000[a]	
		Group 2	> 1	1	.01			
		Total		77	1.00			
1.00	LSILG	Group 1	<= 1	8	.53	.50		1.000
		Group 2	> 1	7	.47			
		Total		15	1.00			
2.00	LSILG	Group 1	<= 1	12	.50	.50		1.000
		Group 2	> 1	12	.50			
		Total		24	1.00			
3.00	LSILG	Group 1	<= 1	2	.33	.50		.687
		Group 2	> 1	4	.67			
		Total		6	1.00			

a. Based on Z Approximation.

Table 5.2.14 Correlation between pain severity and orthopedic testing

Binomial Test

LSISY			Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)	Exact Sig. (2-tailed)
.00	LSILY	Group 1	<= 1	28	.97	.50	.000[a]	
		Group 2	> 1	1	.03			
		Total		29	1.00			
1.00	LSILY	Group 1	<= 1	11	.39	.50	.345[a]	
		Group 2	> 1	17	.61			
		Total		28	1.00			
2.00	LSILY	Group 1	<= 1	10	.25	.50	.002[a]	
		Group 2	> 1	30	.75			
		Total		40	1.00			
3.00	LSILY	Group 1	<= 1	4	.16	.50		.001
		Group 2	> 1	21	.84			
		Total		25	1.00			

a. Based on Z Approximation.

CONCLUSION:

As we can see form the above results as the level of severity increases so does the accuracy of the location tests. One can see this by observing the proportions of correct locations or true positives (with a value of 2) as the severity levels increase and this is apparent across all tests. Not only is this evident but using the Binomial testing procedure we also observe that for the higher pain severity levels that our proportion of successes is significantly higher than 0.5 (50%) and this is definitely not apparent at our lower levels of severity, in fact in some cases the proportion of successes exhibits the opposite trend in that they are significantly lower than 0.5 (50%). This is calculated by observing the p values in the last 2 columns. If a p value is less than 0.05 then the trend exhibited is significant.

Test 7 entailed running a few descriptive statistics on the diagnoses of the participants in the study. These descriptive tests, for gender and age, were run for the full sample size.

The distribution of patients with both Facet and SI syndrome are relatively even amongst both genders and age groups although there is a leaning with more female patients within this sample group to be experiencing SI syndrome with 61.3 % of females with SI and 38.7 % of males with SI. Also amongst the older patients their seems to be more prevalence of SI syndrome with over 65.3 % of patients in the age groups three and four (ages 41-59) combined experiencing SI syndrome.

The mean age of patients is 37.6 years with a standard deviation of 11.4 as reflected in table 5.2.18 below.

TEST 7 DESCRIPTIVE STATISTICS

Table 5.2.15 Frequency of diagnosis of lumbar facet syndrome and sacro-iliac syndrome

DIAG

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	l	54	44.3	44.3	44.3
	si	68	55.7	55.7	100.0
	Total	122	100.0	100.0	

Table 5.2.16 Frequency of diagnosis of lumbar facet syndrome and sacro-iliac syndrome by gender

DIAG

GENDER			Frequency	Percent	Valid Percent	Cumulative Percent
f	Valid	l	24	38.7	38.7	38.7
		si	38	61.3	61.3	100.0
		Total	62	100.0	100.0	
m	Valid	l	30	50.0	50.0	50.0
		si	30	50.0	50.0	100.0
		Total	60	100.0	100.0	

Table 5.2.17 Frequency of diagnosis of lumbar facet syndrome and sacro-iliac syndrome by age group

DIAG

AGEGROUP			Frequency	Percent	Valid Percent	Cumulative Percent
.00	Valid	l	1	50.0	50.0	50.0
		si	1	50.0	50.0	100.0
		Total	2	100.0	100.0	
1.00	Valid	l	20	48.8	48.8	48.8
		si	21	51.2	51.2	100.0
		Total	41	100.0	100.0	
2.00	Valid	l	16	53.3	53.3	53.3
		si	14	46.7	46.7	100.0
		Total	30	100.0	100.0	
3.00	Valid	l	10	41.7	41.7	41.7
		si	14	58.3	58.3	100.0
		Total	24	100.0	100.0	
4.00	Valid	l	7	28.0	28.0	28.0
		si	18	72.0	72.0	100.0
		Total	25	100.0	100.0	

Table 5.2.18 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
AGE	122	18.00	59.00	37.6230	11.43384
Valid N (listwise)	122				

5.3 Study delimitations

One of the most poignant shortfalls of this study is the small sample size (122). A large sample size is always preferred as it improves the validity of a study by reducing the chances of incorrectly accepting or rejecting the Null hypothesis.

Another shortfall would be that several doctors were used in this study and the reliability would have been improved if the same doctor were used to examine all the participants, thus providing a comparison for the researcher's results. It would have been of further benefit to this study if the diagnosis of each participant could have been made by another independent doctor, thus ensuring that the researcher was also blinded to the diagnoses and not only the doctors used to examine the participants.

CHAPTER

SIX

CHAPTER SIX: RECOMMENDATIONS AND CONCLUSIONS

6.1 Recommendations

A longer time period and less financial constraints would allow the researcher to produce a more efficient and valuable study of the clinical severity of low back pain and the role of orthopedic testing, in particular, the Composite Orthopedic Rating Scale. An increased budget would allow the researcher to gain access to a much wider knowledge base and also facilitate the employment or involvement of researchers who have dealt with this area of knowledge but charge for their services. This may provide new insight into the manner in which the tests in the Composite Orthopedic Rating Scale originated and their relevancy in clinical settings, as determined by outside and more experienced professionals.

The researcher can make a number of recommendations:

- A larger sample size is always desired, particularly in studies where reliability and validity are being examined.

- Blinding of the researcher him/herself would benefit the study as this greatly reduces the chances of bias in this study. Although it was not possible for the researcher to be blinded due to various design and

financial constraints, observer bias could be eliminated by allowing another doctor (someone not involved in the application of the tests contained in the Composite Orthopedic Rating Scale) to diagnose the participants using the criteria as outlined in Chapter 2.

- Various doctors, depending on availability, were used to apply the Composite Orthopedic Rating Scale tests to the participants in this study. It would have been preferable to use only one doctor throughout the study to maintain homogeneity.

Further studies involving the reliability and validity of orthopedic testing would be useful as the available literature is limited.

6.2 Conclusion

The aim of this investigation was to develop inter-examiner reliability as well as construct and concurrent validity of the Composite Orthopedic Rating Scale (CORS) so that it may be used as an applicable measurement instrument for use in clinical trials relating to mechanical low back pain.

At a 5% level of confidence it was found that the tests contained in the Composite Orthopedic Rating Scale produced a very low success rate.

Furthermore it was noted that only:

- ❖ Yeoman's,
- ❖ Palpable muscle spasm and
- ❖ The facet challenge test

were accurate more than 50% of the time.
The other tests (Kemp's, Hyperextension, Posterior shear, Patrick Faber and Gaenslen's tests) were significantly lower than 50% implying that their success rate was low.

Thus, it seems that the tests contained in the CORS do not seem to be valid although three (1 and 2 below) of them had a **success rate** not significantly less than 50%.

1. Analysis of the results revealed that Yeoman's test was the most accurate amongst the sacro-iliac tests.
2. The only significant difference discovered in the lumbar facet tests, where the facet challenge test and Kemp's test that exhibited a significant difference in successes.

In terms of the **reliability** of the tests, it was seen that only the palpable muscle spasm and kemp's tests yielded significantly different population proportion success rates i.e. less than 50% success rate.

One value from a run provided by the researcher and one value at each run provided by the Doctor did not yield significantly different results over the whole sample group. In terms of the results observed in Table 5.2.4, **all the tests seem to reliably produce the same or similar results**.

No significant difference was observed between the scores obtained from the Roland-Morris Disability Questionnaire and the NRS-101 Pain Rating Scale as they both yielded very similar results. The Roland –Morris score also did not deviate greatly from the results obtained from all eight severity tests. **This indicated that inter-instrument reliability between both subjective and objective measures was appropriate.**

As **pain severity levels** increased, so did the accuracy of the location tests. One can see this by observing the proportions of correct locations or true positives as the severity levels increased and this was apparent across all the tests.

In conclusion, this study has demonstrated that there is a need for more studies, which focus on orthopedic testing and its relevancy and usefulness, particularly in terms of mechanical low back pain.

The results of this study indicate that the Composite Orthopedic Rating Scale, in its entirety, is not an appropriate instrument for assessing comparative levels of mechanical low back pain. Paton (2001) found no statistically significant

difference between the two groups in her clinical trial in terms of subjective and objective findings in her study. However, she did note a significant improvement in the orthopedic assessment score, using her original orthopedic rating scale, between the initial and second consultation of the participants in her study.

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DURBAN INSTITUTE OF TECHNOLOGY CHIROPRACTIC CLINIC

The reliability and validity of the Composite Orthopaedic Rating Scale as a measurement of clinical severity in the investigation of mechanical low back pain.

Dear Participant

You have been invited to participate in a research study, designed to ascertain the validity and reliability of the orthopaedic tests contained in the Composite Orthopaedic Rating Scale, which is presently used as a measurement tool for low back pain. This study will increase the efficiency and effectiveness in assessing and treating patients.

120 participants will undergo a comprehensive history, relevant physical examination and lumbar regional examination from the researcher. This will identify your specific mechanical low back condition. Immediately thereafter the clinician on duty at the Durban Institute of Technology Chiropractic Day Clinic will apply the tests contained in the Composite Orthopaedic Rating Scale to you. S/He shall grade the tests according to the severity of the pain produced by the application of the tests. Each of you will also be required to complete a pain questionnaire prior to the examination. The consultation will take approximately 1 hour. You will be entitled to 3 free treatments from a fifth year intern at the Durban Institute of Technology Chiropractic Day Clinic following your initial consultation.

The case history and relevant physical examination will serve to screen you for any exclusion criteria. These are:

- Any persons who have taken either anti-inflammatory or analgesic medication in the 48 hours prior to the consultation.
- Any persons found to demonstrate signs or symptoms of organic pathology e.g. an abdominal aortic aneurysm can produce chronic nagging low back pain.
- Anyone with clinical indications necessitating x-rays will be excluded.

You may experience some discomfort or exacerbation of your pain during the application of the orthopaedic tests but this will be transient in nature.

The consultation is free of charge and your participation is voluntary. Confidentiality is always maintained although your records must be open for inspection by clinic supervisory staff. You may ask questions of my supervisor should you wish to telephone the number provided Should you be interested in the results you also have the right to be informed of any new findings regarding the study.

If you have any concerns with any area of the study please feel free to forward complaints to the Durban Institute of Technology Ethics Committee.

I thank you for your interest and participation.

.....
Mr L. Riggien
Tel: 2042205

.....
Dr. C. Korporaal (Supervisor)
Tel: 2042611

INFORMED CONSENT FORM

DATE:_____

TITLE OF RESEARCH PROJECT: **The reliability and validity of the Composite Orthopaedic Rating Scale as a measurement of clinical severity in the investigation of mechanical low back pain.**

NAME OF SUPERVISOR: Dr C. Korporaal **TEL NO:** (031) 2042611

NAME OF RESEARCH STUDENT: Mr L. Riggien **TEL NO:** (031) 2042512

Please circle the appropriate answer:	**YES / NO**
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. Do you understand the implications of your involvement in this study?	YES / NO
7. Do you understand that you are free to withdraw from this study? a) at any time b) without having to give any reason for withdrawing, and c) without affecting your future health care.	YES / NO
8. Do you agree to voluntarily participate in this study?	YES / NO
9. Who have you spoken to?.....	

If you answered NO to any of the above, please obtain the necessary information from the supervisor before signing.

PATIENT NAME:_____**SIGNATURE:**_____

WITNESS NAME:_____**SIGNATURE:**_____

RESEARCH STUDENT:_____**SIGNATURE:**_____

DATE:_____

CHAPTER 7: Condition-specific Outcome Assessment Tools

FORM C-1 LOW BACK PAIN AND DISABILITY QUESTIONNAIRE

NAME: _____DATE: _____AGE: _____SCORE: ___

When your back hurts, you may find it difficult to do some of the things you normally do. Mark only the sentences that describe you today.

1. ☐ I stay at home most of the time because of my back.
2. ☐ I change position frequently to try and get my back comfortable.
3. ☐ I walk more slowly than usual because of my back.
4. ☐ Because of my back, I am not doing any jobs that I usually do around the house.
5. ☐ Because of my back, I use a handrail to get upstairs.
6. ☐ Because of my back, I lie down to rest more often.
7. ☐ Because of my back, I have to hold on to something to get out of an easy chair.
8. ☐ Because of my back, I try to get other people to do things for me.
9. ☐ I get dressed more slowly than usual because of my back.
10. ☐ I stand up only for short periods of time because of my back.
11. ☐ Because of my back, I try not to bend or kneel down.
12. ☐ I find it difficult to get out of a chair because my back.
13. ☐ My back is painful almost all of the time.
14. ☐ I find it difficult to turn over in bed because of my back.
15. ☐ My appetite is not very good because of my back.
16. ☐ I have trouble putting on my socks (or stockings) because of pain in my back.
17. ☐ I walk only short distances because of my back pain.
18. ☐ I sleep less well because of my back.
19. ☐ Because of back pain, I get dressed with help from someone else.
20. ☐ I sit down for most of the day because of my back.
21. ☐ I avoid heavy jobs around the house because of my back.
22. ☐ Because of back pain, I am more irritable and bad tempered with people than usual.
23. ☐ Because of my back, I go up stairs more slowly than usual.
24. ☐ I stay in bed most of the time because of my back.

From Roland M, Morris R. A study of the natural history of back pain: Part 1: Development of a reliable and sensitive measure of disability in low-back pain. Spine 1983; 8: 141-144.

The original 24 item Roland-Morris Questionnaire is displayed. The RM-18 deletes items 2, 15, 17, 19, 20 and 24 without affecting its quality.

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.

_____

Isikali Sokulinganiselwa Kokuphathelene Nezinamba - 101 Imibuzo

Usuku: _____ **Inamba yefayela** _____ **Inamba yokuvakasha**_____

Igama lesiguli:_____

Cacisa kulomugqa ongezansi inamba phakathi kuka **0** no **100** okuyiyona echaza kangcono ubuhlungu obuzwayo uma busezingeni elibi kakhulu. Uziro (o) uzochaza ukuthi "abukho ubuhlungu", u **100** ikhulu elilodwa lizochaza "ubuhlungu obubi obungaba khona".

Bhala inamba **eyodwa** kuphela.

_____

Cacisa kulomugqa ongezansi, inamba ephakathi kuka 0 no 100 okuyiyona engachaza kangcono ubuhlungu obuzwayo uma bubuncane.
Uziro (0) uzochaza ukuthi abukho nhlobo ubuhlungu, kuthi ikhulu elilodwa (100) lizosho ukuthi "ubuhlungu obubi obungaba khona"

Bhala inamba eyodwa kuphela

_____

APPENDIX E

Do you suffer from

Low Back Pain

Research into the diagnosis of this condition is currently being conducted at the Durban Institute of Technology Chiropractic Day Clinic.

Free treatment is available to those persons between the ages of 18 and 59 years who meet the research criteria.

Should you be interested in participating in this program, you may contact:
Lance at 2042205 or 2042512

COMPOSITE ORTHOPEDIC RATING SCALE

Facet syndrome:

	Mild (1)	Moderate (2)	Severe (3)	Total
Kemp's Test				
Facet joint challenge Test				
Hyperextension in prone position				
Palpable muscle spasm with focal tenderness over affected joint				

Sacro-iliac syndrome:

	Mild (1)	Moderate (2)	Severe (3)	Total
Posterior Shear Test				
Patrick Faber Test				
Gaenslen's Test				
Yeoman's Test				

Facet Syndrome:

	Localised (True) (2)	Non-localised (1)
Kemp's Test		
Facet Joint Challenge Test		
Hyperextension in prone position		
Palpable muscle spasm with focal tenderness over affected joint		

Sacro-iliac syndrome:

	Localised (True) (2)	Non-localised (1)
Posterior Shear Test		
Patrick Faber Test		
Gaenslen's Test		
Yeoman's Test		

DURBAN INSTITUTE OF TECHNOLOGY
CHIROPRACTIC DAY CLINIC
CASE HISTORY

Patient: Date:

File # : Age :

Sex : Occupation:

Intern : Signature:

FOR CLINICIANS USE ONLY:

Initial visit

Clinician: Signature :

Case History:

Examination:

Previous: Current:

X-Ray Studies:

Previous: Current:

Clinical Path. lab:

Previous: Current:

CASE

PTT:	Signature:	Date:

CONDITIONAL:

Reason for Conditional:

Signature: Date:

Conditions met in Visit No:	Signed into PTT:	Date:

Case History signed off:	Date:

Intern's Case History:

1. **Source of History:**
2. **Chief Complaint : (patient's own words):**
3. **Present**

Complaint 1	Complaint 2

< Location

< Onset : Initial:

Recent:

< Cause:

< Duration

< Frequency

< Pain (Character)

< Progression

< Aggravating Factors

< Relieving Factors

< Associated S & S

< Previous Occurrences

< Past Treatment

< **Outcome:**

4. **Other Complaints:**

5. **Past Medical History:**

< General Health Status

< Childhood Illnesses

< Adult Illnesses

< Psychiatric Illnesses

< Accidents/Injuries

< Surgery

< Hospitalizations

6. **Current health status and life-style:**

< Allergies

< Immunizations

< Screening Tests incl. xrays

< Environmental Hazards (Home, School, Work)

< Exercise and Leisure

< Sleep Patterns

< Diet

< Current Medication
Analgesics/week:

< 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

8. Psychosocial history:

< Home Situation and daily life
< Important experiences
< Religious Beliefs

9. Review of Systems:

< General

< Skin

< Head

< Eyes

< Ears

< Nose/Sinuses

< Mouth/Throat

< Neck

< Breasts

< Respiratory

< Cardiac

< Gastro-intestinal

< Urinary

< Genital

< Vascular

< Musculoskeletal

< Neurologic

< Haematologic

< Endocrine

< Psychiatric

DURBAN INSTITUTE OF TECHNOLOGY
CHIROPRACTIC DAY CLINIC
PHYSICAL EXAMINATION

Patient:_____ File#: _____ Date:_____

Clinician:_____ Signature:_____

Student:_____ Signature:_____

1. VITALS

Pulse rate:
Respiratory rate:
Blood pressure: R L Medication if hypertensive:
Temperature:
Height:
Weight: Any change Y/N If Yes : how much gain/loss _____
Over what period _____

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:

Pulses: - General Impression:
- Radio-femoral delay:
- Carotid:
- Radial:
- Dorsalis pedis:
- Posterior tibial:
- Popliteal:
- Femoral:

Percussion: - borders of heart

Auscultation:- heart valves (mitral, aortic, tricuspid, pulmonary)
- Murmurs (timing,systolic/diastolic, site, radiation, grade).

4. RESPIRATORY EXAMINATION

1) Is this patient in **Respiratory Distress** ?

Inspection
- Barrel chest:
- Pectus carinatum/cavinatum:
- Left precordial bulge:
- Symmetry of movement:
- Scars:

Palpation
- Tracheal symmetry:
- Tracheal tug:
- Thyroid Gland:
- Symmetry of movement (ant + post)
- Tactile fremitus:

Percussion
- Percussion note:
- Cardiac dullness:
- Liver dullness:

Auscultation
- Normal breath sounds bilat.:
- Adventitious sounds (crackles, wheezes, crepitations)
- Pleural frictional rub:
- Vocal resonance
  - Whispering pectoriloquy:
  - Bronchophony:
  - Egophony:

5. ABDOMINAL EXAMINATION

1) Is this patient in **Liver Failure** ?

Inspection
- Shape:
- Scars:
- Hernias:

Palpation
- Superficial:
- Deep = Organomegally:
- 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:
- Pupillary light reflexes = Direct:
= Consensual:
- Fundoscopy findings:

III Ocular Muscles:
Eye opening strength:

IV Inferior and Medial movement of eye:

V a. Sensory
- Ophthalmic:
- Maxillary:
- Mandibular:

b. Motor
- Masseter:

- Jaw lateral movement:

c. Reflexes - Corneal reflex
- Jaw jerk

VI Lateral movement of eyes

VII a. Motor - Raise eyebrows:
- Frown:
- Close eyes against resistance:
- Show teeth:
- Blow out cheeks:

b. Taste - Anterior two-thirds of tongue:

VIII General Hearing:
Rinnes = L: R:
Webers lateralisation:
Vestibular function - Nystagmus:
- Rombergs:
- Wallenbergs:
Otoscope examination:

IX & X Gag reflex:
Uvula deviation:
Speech quality:

XI Shoulder lift:
S.C.M. strength:

XII Inspection of tongue (deviation):

Motor System:

a. Power
- Shoulder = Abduction & Adduction:
= Flexion & Extension:
- Elbow = Flexion & Extension:
- Wrist = Flexion & Extension:
- 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. <u>SPINAL EXAMINATION:</u>(See Regional examination)

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

9. <u>BREAST EXAMINATION:</u>

Summon female chaperon.

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

Palpation
- masses:

REGIONAL EXAMINATION - LUMBAR SPINE AND PELVIS

Patient:_____ File#:_____Date:_________

Intern\Resident:_____ Clinician:_____

STANDING:

Posture– scoliosis, antalgia, kyphosis
Body Type
Skin
Scars
Discolouration

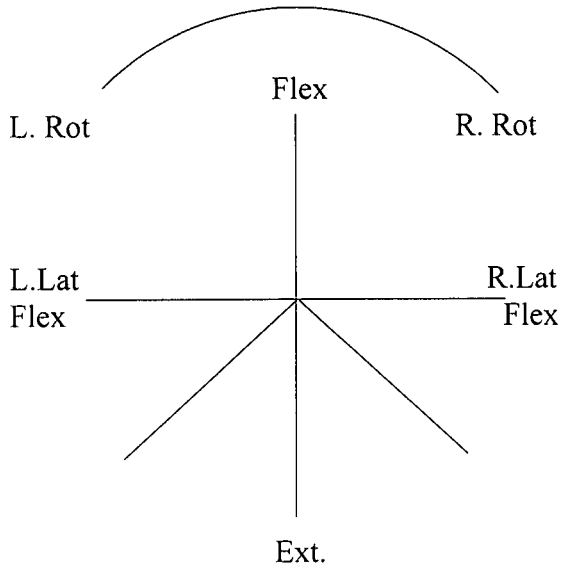
Minor's Sign
Muscle tone
Spinous Percussion
Scober's Test (6cm)
Bony and Soft Tissue Contours

GAIT:

Normal walk
Toe walk
Heel Walk
Half squat

ROM:

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



Which movt. reproduces the pain or is the worst?

- Location of pain
- Supported Adams: Relief? (SI)
  Aggravates? (disc, muscle strain)

SUPINE:

Observe abdomen (hair, skin, nails)
Palpate abdomen\groin
Pulses - abdominal
- lower extremity
Abdominal reflexes

		Degree	LBP?	Location	Leg pain	Buttock	Thigh	Calf	Heel	Foot	Braggard
SLR	L										
	R										

	L	R
Bowstring		
Sciatic notch		
Circumference (thigh and calf)		
Leg length: actual -		
apparent -		
Patrick FABERE: pos\neg – location of pain?		
Gaenslen's Test		
Gluteus max stretch		
Piriformis test (hypertonicity?)		
Thomas test: hip \ psoas? \ rectus femoris?		
Psoas Test		

SITTING:

Spinous Percussion
Valsalva
Lhermitte

		Degree	LBP?	Location	Leg pain	Buttock	Thigh	Calf	Heel	Foot	Braggard
TRIPOD	L										
Sl, +, ++	R										

Slump	L										
7 test	R										

LATERAL RECUMBENT:	L	R
Ober's		
Femoral n. stretch		
SI Compression		

PRONE:	L	R
Gluteal skyline		
Skin rolling		
Iliac crest compression		
Facet joint challenge		
SI tenderness		
SI compression		
Erichson's		
Pheasant's		

MF tp's	Latent	Active	Radiation
QL			
Paraspinal			
Glut Max			
Glut Med			
Glut Min			
Piriformis			
Hamstring			
TFL			
Iliopsoas			
Rectus Abdominis			
Ext/Int Oblique muscles			

NON ORGANIC SIGNS:

Pin point pain
Axial compression
Trunk rotation
Burn's Bench test
Flip Test
Hoover's test
Ankle dorsiflexion test
Repeat Pin point test

NEUROLOGICAL EXAMINATION

Fasciculations

Plantar reflex

level	Tender?	Dermatomes		DTR		
		L	R		L	R
T12						
L1						
L2						
L3						
L4				Patellar		
L5				Med h\s		
S1				Achilles		
S2				Incont?		
S3						

MYOTOMES					
Action	**Muscles**	**Levels**	**L**	**R**	
Lateral Flexion spine	Muscle QL	T12-L4			
Hip flexion	Psoas, Rectus femoris	L1,2,3,4			5+ Full strength
Hip extension	Hamstring, glutes	L4,5;S1.2			4+ Weakness
Hip internal rotat	Glutmed, min;TFL, adductors				3+ Weak against grav
Hip external rotat	Gluteus max, Piriformis				2+ Weak w\o gravity
Hip abduction	TFL, Glut med and minimus				1+ Fascic w\o gross movt
Hip adduction	Adductors				0 No movement
Knee flexion	Hamstring,	L4,5:S1			
Knee extension	Quad	L2,3,4			W - wasting
Ankle plantarflex	Gastroc, soleus	S1,2			
Ankle dorsiflexion	Tibialis anterior	L4,5			
Inversion	Tibialis anterior	S1			
Eversion	Peroneus longus	L4			
Great toe extens	EHL	L5			

BASIC THORACIC EXAM

History
Passive ROM
Orthopedic

BASIC HIP EXAM

History
ROM: Active
Passive : Medial rotation : A) Supine (neutral) If reduced - hard \ soft end feel
B) Supine (hip flexed): - Trochanteric bursa