The Relative Effectiveness of Muscle Energy Technique as Opposed to Specific Passive Mobilization in the Treatment of Acute and Sub-acute Mechanical Low Back Pain.

By

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A dissertation submitted to the Faculty of Health at the Durban Institute of Technology in partial compliance with the requirements for the Master's Degree in Technology: Chiropractic.

I, Keshnee Pillay, do declare that this dissertation is representative of my own work in both conception and execution.

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Dedication

This work is dedicated to my parents, Logan and Kamla Pillay for their undying love and support through the long years of hard work. You both have been my pillar of strength and inspiration and will continue to be a guiding light in my future.

Love Always
Keshnee

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ABSTRACT

It has generally been accepted that 60 to 80% of the general population will suffer from low back pain at some point in their life. (Kirkaldy - Willis, 1992). The use of manipulation for the treatment of low back pain is well documented but lumbar mobilization has undergone comparatively little investigation (Goodsell et al., 2000). Furthermore, there remains little evidence to advocate the use of Muscle Energy Technique (MET) in the form of a randomized clinical trial (Wilson, 2003). The purpose of this study was to determine whether patients with acute and sub-acute low back pain would demonstrate a reduction in disability after being treated with MET or specific passive mobilization. Both interventions are joint mobilization techniques the only difference being that one is passive and the other (MET), is an active technique.

Sixty patients aged between 18 and 45 were recruited by means of advertisement and randomly assigned to one of two groups. Both Group A (Specific Passive Mobilization) and Group B (MET) consisted of 30 patients each. This was a quantitative study as patients; on initial visit were assessed subjectively using the 101-point numerical rating scale and Oswestry Pain and Disability Index and objectively using a Digital Inclinometer to assess lumbar range of motion and an Algometer to assess the pain intensity in the lumbar region. Thereafter, they were treated using MET or passive mobilization, depending on which group they were randomly assigned to. Each patient received four treatments over a two week period with a follow up scheduled one week after treatment ended. Measurements were taken on the first and third visit as well as on the last visit and the outcomes were measured by comparing the initial scores with the follow up scores.

All data was analyzed using SPSS version 11.5 statistical software and parametric testing was used. All tests were conducted at the 5% level of significance and p-values were used for decision making. A treatment effect was concluded if $p<0.005$. Results

indicated that those treated with passive mobilization improved to the same extent as those treated with MET. In the researchers opinion this study has shown that both MET and passive mobilization can be used as safe and effective alternatives in instances where manipulation may be contra-indicated.

Article for Peer Review

Title: The Relative Effectiveness of Muscle Energy Technique as Opposed to Specific Passive Mobilization in the Treatment of Acute and Sub-acute Mechanical Low Back Pain.

The main purpose of this study is to evaluate the relative effectiveness of Muscle Energy Technique (MET), an active technique, as opposed to Specific Passive Mobilization in the treatment of mechanical low back pain in terms of subjective and objective clinical findings.

Introduction

The incidence and prevalence of low back pain is roughly the same world over.   Such pain ranks high as a cause of disability and inability to work, as an interference with the quality of life, and as a reason for medical consultation (Ehrlich, 2003). A survey conducted on the prevalence of low back pain in the general population of South Manchester, revealed that 35% of the male participants and 42% of females, experienced low back pain of one month or longer duration. (Papageorgiou et al., 1995). Furthermore, almost two thirds of all visits to chiropractors are for low back pain, hence chiropractors are the primary health care providers for approximately 40% of all patients suffering from low back pain (Spitzer et al., 1995).
Acute and sub-acute episodes that last up to three months are the commonest presentation of low back pain and recurrent episodes are the norm (Ehrlich, 2003). In 1995 acute low back pain was the fifth most common reason for all physician visits in the United States. Of these visits, 57% of patients presented with non-specific low back pain (Deyo et al., 1995). In 1997, Van der Meulen conducted an epidemiological investigation on low back pain in a formal Black South African township. This study revealed that the lifetime incidence of low back pain amongst Black South Africans within the greater Durban area was 57.6%. In 1999, Docrat conducted a similar study in an Indian and Colored

community in the greater Durban area and found that the lifetime incidence of low back pain amongst Indians was 78.2% and Coloreds 76.6%.

The most commonly overlooked muscular source of low back pain is the Quadratus Lumborum muscle (Travell & Simons, 1999). De Franca et al., (1991) concluded that joint and muscle dysfunction occur together and need to be addressed together. He also stated that a taut and painful quadratus lumborum as well as articular dysfunction in the lumbar spine requires appropriate therapy in order to provide relief and restore function.

The use of manipulation for the treatment of low back pain is well documented and it has also been shown that lumbar mobilization can also provide short term benefits for patients with acute low back pain (Goodsell et al., 2000; Enebo, 1998). There however remain instances where spinal manipulation is contra-indicated, e.g. general fever, influenza, rheumatoid arthritis, spinal diseases including TB, metastasis, osteomyleitis, advanced osteoporosis, bleeding disorders, instability, fractures, pregnancy, spondylosis and acute discs with advancing neurological signs (Paris, 1983). The author thus suggests that gentle mobilization of the vertebrae be performed as it has fewer specific contra-indications. Hence the motivation to conduct a study in which two forms of spinal mobilization are compared (i.e. an active and a passive technique).

Specific Passive Mobilization

Joint mobilization is a form of manual therapy that involves low velocity passive movements within or at the limit of joint range of motion (DiFabio, 1992). In practice, approximately 85% of patients successfully treated will respond to mobilization, leaving 15% requiring stronger manipulative techniques (Maitland et al., 2001). Grieve (1991: 177), defines passive mobilization as the attempted restoration of full, painless joint function by sustained rhythmic, repetitive passive movements to the patients tolerance, in voluntary and or accessory range.

Muscle Energy Technique

According to Chaitow (1996), the following are classified as muscle energy techniques: reciprocal inhibition, post-isometric relaxation and joint mobilization. The latter will be investigated in this study. For the purpose of mobilizing a joint, the joint is put in a specific position to facilitate optimum contraction of a particular muscle or muscle group. The patient is asked to contract the muscle against counter pressure, thus causing the muscle to contract isometrically. This causes the muscle to pull its bony attachment, thus moving one bone in relation to its articulating counterpart, hence restoring normal joint range of motion. MET has the advantage of allowing the patient to control the movement, so if too much pain is reproduced by this technique, the patient can terminate the procedure (Edward, 1993).

Methods

Adverts were placed in local newspapers. Flyers were also posted around DIT campus, clinics, gyms, pharmacies,etc. Due to a poor response and lack of patient compliance the remaining half of this study was conducted on the staff at R.K Khan Hospital. Circulars were sent out to each department notifying the staff that this study was been conducted at the staff sick bay. This study only included those who were between the ages of 18 and 45 and had low back pain of less than two months duration. On the initial visit, participants underwent a full case history, physical examination and a lumbar spine regional examination. During this process they were screened for lumbar facet syndrome and myofascial pain syndrome. If patients met the inclusion and exclusion criteria, they were requested to sign a letter of informed consent.
Patients with concomitant myofascial pain and dysfunction syndrome of the lumbar region (Travell and Simons, 1999 1:1) were not excluded from this study; however the myofascial component was not specifically treated.

The sample size was limited to 60 patients. Low back pain is a common condition and it was suggested by Myburgh, (1998) that a sample size of 100 would be more representative of the population but the time and financial constraints of this study prevent it. Therefore a sample of 60 participants, twice the number used in Myburghs' study was recruited. This sample group was then divided into two groups of 30 patients each by random allocation, i.e. Group A – Passive Mobilization and Group B – MET. Each patient received four treatments over a two week period with a fifth follow up scheduled one week after treatment ended. Measurements were taken on the first, third and fifth visits.

Subjective data was obtained using the Numerical Pain Rating Scale-101 (NRS) and the Oswestry Low Back Pain and Disability Index (ODI). Objective measurements were taken using the digital Inclinometer which measured lumbar flexion, extension, bilateral lateral flexion and rotation. An Algometer was also used to test the pain threshold at the level of joint fixation. Data obtained from the first visit was compared to those taken on the third and fifth visits.

Results

The hypothesis tested in this study stated that a group of subjects with limited range of motion treated with MET would demonstrate a statistically significant increase in lumbar range of motion and a decrease in pain as compared to subjects being treated with specific passive mobilization. Data analysis was done in SPSS version 11.5 (SPSS Inc., Chicago, Ill, USA).

The treatment effect of the muscle energy technique compared to the passive mobilization was tested using repeated measures ANOVA for each outcome measurement over three time points. Algometer readings were averaged for each time point between the algometer readings at each side (left or right) for each fixation. If the time*group interaction effect was statistically significant ($p<0.005$) a treatment effect was concluded. Repeated contrasts were used to compare the interaction and time effect between time 1 and 2, and between time 2 and 3. The profile plot of the means for the two groups over time was examined for the direction of the treatment effect or to detect any possible trends in the data which may not have been statistically significant. The number of joints fixated was used as a covariate in the models to test whether this factor affected the outcomes.

With respect to over all range of motion, it was noted that there was a decrease in results between the second and third readings for both groups. This indicated a non significant treatment effect. Algometer readings at respective joints decreased over the treatment period. This indicated a statistically significant effect (p=0.002) for both treatment groups over time. There was also a significant decrease in both ODI and NRS measurements for both the groups (p=0.001) which indicated that these scores improved over the treatment period.

Conclusion

It was noted that the treatment effects between the groups were not significant, indicating that there was no additional benefit of MET over passive mobilization.
The treatment was not harmful, but provided as much benefit as the control. Thus subjects who were exposed to passive mobilization recovered to the same extent as those treated with MET. Some objective outcomes showed a trend which suggested that there might have been an interaction if the sample size was larger, but some trends favoured the control group and some favoured the muscle energy group. Thus the conclusion from this research is that there was no difference between the treatments.

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CHAPTER ONE

INTRODUCTION

1.1 THE PROBLEM

The incidence and prevalence of low back pain is roughly the same world over. Such pain ranks high as a cause of disability and inability to work, an interference with the quality of life and a reason for medical consultation (Ehrlich, 2003). Low back pain and disability is getting steadily worse. In western society, simple back strains now disable many more people than all the serious spinal diseases put together (Wadell, 1998: 71).

Mechanical low back pain is a result of the lumbar spines' inherent susceptibility to static loads. These loads are due to muscle action, gravitational forces and abnormal kinematics (Gatterman, 1990: 129). Acute and sub-acute episodes that last up to three months are the commonest presentation of low back pain and recurrent episodes are the norm (Ehrlich, 2003). Kirkaldy-Willis, (1992) classifies low back pain into three stages namely, Dysfunction, Instability and Stabilization.

According to Gatterman (1990: 129), a large percentage of cases of mechanical low back pain respond well to chiropractic management. Furthermore, studies have proven that chiropractic is an effective form of treatment in the management of low back pain (Meade et al., 1995; Koes et al., 1995; Carey et al., 1995).

The use of manipulation for the treatment of low back pain is well documented and it has also been shown that lumbar mobilization can provide short term benefits for patients with acute low back pain (Goodsell et al., 2000; Enebo, 1998). There however remain instances where spinal manipulation is contra-indicated, e.g. general fever, influenza, rheumatoid arthritis, spinal diseases including TB, metastasis, osteomyleitis, advanced osteoporosis, bleeding disorders, instability, fractures, pregnancy, spondylosis and acute discs with advancing neurological signs (Paris, 1983). The author thus suggests that gentle mobilization of the vertebrae be performed as it has fewer specific contra-indications. Hence the motivation to conduct a study in which two forms of spinal mobilization are compared (i.e. an active and a passive technique). MET is used widely in practice, but there also remains little evidence to advocate its use in the form of a randomized clinical trial (Wilson et al., 2003).

By comparing an active to a passive mobilization technique it would provide insight as to which technique would be more beneficial to the patient when manipulation may be contra-indicated.

1.2 THE STATEMENT OF THE PROBLEM

This study proposes to evaluate the relative effectiveness of Muscle Energy Technique (MET), an active technique, as opposed to Specific Passive Mobilization in the treatment of acute and sub-acute mechanical low back pain in terms of subjective and objective clinical findings.

1.2.1 Objective One

The first objective was to record lumbar range of motion and pain tolerance (objective data) before, during and after treatment by MET or passive mobilization.

1.2.2 Objective Two

The second objective was to record pain rating and level of disability (subjective data) before, during and after treatment by MET or passive mobilization.

1.2.3 Objective Three

The third objective was to evaluate the data obtained from objectives one and two, in order to determine whether one of these interventions is more beneficial in treating acute and sub-acute low back pain.

1.3 Definitions

1.3.1 Muscle Energy Technique: According to Greenman (1989) MET is, “ A manual medicine treatment procedure that involves the voluntary contraction of the patients muscle in a precisely controlled direction, at varying levels of intensity against a distinctly executed counter force applied by the operator.”

1.3.2 **Mobilization:** It is a passive movement performed in such a manner (particularly in relation to speed of the movements) that it is, at all times, within the ability of the patient to prevent the movement if he chooses to (Maitland, 2001: 4).

1.3.3 **Acute and Sub-acute:** The Quebec Task Force defines acute as 0-7 days following the onset of symptoms and sub-acute as 7 days to 7 weeks since onset of symptoms (Spitzer et al., 1987).

1.3.4 **Mechanical Low Back Pain:** Pain resulting from inherent susceptibility of the spine to static loads due to muscle and gravitational forces and to kinetic deviation from normal function (Gatterman, 1990: 129). Furthermore, Kirkaldy-Willis classifies uncomplicated mechanical low back pain as pain within the dysfunction stage and specifically posterior facet syndrome of the lumbar spine (Kirkaldy-Willis, 1988: 133-135).

1.3.5 **Disability:** Disability is any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being (Wadell, 1998: 37).

1.4 Potential Benefits of This Study

This study will add to the growing body of knowledge regarding the chiropractic management of acute and sub-acute low back pain by allowing a systematic evaluation of commonly used treatment methods, other than manipulation. The expected outcome of this study was to show whether MET or passive mobilization is more advantageous in the treatment of acute and sub-acute mechanical low back pain and which intervention should be the alternate choice of treatment when manipulation is contra-indicated.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

In this chapter the relevant literature pertaining to this study will be reviewed under the following headings,

2.2 Anatomy and functional biomechanics of the lumbar spine.

2.3 The Quadratus Lumborum muscle and its relation to low back pain.

2.4 The incidence and prevalence of low back pain.

2.5 Contributing and risk factors for low back pain.

2.6 Classification of low back pain.

2.7 Specific Passive Mobilization.

2.8 Muscle Energy Technique.

The following information was obtained from journal articles, published reports, websites and textbooks.

2.2 Anatomy and Functional Biomechanics

2.2.1 Introduction

The spine is an aggregate of superimposed segments that can be termed functional units. The functional unit is composed of two adjacent vertebral bodies, separated by an intervertebral disc. The anterior segment of this functional unit is essentially a supporting, weight-bearing, shock absorbing, flexible structure. The posterior segment of the functional unit is a non-weight bearing structure that contains and protects the neural structures of the CNS as well as the facet joints that function to direct the movement of the spine. Each functional unit contains all the tissues needed for total function including muscles and ligaments. Four of these functional units constitute the lumbar spine. Impairment of any part of this unit may lead to functional impairment of the total system (Calliet 1991: 1).

2.2.2 The Lumbar Vertebrae

There are five lumbar vertebrae that increase in size from L1 to L5. The lumbar vertebral body is a kidney shaped structure, with vertebral foramina on its surface varying from an oval to triangular shape. Each vertebral body is made of a dense cancellous bone, enclosed in a thin cortical shell, which is pierced on its front and sides by multiple small foramina for arterial supply and venous drainage. The vertebral end plates on the superior and inferior surface of the vertebral bodies are flat and rough with a smooth peripheral ring.

The vertebral arch is a horse shoe shaped structure. Two broad, flat laminae project directly posteriorly from the pedicles and blend in the mid-line to form a flat, broad, rectangular shaped spinous process. The paired transverse processes project laterally and slightly posteriorly from the junction of the pedicles and laminae. The paired superior processes have a slightly concave articular surface and face posteromedially. The paired inferior processes have a slightly convex articular surface and point anterolaterally (Moore, 1992: 327-350; Kirkaldy-Willis, 1992: 7).

2.2.3 Stability of the lumbar spine

Ligaments provide structural stability to the spine. They are passive elastic structures that prevent excessive motion. The posterior and anterior longitudinal ligaments support the vertebral body and discs. The ligamentum flavum is very strong and elastic and lengthens with flexion and shortens with extension. The strongest ligamentous structure; however are the capsular ligaments that surround the facet joints. Other ligamentous support includes the supraspinous, interspinous and intertransverse ligaments.

Muscles are also important spinal stabilizers. They position and stabilize the spine during awkward postures and provide power for lifting and carrying. These include flexors, extensors and lateral flexors (Kirkaldy-Willis, 1992: 29-31).

2.2.4 The Facet Joints

These are plane synovial joints formed by the superior articular process of one vertebra and the inferior articular process of the vertebra above it. They permit gliding movements between vertebrae. The articulating surfaces are covered by hyaline cartilage. A thick fibrous capsule surrounds the dorsal aspects of these joints, whereas the ventral aspect is made up of an extension of ligamentum flavum (Moore, 1992: 347).

2.2.4.1 Innervation of facet joints

Facet joints are innervated by nerves that arise from medial branches of the dorsal primary rami of spinal nerves. As these nerves pass posteroinferiorly, they lie in grooves on the posterior surfaces of the medial parts of the transverse processes. Each articular branch supplies the joint nearby, and may send branches to the sub-adjacent joints as well (Moore, 1992: 347-348).

2.2.4.2 Biomechanics of facet joints

These joints are important in resisting torsion, shear and compressive stresses. Facet joints and discs together provide approximately 80% torsional resistance, half this amount is provided by facet joints. They also bear 25% axial compressive loads. The load bearing of a facet joint however depends on whether the motion segment is loaded in flexion or extension. Excessive loading in extension may lead to pars failure and spondylosis (Kirkaldy-Willis, 1992: 28).

2.3 The Quadratus Lumborum Muscle and its Relation to Low Back Pain

Kravitz et al., (1981) found that there were high levels of paralumbar muscle tension in patients with low back pain. The way in which muscles tend to react, either by over activation and tightness or by inhibition and weakness, appears to be fairly consistent for the particular muscle concerned (Twomey & Taylor, 1987: 257). Muscles which have a tendency to become tight are usually those that span more than one joint namely, quadratus lumborum and erector spinae (especially lumbar and thoracolumbar segments). Any acute pain in the lumbar motion segment can initiate muscle responses which, if they persist, can alter the patients' pattern of movement and in turn perpetuate adverse strains on the lumbar spine (Twomey & Taylor, 1987: 257).

The most commonly overlooked muscular source of low back pain is the Quadratus Lumborum muscle (Travell & Simons, 1999). De Franca et al., (1991) concluded that joint and muscle dysfunctions occur together and need to be addressed together. He also stated that a taut and painful quadratus lumborum as well as articular dysfunction in the lumbar spine requires appropriate therapy in order to provide relief and restore function.

The quadratus lumborum has three distinct fibre groups namely, iliocostal, iliolumbar and lumbosacral. The latter two groups are attached to the transverse processes of the lumbar vertebrae and provide segmental control of the movement and curvature of the lumbar spine (Travell & Simons, 1999). The MET technique that was used in this study caused isometric contraction of quadratus lumborum at the level of restriction in the lumbar spine. This caused the muscle to act as a lever, pulling on its attachment to the transverse processes to move one vertebra in relation to its counterpart, and restore normal joint range of motion (Edward, 1993).

2.4 The Incidence and Prevalence of Low Back Pain

A large number of international studies show that 17 to 31% of people report back pain on initial interview, 19 to 43% report having back pain of one month duration and approximately 60 to 70% report back pain at some point in their life (Wadell, 1998: 71). A survey conducted on the prevalence of low back pain in the general population of South Manchester, revealed that 35% of the male participants and 42% of female participants experienced low back pain of one month or longer duration (Papageorgiou et al., 1995).

Acute and sub-acute episodes that last up to three months are the commonest presentation of low back pain and recurrent episodes are the norm (Ehrlich, 2003). In 1995 acute low back pain was the fifth most common reason for all physician visits in the United States. Of these visits, 57% of patients presented with non-specific low back pain (Deyo et al., 1995). Significant costs in both treatment and decreased work productivity results in more than 25 billion dollars being spent in the United States on the management of lower back pain each year (Carey et al., 1995).

In 1997, van der Meulen conducted an epidemiological investigation on low back pain in a formal Black South African township. This study revealed that the lifetime incidence of low back pain amongst Black South Africans within the greater Durban area was 57.6%. In 1999, Docrat conducted a similar study in an Indian and Colored community in the greater Durban area and found that the lifetime incidence of low back pain amongst Indians was 78.2% and Coloreds 76.6%.

2.5 Factors Contributing to Low Back Pain

Although no single factor has been identified as the primary etiological cause of low back pain, there seems to be a correlation between the following factors.

Occupational Factors

It has been found that an increase in absence from work because of low back pain is associated with the following factors: physically heavy work, prolonged static work postures, frequent bending and twisting, lifting and forceful movements, repetitive work and vibrations. These factors all increase the load on the spine and often more than one factor is present at the same time (Andersson et al., 1981).

Individual Factors

Age and Sex: Deyo et al. (1995) found that the number of visits to physicians for low back pain over a two year period was 15,352 in females older than 15 and 15,112 in males over the age of 15. Hence low back pain is common in both sexes with only a slight difference in incidence and prevalence between the two.

Anthropometric factors: Thus far data has shown that there is no strong correlation between height, weight, body build and low back pain. However, tallness and obesity seem to carry a higher than average risk of back pain (Frymoyer et al., 1983).

Muscle Strength and Physical Fitness

Abdominal and back muscle strength and tone, a sedentary lifestyle and certain sports may also increase the loading on the lumbar spine (Frymoyer et al., 1980).

Psychological and Social Factors

Anxiety, stress, depression, poor intellectual capacity and a decreased ability to establish emotional contacts were found to be common in back pain sufferers. Social factors such as poor socioeconomic situations, drug and alcohol abuse, divorces, family disputes, poor education levels, and smoking are also factors that contribute to low back pain (Andersson et al., 1981).

Radiological Factors

Low back pain appears to be more frequent in subjects with severe degenerative changes involving the intervertebral discs. The following factors have also been shown to increase the prevalence of low back pain: Spondylolisthesis, Lumbarization and Sacralization, Osteoarthritis of facet joints, advanced Osteoporosis with macro and micro type fractures is also known to be painful.

Skeletal deformities such as scoliosis, kyphosis, hypolordosis, hyperlordosis and leg length discrepancy do not seem to predispose to low back pain in general but a scoliosis with vertex greater than 80 degrees in the lumbar spine does increase the risk of low back pain (Andersson et al., 1981; Frymoyer et al., 1983).

2.6 Classification of Low Back Pain

The three phases of degeneration utilized to classify low back was set out by Kirkaldy-Willis (1992: 105) and has been used in this study.

2.6.1 Phase One: Dysfunction phase

Most patients with low back pain present in this phase of degeneration. Pathology is usually minor and reversible. It is commonly associated with rotational or compressive strain, pain after an unusual activity or it may be a recurrence of pain due to a minor episode of trauma.

Pathophysiological mechanism:

An episode of trauma causes posterior joint and annular strain, which result in small capsular and annular tears. This in turn results in minor joint subluxation. The posterior joints' synovium becomes inflamed, known as a synovitis. Muscles surrounding the area go into protective spasm. This sustained contraction produces metabolites, which enhances pain and promotes sustained contraction, hence the subluxation is maintained.

Symptoms experienced during phase one

The pain is unilateral and often localized to one area but can also be referred to the groin, greater trochanter, posterior thigh to the knee, but rarely past the knee. The pain is also relieved by rest and aggravated by movement.

Signs observed during phase one

There is local muscle tenderness. Muscles are hypertonic which results in abnormal lateral bending. Patients present with hypomobility especially in extension and movement is painful. It is also possible to have a functional scoliosis and static palpatory spinous deviation.

2.6.2 Phase Two: Instability Phase

This phase may either be similar to that described in the dysfunction phase or it may be chronic and insidious without any recorded history of minor trauma.

Pathophysiological mechanism:

Further episodes of trauma and continuing stress causes further dysfunction. Changes that occur in the facet joints include: degeneration of the cartilage, stretching or attenuation of the capsule and thus laxity of the capsule. Changes seen in the disc include: coalescence of tears, loss of nuclear substance with internal disruption and bulging of the annulus around the circumference of the disc. This results in a detectable increased abnormal movement in the functional units of the lumbar spine.

Symptoms experienced during phase two

Patients may state that their back feels weak, as if it’s going to give way or they may feel a catch in the back on certain movements. Symptoms may also be similar to that of severe dysfunction.

Signs observed during phase two

There is an increase in abnormal movement between two vertebrae. It is possible to palpate the spinous processes with excess movement on bending and straightening.

2.6.3 Phase Three: Stabilization Phase

This phase develops in response to the instability of the spine. It usually occurs in older people with a long history of low back pain. Back pain is associated with degeneration, scoliosis and abnormal muscle action. Leg pain is often a predominant feature.

Pathophysiological mechanism:

Destruction of articular cartilage, fibrosis and enlargement and locking of the facets result in stiffness in the posterior joints. Within the discs there is loss of nuclear material. This is accompanied by fibrosis and osteophyte formation around the periphery of the disc. There is also destruction of vertebral endplates and approximation of vertebral bodies. Occasionally two vertebrae may be joined by bony ankylosis.

Symptoms experienced during phase three

Frequently, low back pain that was severe in the past becomes less incapacitating. Painful episodes may occur from time to time but are often muscular in origin.

Signs observed during phase one

There may be muscle tenderness and stiffness. Reduced movement in all directions. There may be a scoliosis, often with a rotational component. It is also possible to observe signs of a nerve root entrapment. Back pain may not be the predominant symptom, but leg pain with altered sensation and muscle weakness may be severe.

2.7 Specific Passive Mobilization

Joint mobilization is a form of manual therapy that involves low velocity passive movements within or at the limit of joint range of motion (Di Fabio, 1992). In practice, approximately 85% of patients successfully treated will respond to mobilization, leaving 15% requiring stronger manipulative techniques (Maitland et al., 2001). Grieves (1991: 177), defines passive mobilization as the attempted restoration of full, painless joint function by sustained rhythmic, repetitive passive movements to the patients tolerance, in voluntary and or accessory range. These movements are graded according to examination findings and the patient is at all times able to stop the movement if so wished.

Palastanga and Boyling (1994: 646) postulated that mobilization has the following effects:

1. It effects the hydrostatics of the discs and the vertebral bodies.
2. It activates the Type I and Type II mechanoreceptors in the capsule of the facet joint influencing the spinal gating mechanism.
3. It alters the activity of the neuromuscular spindles in the intrinsic muscles of the segment subsequently affecting bias in the gray matter cells.

4 It assists in the pumping effect on the venous plexus of the vertebral segments.

Studies Involving Passive Mobilization

Brodin, (1984) conducted a randomized controlled trial on patients suffering from mechanical neck pain. A sample population of 63 patients was divided into three groups, namely a control group receiving no treatment, an experimental group receiving passive mobilization without thrusting and a third group receiving massage, gentle traction and electric stimulation. Results showed that a week after treatment ended 48% of the mobilization group, 22% of the control group and 12% of the massage group were symptom free. Overall, 78% of the mobilization group experienced a decrease in pain as compared to 39% of the control group and 35% in the massage group ($p<0.05$). Cervical ranges of motion were found to be significantly increased in the mobilization group as compared to the other two groups at the end of treatment ($p<0,001$), but this difference was not as significant after the 4^{th} week ($p<0.1$).

The author thus concluded that mobilization was an effective form of treatment for mechanical neck pain, and although cervical range of motion increased initially, it tended to decrease once treatment ended. He also remarked that a relationship between increased mobility of the cervical spine and a decrease in pain could not be established in the outcome of patients suffering from mechanical neck pain.

Goodsell et al., (2000), conducted a crossover study to determine the short-term effects of lumbar posteroanterior mobilization on patients with low back pain. Twenty-six patients with non-specific low back pain were randomly divided into two groups. Both groups received the lumbar mobilization and a control intervention of prone lying for three minutes. Analysis of data revealed no significant differences between the mobilization and control interventions in relation to the posteoanterior response or range of movement. However, the score for pain on the worst movement showed significantly greater improvement for the mobilization than for the control intervention. The authors thus concluded that the lumbar posteroanterior mobilization did not produce an objectively measurable change in the mechanical behavior of the lumbar spine, but the subjective pain experience in patients with low back pain did improve. They further attributed the improvement in some pain variables to the placebo effect. The shortcomings of this study were that no restriction was placed on the patients ages, or duration of symptoms. The custom made stiffness measuring device, which was an oil-filled pendulum inclinometer modified by the research team, was not independently tested for validity, further highlighting the poor research design.

More recently, Hurley et al. (2004) conducted a descriptive study on the usage of spinal manipulative therapy (SMT) within a randomized clinical trial on acute low back pain. In this study, 240 patients with acute low back pain (4-12 week duration) were treated by one of 16 physiotherapists. Patients were randomly allocated to one of six groups. The three treatment groups received Maitland mobilization, Cyriax manipulation or a combination of both. The other three groups received one of these treatments together with Interferential Therapy (IFT). The majority of patients received mobilization rather than manipulation within this trial. In the manual therapy groups 34 out of 74 patients received mobilization alone and in the combined therapy groups, 25 out of 72 patients received mobilization with IFT.

Outcomes were evaluated in terms of the mean change in the primary outcome measure, the Roland Morris Disability Questionnaire (RMDQ). Regardless of the type of SMT treatment, subjects experienced clinically significant improvement of at least 4 points on the RMDQ at the end of treatment and at a 12 month follow up there were no significant differences detected between the SMT groups.

2.8 Muscle Energy Technique

The inception of MET as one of the disciplines under the broad umbrella of manual therapy in the 1940's is attributed to Fred Mitchell SR, an osteopath. This approach targets soft tissues primarily while at the same time making a major contribution towards joint mobilization (Chaitow, 1996). Greenman (1989), states that MET can restore the normal length tension relationships to shortened, contracted or spastic muscles, strengthen weak muscles and decrease edema by acting as a pump for the lymphatic system. It can also restore mobility to hypomobile joints. There however remains little clinical evidence to support these claims, hence they remain anecdotal.

According to Chaitow (1996), the following are classified as muscle energy techniques: reciprocal inhibition, post-isometric relaxation and joint mobilization. The latter will be investigated in this study. For the purpose of mobilizing a joint, the joint is put in a specific position to facilitate optimum contraction of a particular muscle or muscle group. The patient is asked to contract the muscle against counter pressure, thus causing the muscle to contract isometrically. This causes the muscle to pull its the bony attachment, thus moving one bone in relation to its articulating counterpart, hence restoring normal joint range of motion. MET has the advantage of allowing the patient to control the movement, so if too much pain is reproduced by this technique, the patient can terminate the procedure (Edward, 1993). This form of concentric isotonic contraction of muscles separates MET from Post Isometric Relaxation, in which isometric contractions and subsequent muscle stretching restores its normal length (Schneider et al., 1988: 10). Concentric isotonic contractions are made against progressively increasing resistance resulting in increased muscle tone, strength, inhibition of antagonistic muscle activity, and mobilization of fixated joints (Greenman, 1996: 94-95).

Studies Involving Muscle Energy Technique

Schenk et al., (1994) tested the efficacy of MET on cervical range of motion in patients that were pain free. The treatment group showed a significant improvement in cervical range of motion in both left and right rotation in comparison to the placebo group. However, no conclusion could be drawn about the effect of MET on neck pain itself as all the participants were pain free. Furthermore, this study was non-parametric thus a conclusion about the general population could not be made. Schenk et al., (1997) conducted a second randomised clinical trial on asymptomatic patients with restricted lumbar range of motion. Twenty-six subjects (13 males and 13 females), between the ages of 18 and 40 were recruited and assessed for limited active lumbar range of motion. If a limitation was present the subject was randomly assigned to either the control group or experimental group. The treatment group underwent MET for limitation of lumbar extension. It was found that the average range of lumbar extension for the MET group pre-test was 13,8° and 20,7° post test and for the control group 17,1° pre test and 16,17° post test. This study was however, conducted on an asymptomatic population therefore the results of this study cannot be generalized to the symptomatic population. A potential flaw in this study is that a researcher bias may have existed in the measurement of range of motion. It was suggested by the authors that a future double blind study would eliminate this potential bias and that enhanced research involving symptomatic individuals, will further determine the effectiveness of MET.

Scott Dawkins, (1996) conducted a clinical trial comparing the effectiveness of manipulation to MET in the treatment of chronic mechanical neck pain. Initially the manipulation group showed greater reduction in pain whereas the MET group showed a more gradual improvement over the three-week treatment period. However, at the end of treatment, a further three-week follow up period revealed no statistically significant difference between both groups. The shortcomings of this study was that it was non parametric and the criteria for patient selection was poorly defined in terms of acute, sub-acute and chronic presentations. Hence the researcher suggested that further studies involving MET should incorporate a larger sample size and a placebo control.

Boodhoo, (2002) evaluated the efficacy of MET compared to detuned laser in the treatment of chronic mechanical neck pain. Sixty patients were recruited and if they met the inclusion criteria they were randomly allocated to either the MET or placebo group. Group A received MET together with detuned laser to the fixated levels. Group B received detuned laser only to the fixated levels. From the data, group A showed a statistically significant improvement in all ranges of cervical motion and pain intensity from visit one to six hence suggesting that MET is effective in treating chronic mechanical neck pain. The author does however suggest further research to be conducted in this field.

A more recent study involving MET was conducted by Wilson et al., (2003), on patients with acute lower back pain. The control group received supervised neuromuscular re-education and resistance training while the experimental group received the same exercises coupled with MET. A 2-tailed *t* test ($P<.05$) demonstrated a statistically significant difference with the experimental group showing a greater improvement in the Oswestry Disability Index score than the control group. The data from this study also suggests that a relatively small number of MET interventions (range 2-4) can result in a significantly greater reduction in self-reported disability and that it would be interesting to compare the number of MET interventions with other manual therapy interventions on patient outcomes in future studies.

CHAPTER THREE

MATERIALS AND METHODS

Introduction

This chapter outlines the methodology utilized to conduct this study. It includes patient selection criteria, intervention as well as measurements. The statistical procedures conducted will also be discussed.

3.2 The Data

The data used in this study were primarily of two types: primary and secondary data.

3.2.1 The Primary Data

The primary data was obtained directly from the patients and consisted of the following:

1. Information gathered from a case history (Appendix A), physical examination (Appendix B) and lumbar regional examination (Appendix C).
2. The patients' pain sensitivity was measured by means of an Algometer (Appendix F).
3. The patients perceived level of pain as indicated on the Numerical Pain Rating Scale 101 (Appendix D).
4. The level of disability perceived by patients as indicated on the revised Oswestry Low Back Pain and Disability Index (Appendix E).

5. The patients' range of motion was measured by means of a digital inclinometer (Appendix F).
6. Findings from orthopaedic tests used to diagnose lumbar facet syndrome:

Kemps test and Facet joint challenge.

3.2.2 The Secondary Data

The secondary data was obtained from a review of related literature, which included journal articles, textbooks and published reports containing information relevant to this study.

3.3 Criteria Governing the Admissibility Of Data

The only subjective data that was admitted to this study came from the Numerical Pain Rating Scale 101 and the revised Oswestry Low Back Pain and Disability Index, which were both completed by the patient under the supervision of the researcher.

The only objective data that was admitted to this study was obtained from algometer and inclinometer readings and the orthopaedic tests for lumbar facet syndrome. The researcher documented these findings.

3.4 Research Methodology and Materials Used

The objective of this study was to compare MET to specific passive mobilization in terms of objective and subjective clinical findings, in order to determine which intervention is more effective in treating acute and sub-acute low back pain.

3.4.1 Patient Selection

Advertisements

Adverts were placed in local newspapers. Flyers were also posted around DIT campus, clinics, gyms, pharmacies. These adverts called upon people who had low back pain of less than two months duration, and were between the ages of 18 and 45. Due to a poor response and lack of patient compliance the remaining half of this study was conducted on the staff at R.K Khan Hospital. Circulars were sent out to each department notifying the staff that this study was being conducted at the staff sick bay.

Telephonic Interviews

Upon reply interested participants were interviewed telephonically to see if they met the inclusion criteria, thereafter an appointment was made.

Initial Consult

On the initial visit participants underwent a full case history (Appendix A), physical examination (Appendix B) and a lumbar spine regional examination (Appendix C). During this process they were screened for lumbar facet syndrome and myofascial pain syndrome. If patients met the inclusion and exclusion criteria, they were requested to sign a letter of informed consent (Appendix G).

Patients with concomitant myofascial pain and dysfunction syndrome of the lumbar region (Travell and Simons 1999, 1:1) were not excluded from this study, however the myofascial component was not specifically treated.

The orthopaedic tests used to specifically diagnose lumbar facet syndrome were Kemps test and facet joint challenge.

Kemps Test was conducted whilst the patient was seated with the examiner standing behind the patient. The examiner reached around the patients' shoulders and upper chest from behind so as to support and control the patient. The patient was then instructed to lean forward to one side and then to bend obliquely backward as far as possible. At this point the examiner applied axial pressure so as to compress the side of rotation. If this maneuver produced or aggravated pain over the local spinal segment(s) it was indicative of a lumbar facet syndrome (Schafer and Faye, 1989: 208-

209).

Lumbar Facet Joint Challenge was carried out with the patient lying prone. The examiner contacted one lumbar spinous process with the thumb of one hand and the spinous process above or below with the thumb of the other hand. The examiner then applied lateral forces in opposite directions. If no pain was noticed initially then the examiner applied a slightly greater force thereby bouncing the joints. The aim of this test was to note " springiness" or joint play. In a normally functioning joint this joint play should never have a hard end feel. A loss of springiness with or without pain indicated a lumbar facet syndrome (Gatterman, 1990: 84)

<u>Sample Size</u>

The sample size was limited to sixty patients. Low back pain is a common condition and it was suggested by Myburgh, (1998) that a sample size of a hundred would be more representative of the population but the time and financial constraints of this study prevented it. Therefore a sample of sixty participants, twice the number used in Myburghs' study was recruited. This sample group was then divided into two groups of thirty patients each by random allocation, i.e. Group A – Passive Mobilization and Group B – MET.

<u>Randomization</u>

Sixty pieces of paper were put into a hat. Thirty pieces with the letter A on them and thirty with the letter B. Each patient was required to draw out one piece of paper, which then determined which treatment group they would be allocated to. By using this method, each patient had an equal chance of being allocated to either group A or B.

3.4.2 Inclusion Criteria

1 Patients with low back pain of two months or less duration.
2 Pain confined to the lumbar region without radiation to the buttock and lower extremities. This served mainly to exclude pain arising from the sacroiliac joint and muscles in the gluteal region.
3 Patients aged from 18 to 45 years.
4 Decreased lumbar range of motion.
5 An initial pain rating score of 5-10 on the numerical pain rating scale.

3.4.3 Exclusion Criteria

1 The sample excluded patients who presented with parasthesias and numbness, motor weakness, absent or diminished muscle reflexes.
2 Patients with spondylolisthesis, previous back surgery or a history of trauma to the lower back were excluded.
3 The study also excluded patients with any organic pathology that may have contributed to low back pain.
4 Patients who received other forms of treatment for low back pain including massage, manipulation, electrotherapeutic or electromagnetic treatment, acupuncture, traction, low back exercises and those on any form medication, including topical rubs. This was done to limit the number of variables in the study and increase the validity of results.
5 Patients, who refused to sign the informed consent form (Appendix G), were automatically excluded.
6 Patients who engaged in activities that varied from their normal daily routine were also excluded.
7 Chiropractic students from fourth to sixth year were excluded, and the sample included no more than 10% of first to third year students.

3.5 Intervention

3.5.1 Specific Passive Mobilization

Maitland (1986: 41) classifies mobilization into two types:

1. Passive Oscillatory Movements and,
2. Sustained Stretching.

Passive oscillatory movements may be performed slowly (one in two seconds), or quickly (three per second), smooth or staccato, with a small or large amplitude applied to any part in the total range of motion. These movements may be performed while the joint surfaces are distracted or compressed. Sustained stretching movements, on the other hand, may be performed with or without tiny amplitude oscillations at the limit of range of motion.

Maitland grades mobilization as the following:

Grade 1: A small amplitude movement or oscillation at or near the beginning of range of motion.
Grade 2: A large amplitude movement or oscillation that is into the restricted range of motion but does not engage the barrier.
Grade 3: A large amplitude movement or oscillation that is into the restricted range of motion and engages the barrier.
Grade 4: A small amplitude movement or oscillation at the restrictive barrier.
(Maitland 2001: 96, Grieves 1991: 177-183)

Patients were briefly educated on the mobilization technique and what to expect during the procedure i.e. pressure over the painful area with a possibility of discomfort during the mobilization. Patients were instructed to inform the researcher of any pain or discomfort experienced, as this subjective feedback was important in determining the grade of mobilization used.
Appendix I outlines the procedure used.

3.5.2 Muscle Energy Technique

Wilson et al., (2003) found that the mean number of MET treatments required in the experimental group was three, with a range of two to four treatments. This data suggested that a relatively small number of MET interventions could result in a significantly greater reduction in self-reported disability. They thus suggest that the same number of MET treatments should be compared to the same number of manual therapy interventions, and the outcomes of each should be compared. Therefore, in this study, each patient received four treatments over a two-week period, i.e. one treatment every alternate day as suggested by Wilson, (2003). A fifth visit was scheduled one week after treatment ended as there are times when improvement is only evident two weeks after treatment began (Maitland, 2001).

Patients were given a brief explanation on the procedure of MET and were made aware of the potential discomfort they may experience i.e. pressure at the point of contact, discomfort or pain during or after the treatment due to muscle stretching. They were also told that if the mobilization was too painful, they should resist the movement with less strength so as to minimize the discomfort during the procedure.
Appendix J outlines the procedure of MET used.

3.6 Methods of Measurement

The subjective and objective measurements were taken on the first, third and fifth consults, prior to any treatment given.

3.6.1 Subjective data was obtained from groups A and B using:

3.6.1.1 Numerical Pain Rating Scale 101 (NRS 101)

The NRS 101 has been found to be a practical, reliable and valid method to measure clinical pain intensity (Jenson et al., 1986). Patients were instructed to record their pain when it was at its least and when it was at its worst on a scale of zero to one hundred. A zero would indicate, “no pain” and one hundred would mean, “pain as bad as it could be". By averaging the two scores an accurate assessment of pain could be obtained (Jenson et al., 1986). (Appendix D)

3.6.1.2 The Revised Oswestry Low Back Pain and Disability Questionnaire

In a recent review the ODI was shown to be a valid and vigorous measure (Fairbank and Pynsent, 2000). In each section of six statements the total score is five. If the first statement was marked, the score = 0, if the last statement was marked the score = 5. Intervening statements are scored according to rank. If more than one box was marked in each section, then the highest score was taken. The total scored out of fifty possible points was then converted to a percentage (Fairbank and Pynsent, 2000). (Appendix E)

3.6.2 Objective data will be obtained from groups A and B using:

3.6.2.1 The Digital Inclinometer

This instrument was found to be a highly reliable and valid tool to measure lumbar mobility (Saur et al., 1996). The following p-values were presented in this study. Total lumbar range of motion (r =0.94; p<0,001), flexion (r = 0,88; p<0,001) and extension (r = 0,42: p<0,05) were closely related as indicated by inter-rater correlation.

The procedures listed in the users' manual were followed to measure lumbar flexion, extension, bilateral lateral flexion and rotation. The degrees of motion were noted and recorded on the patients' data sheet. (Appendix F)

The instrument used in this study was the Saunders Digital Inclinometer. The Saunders Group Inc. 4250 Narex Drive, Chask, Minnesota. 5531-3047 USA.

3.6.2.1 The Algometer

The algometer was shown to be a reliable tool to test pain threshold (Fischer, 1987). Fischer further defined the pressure threshold as the minimum amount of pressure required to cause pain. The applicator tip was placed over the level of joint dysfunction as determined by motion palpation of the lumbar spine. Pressure was applied to the point until the patient responded. The reading at this point was recorded and was compared to readings taken on third and fifth visits. (Appendix F)

The instrument used in this study was the Force Dial, manufactured by Wagner Insturments: P.O Box 1217, Greenwich CT 06836, USA. The pressure range of the algometer was 11 kilograms.

2.7 Statistical Analysis

Data analysis was done in SPSS version 11.5 (SPSS Inc., Chicago, Ill, USA). Age and gender were compared between the two treatment groups using a chi square test and an independent t-test respectively. The number of fixations was compared between the treatment groups using a non-parametric Mann-Whitney test for ordinal data.

The treatment effect of the muscle energy technique compared to the passive mobilization was tested using repeated measures ANOVA for each outcome measurement over three time points. Algometer readings were averaged for each time point between the algometer readings at each side (left or right) for each fixation. If the time*group interaction effect was statistically significant ($p<0.005$) a treatment effect was concluded. Repeated contrasts were used to compare the interaction and time effect between time 1 and 2, and between time 2 and 3. The profile plot of the means for the two groups over time was examined for the direction of the treatment effect or to detect any possible trends in the data which may not have been statistically significant. The number of joints fixated was used as a covariate in the models to test whether this factor affected the outcomes.

CHAPTER FOUR

THE RESULTS

4.1 Introduction

This chapter illustrates the results obtained following statistical analysis of the data collected in this study. This data includes the demographic aspect of this study as well as the subjective and objective data obtained from patients, namely:

- Inclinometer readings of lumbar range of motion.
- Algometer readings of pain threshold at the levels of fixation.
- Scores of the Oswestry Disability Index.
- Ratings of pain on the NRS-101.

These results have been tabulated and where appropriate, shown in the form of a graph. The demographic data illustrates the differences in age and gender between Group A and Group B. The results of comparing those that had the same number of fixations present have also been tabulated. For the subjective and objective data, the following abbreviations were used. **Time** represents the changes in both groups over time. **Time*group** indicates the treatment effect, i.e. if there was any significant interaction between both groups in terms of effectiveness of the treatment over time. **Time*fixation** shows whether there was any significant changes in results according to those who had the same number of joints fixated. **Group** indicates the change in both groups regardless of time. **N** indicates the sample size and **P-value** shows the level of significance.

4.2 Demographics and Baseline Factors

Table 1: Comparison of the proportion of males and females in each treatment group (n=60)

			Group		Total
			A-passive mobilization	B-muscle energy group	
SEX	Male	Count	14	9	23
		%	60.9%	39.1%	100.0%
	female	Count	16	21	37
		%	43.2%	56.8%	100.0%
Total		Count	30	30	60
		%	50.0%	50.0%	100.0%

Fisher's exact p=0.288

Table 2: T-test for the comparison of mean age between the two groups (n=60)

	group	N	Mean	Std. Deviation	Std. Error Mean	P value
AGE	A-passive mobilization	30	31.800	7.6582	1.3982	0.176

	B-muscle energy group	30	34.233	6.0097	1.0972	

Table 3: Mann-Whitney test for comparison of median number of fixations between the two groups (n=60)

	group	N	Mean Rank	Sum of Ranks	P value
Number of fixations	A-passive mobilization	30	27.40	822.00	0.152
	B-muscle energy group	30	33.60	1008.00	
	Total	60			

4.3 Objective Data

4.3.1 Inclinometer Outcomes

4.3.1.1 Flexion

Table 4: Within and between-subjects effects for Flexion

Effect	**Overall effect**		**Repeated contrasts**	
	Statistic	**P value**	**Time1 vs. 2**	**Time2 vs. 3**
Time	Wilk's Lambda =0.980	0.568	0.601	0.447
Time*group	Wilk's Lambda =0.973	0.459	0.668	0.816
Time* fixations	Wilk's Lambda =0.994	0.856	0.312	0.323
Group	F=0.543	0.464		

There was no evidence of a treatment effect for the outcome of flexion (p=0.459). This interaction was not significant between any time points. There was also no significant change over time in general (p=0.568). The number of fixations did not influence the outcome at all (p=0.856).

4.3.1.2 Extension

Table 5: Within and between-subjects effects for Extension

Effect	Overall effect		Repeated contrasts	
	Statistic	P value	Time1 vs. 2	Time2 vs. 3
Time	Wilk's Lambda =0.967	0.393	0.707	0.178
Time*group	Wilk's Lambda =0.991	0.786	0.187	0.258
Time* fixations	Wilk's Lambda =0.963	0.355	0.312	0.323
Group	F=0.000	0.984		

Extension did not show a treatment effect overall (p=0.786), nor between the various time points.

4.3.1.3 Right Lateral Flexion

Table 6: Within and between-subjects effects for Right lateral flexion

Effect	Overall effect		Repeated contrasts	
	Statistic	P value	Time1 vs. 2	Time2 vs. 3
Time	Wilk's Lambda =0.998	0.958	0.802	0.988
Time*group	Wilk's Lambda =0.926	0.117	0.041	0.529
Time* fixations	Wilk's Lambda =0.915	0.083	0.060	0.821
Group	F=0.691	0.409		

The overall treatment effect was not quite significant (p=0.117), however, the treatment effect between time 1 and time 2 was statistically significant (p=0.041).

4.3.1.4 Left Lateral Flexion

Table 7: Within and between-subjects effects for left lateral flexion

Effect	Overall effect		Repeated contrasts	
	Statistic	P value	Time1 vs. 2	Time2 vs. 3
Time	Wilk's Lambda	0.240	0.274	0.135

	=0.950			
Time*group	Wilk's Lambda =0.960	0.319	0.130	0.859
Time* fixations	Wilk's Lambda =0.953	0.262	0.898	0.103
Group	F=0.390	0.535		

There was no evidence of a treatment effect for left lateral flexion (p=0.319).

4.3.1.5 Right Rotation

Table 8: Within and between-subjects effects for right rotation

Effect	Overall effect		Repeated contrasts	
	Statistic	**P value**	**Time1 vs. 2**	**Time2 vs. 3**
Time	Wilk's Lambda =0.950	0.240	0.274	0.135
Time*group	Wilk's Lambda =0.960	0.319	0.130	0.859
Time* fixations	Wilk's Lambda =0.953	0.262	0.898	0.103
Group	F=0.390	0.535		

Table 8 shows that there was no statistical evidence for a treatment effect for right rotation (p=0.319).

4.3.1.6 Left Rotation

Table 9: Within and between-subjects effects for left rotation

Effect	Overall effect		Repeated contrasts	
	Statistic	**P value**	**Time1 vs. 2**	**Time2 vs. 3**
Time	Wilk's Lambda	0.008	0.003	0.444

	=0.843			
Time*group	Wilk's Lambda =0.965	0.368	0.156	0.466
Time* fixations	Wilk's Lambda =0.966	0.382	0.169	0.390
Group	F=0.187	0.667		

The change in mean left rotation over time was statistically significant overall regardless of which group the subject belonged to (p=0.008), but the significance lay in the change between time 1 and 2 (p=0.003). There was no significant treatment effect (p=0.368).

4.3.2 Algometer Outcomes

Table 10: Within and between-subjects effects for algometer readings.

Effect	**Overall effect**		**Repeated contrasts**	
	Statistic	**P value**	**Time1 vs. 2**	**Time2 vs. 3**
Time	Wilk's Lambda =0.800	0.002	0.073	0.005
Time*group	Wilk's Lambda =0.991	0.786	0.774	0.500
Time* fixations	Wilk's Lambda =0.979	0.557	0.992	0.282
Group	F=0.260	0.612		

Algometer readings showed a significant increase over time in both groups (p=0.002). However there was no treatment effect (p=0.786), and Figure 7 shows parallel profiles of the two groups over time.

4.4 Subjective Data

4.4.1 Oswestry Disability Index (ODI)

Table 11: Within and between-subjects effects for ODI

Effect	Overall effect		Repeated contrasts	
	Statistic	**P value**	**Time1 vs. 2**	**Time2 vs. 3**
Time	Wilk's Lambda =0.775	0.001	0.109	0.003
Time*group	Wilk's Lambda =0.991	0.767	0.635	0.253
Time* fixations	Wilk's Lambda =0.977	0.517	0.992	0.282
Group	F=0.698	0.407		

There was a significant decrease in mean ODI measurement in both groups (p=0.001). However there was no significant treatment effect (p=0.767) and this is confirmed by Figure 8 which shows parallel profiles over time.

4.4.2 Numerical Pain Rating Scale (NRS-101)

Table 12: Within and between-subjects effects for NRS

Effect	Overall effect		Repeated contrasts	
	Statistic	**P value**	**Time1 vs. 2**	**Time2 vs. 3**
Time	Wilk's Lambda =0.770	0.001	0.045	0.064
Time*group	Wilk's Lambda =0.984	0.634	0.558	0.339
Time* fixations	Wilk's Lambda =0.977	0.517	0.712	0.549
Group	F=0.091	0.763		

There was a significant decrease in NRS scores over time on both groups, and this decrease was not dependant on the group (p=0.634).

4.5 Graphical Representation Of Data

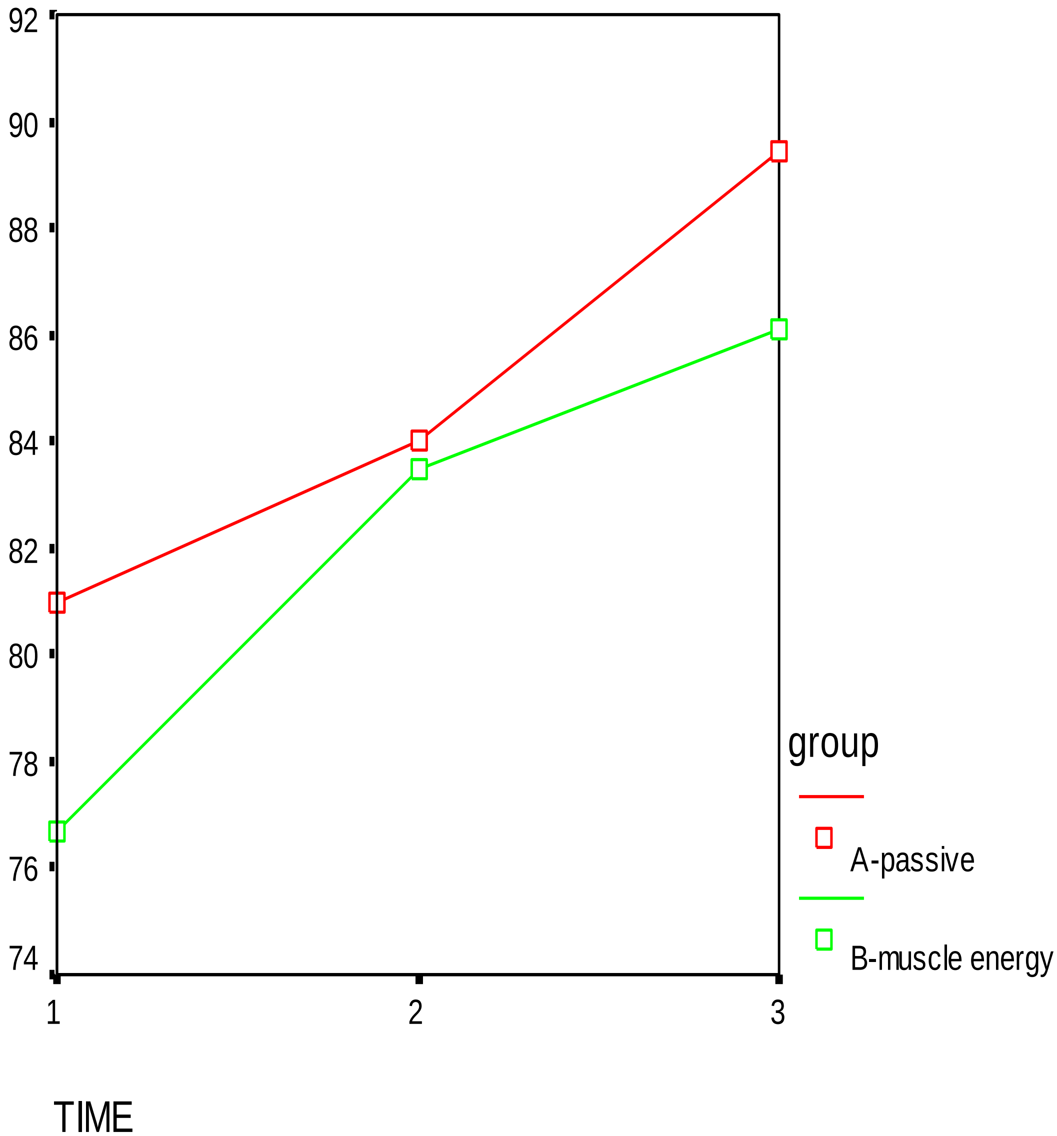


Figure 1: Mean flexion by group over time

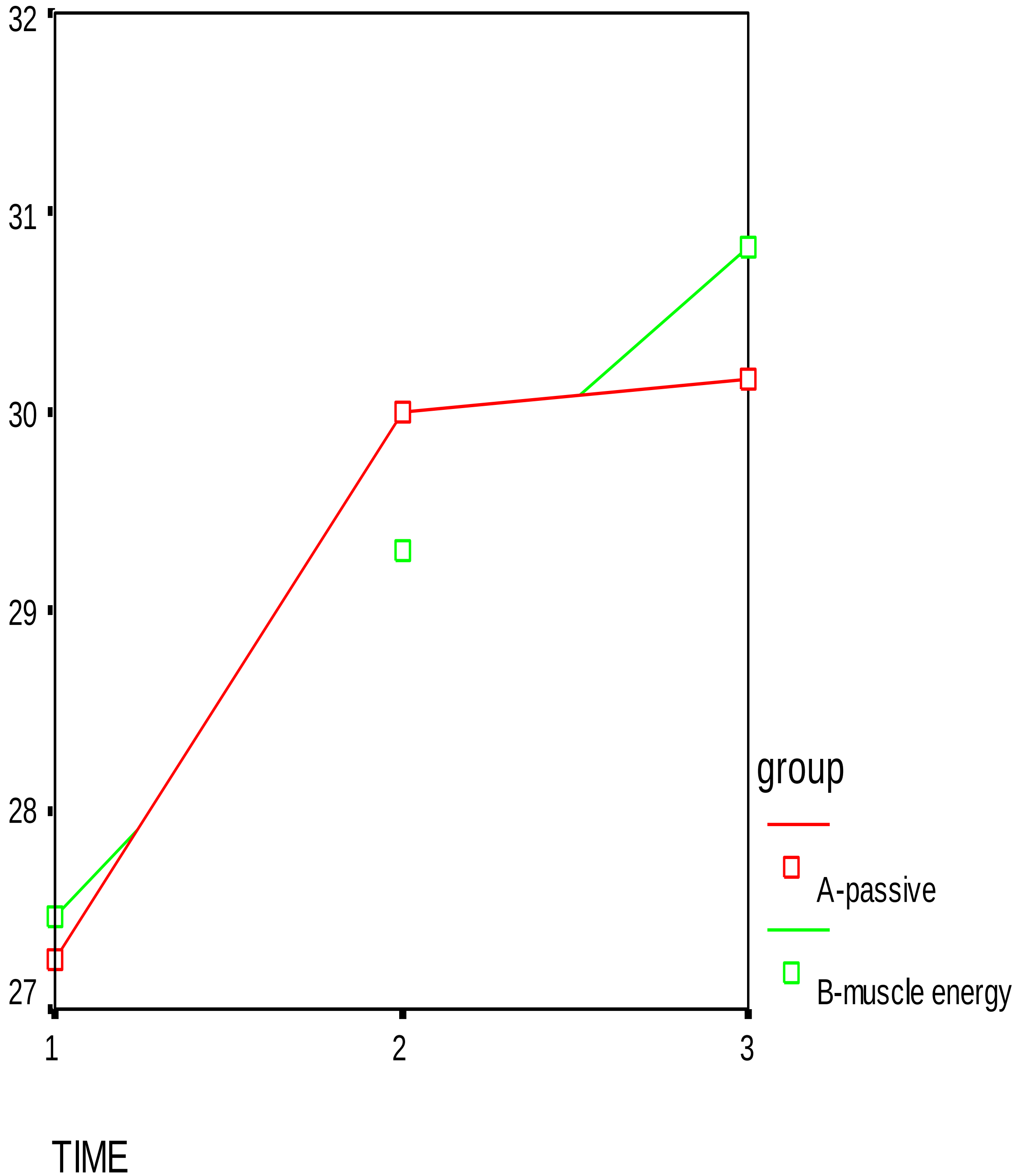


Figure 2: **Mean extension by group over time**

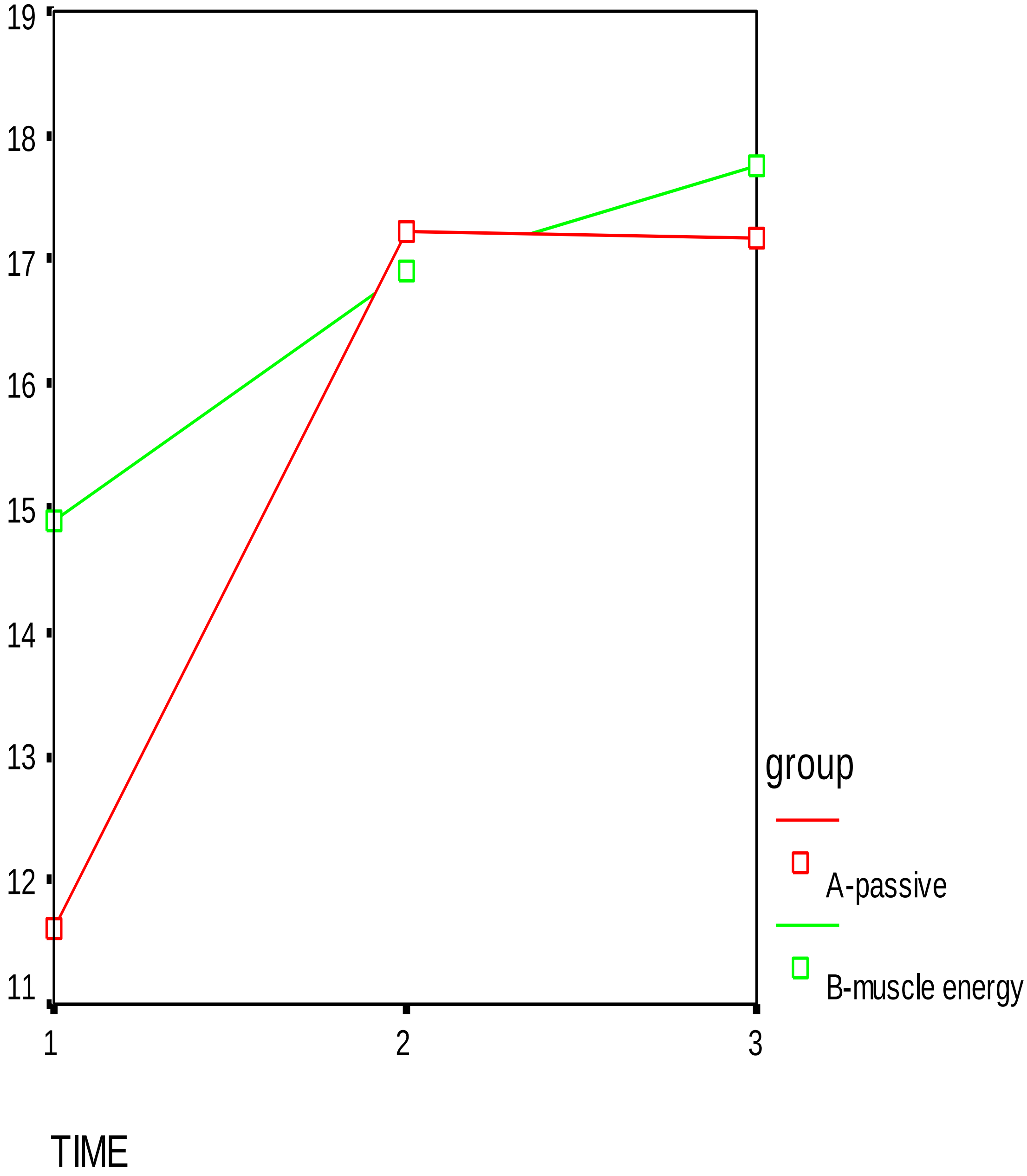
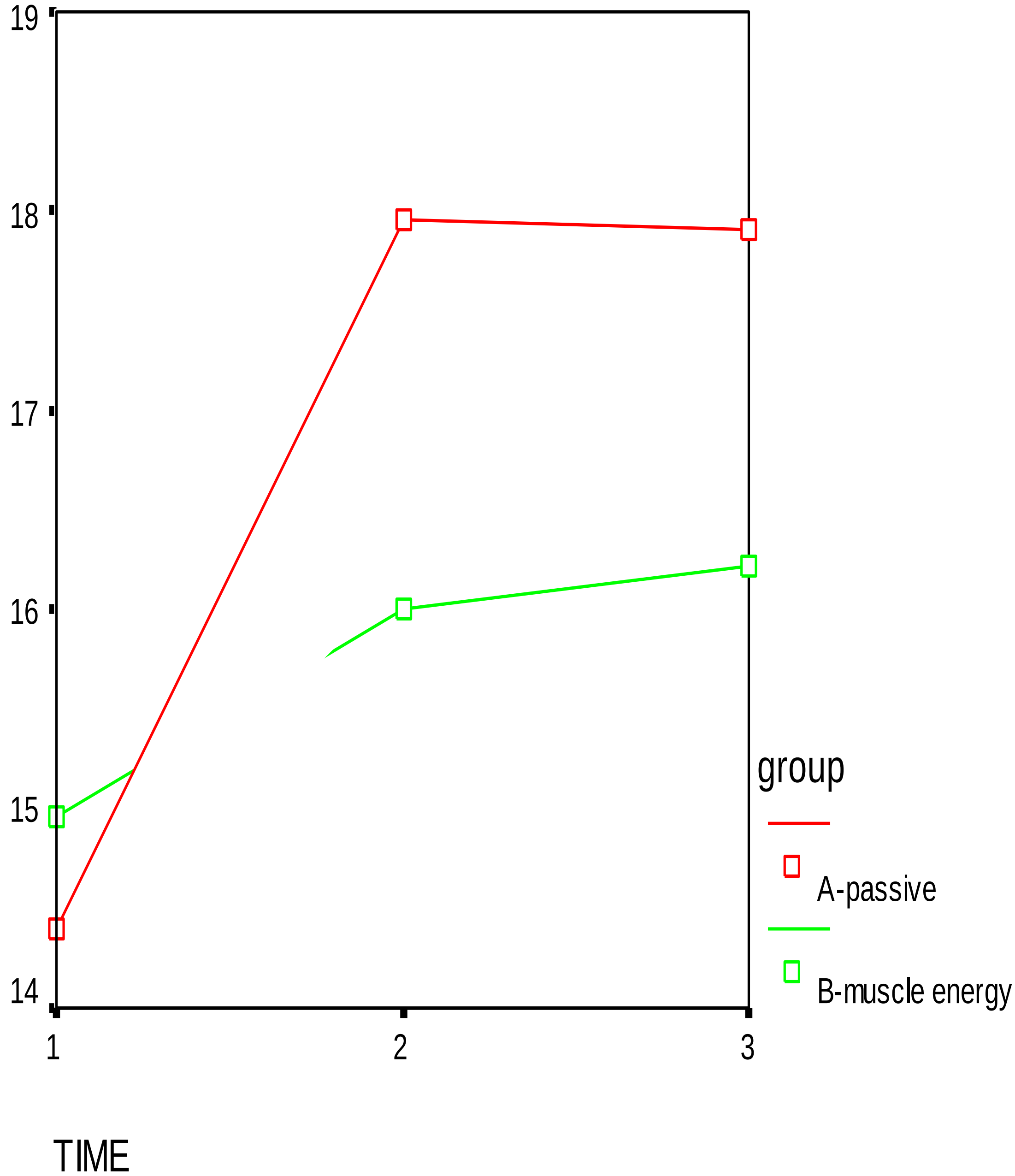


Figure 3: Mean right lateral flexion by group over time



<u>Figure 4:</u> **<u>Mean left lateral flexion by group over time</u>**

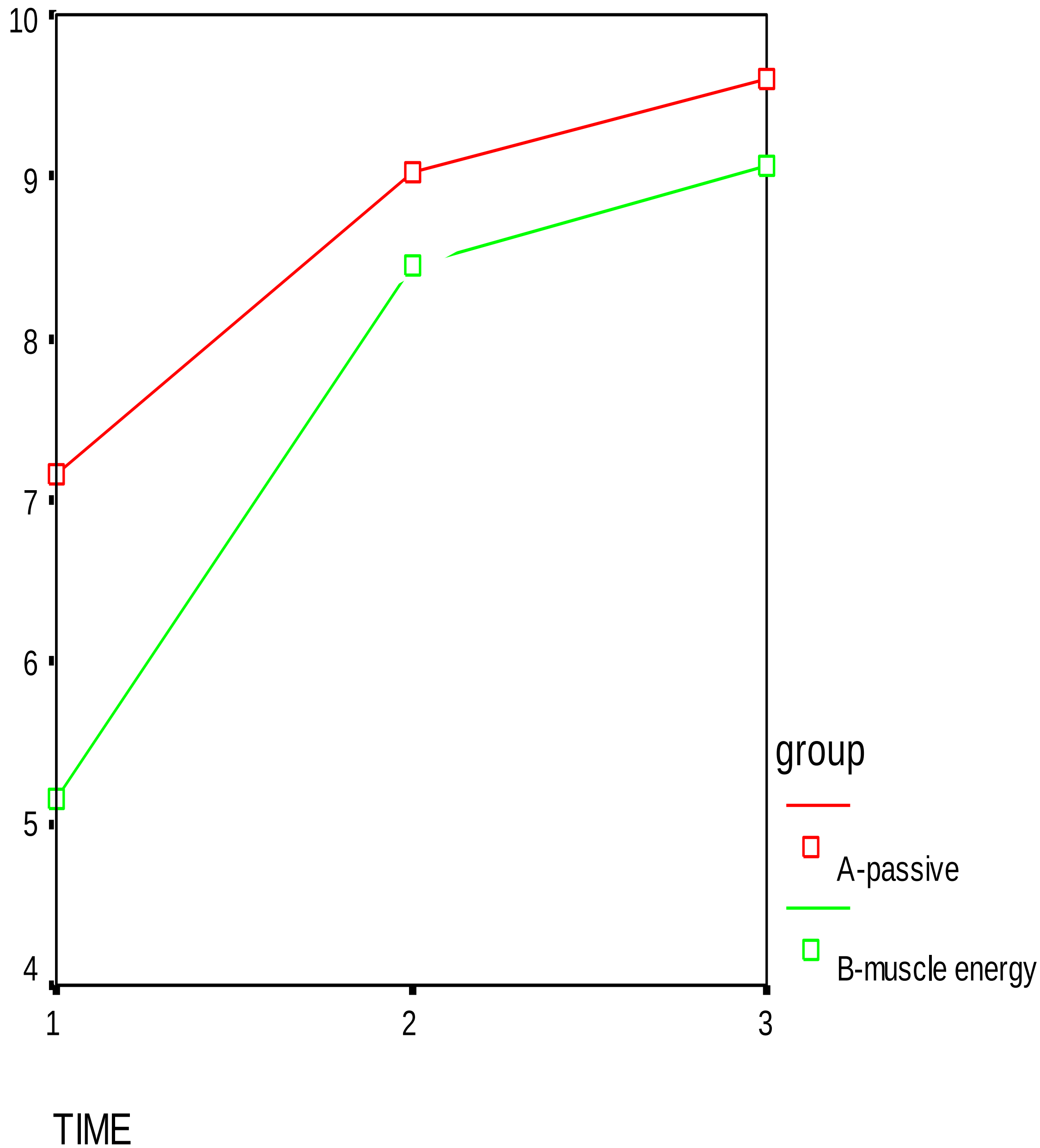


Figure 5: Mean right rotation by group over time

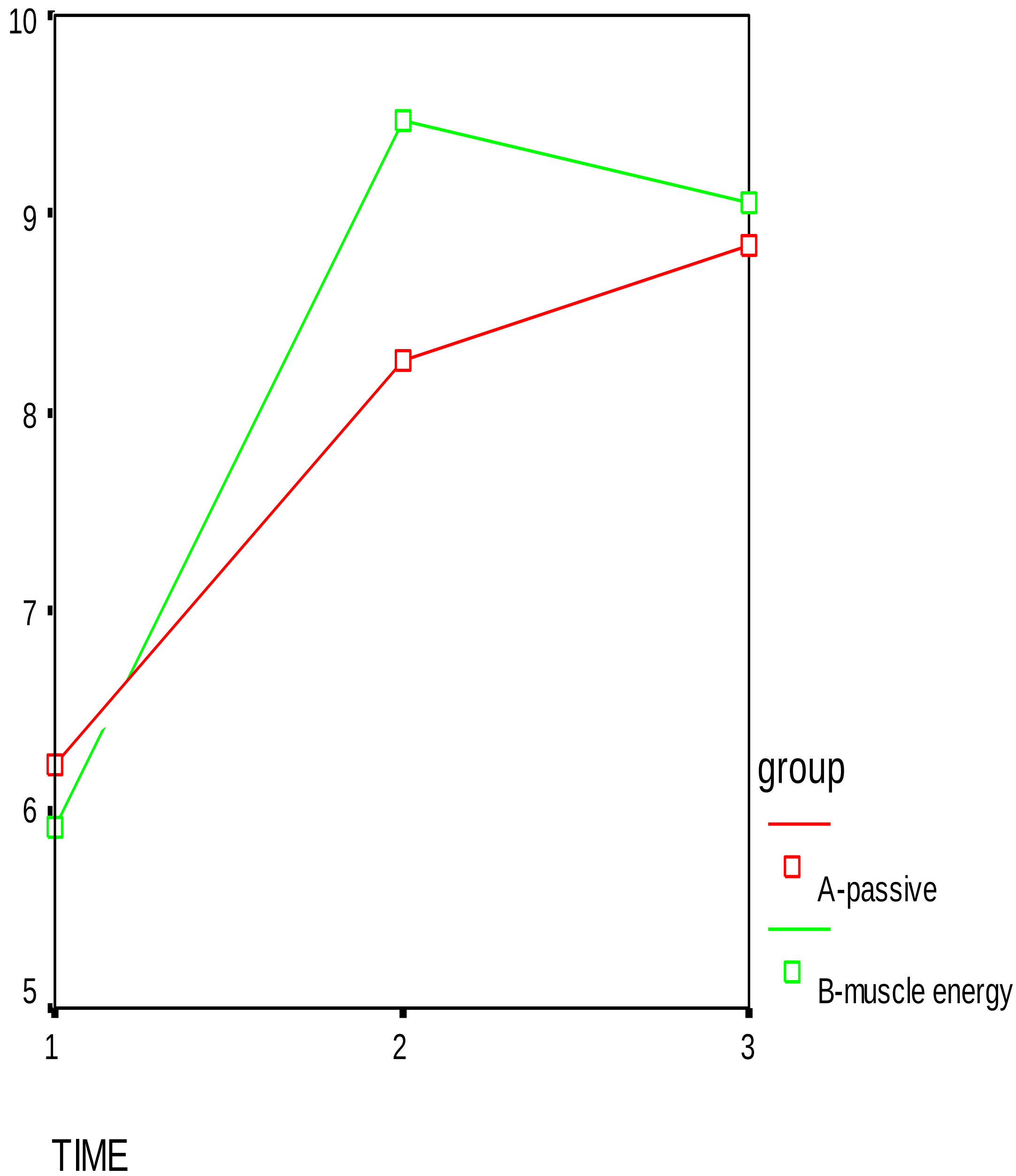


Figure 6: Mean left rotation by group over time

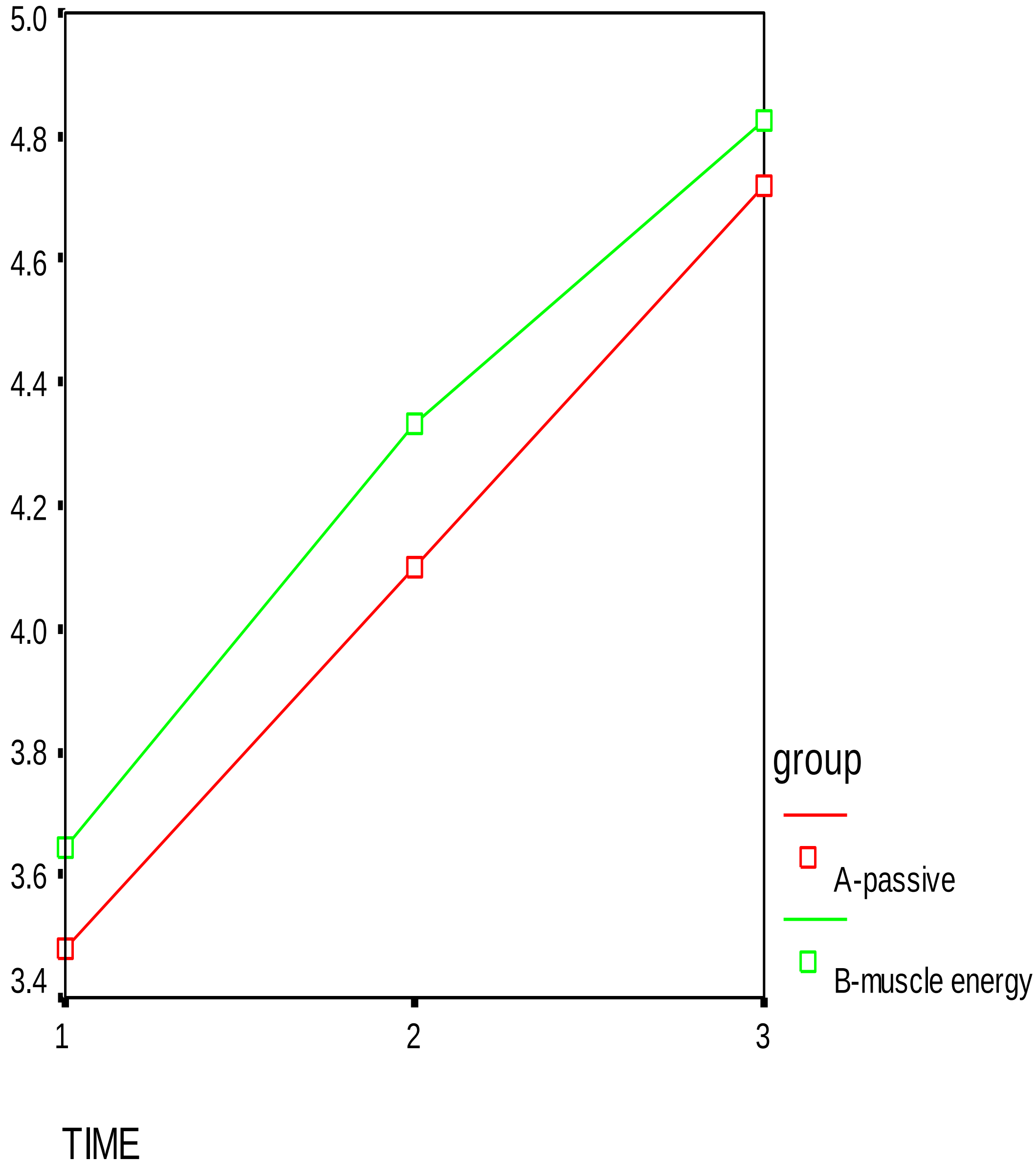


Figure 7: **Mean algometer measurement by group over time**

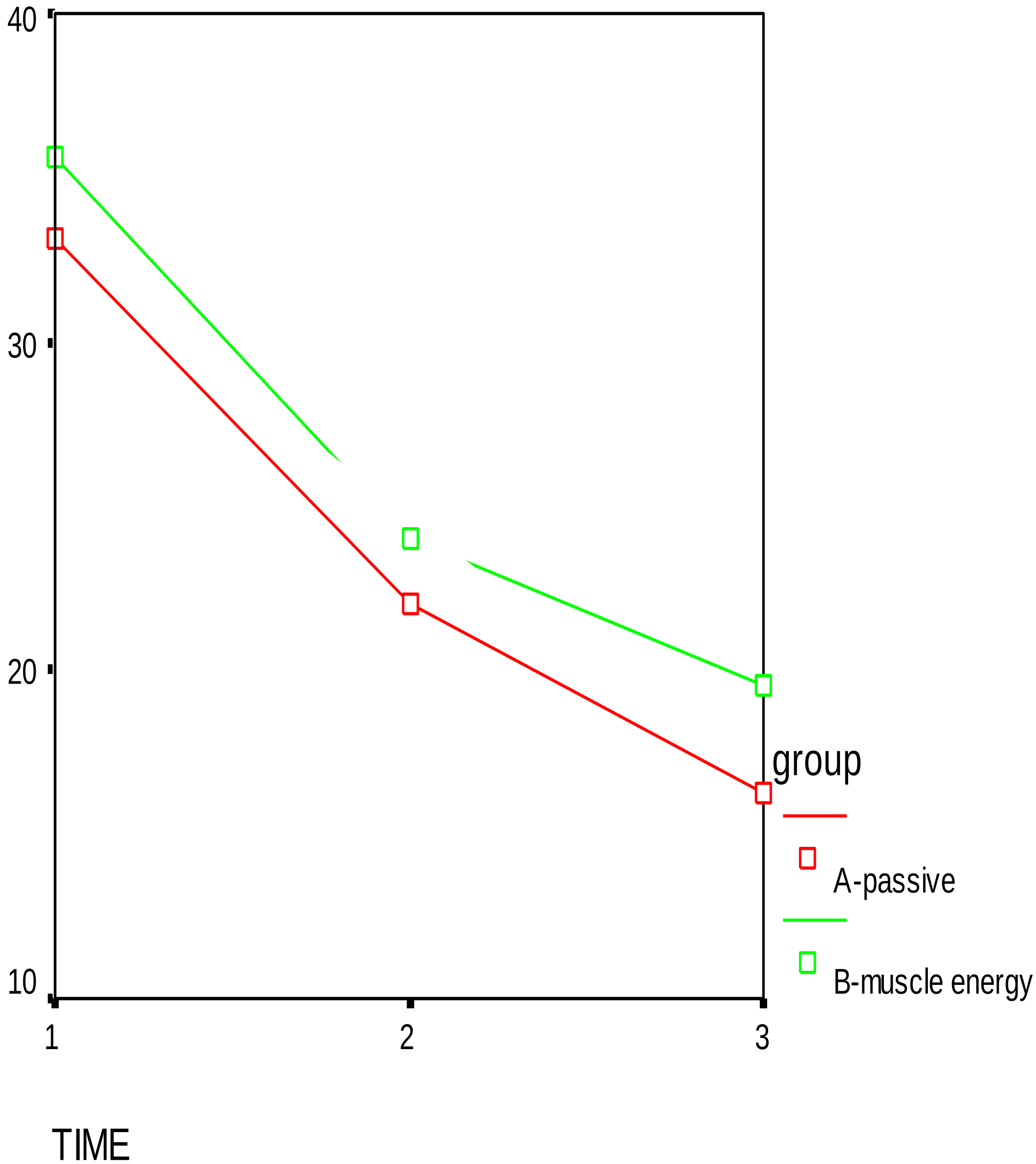


Figure 8: **Mean ODI measurement by group over time**

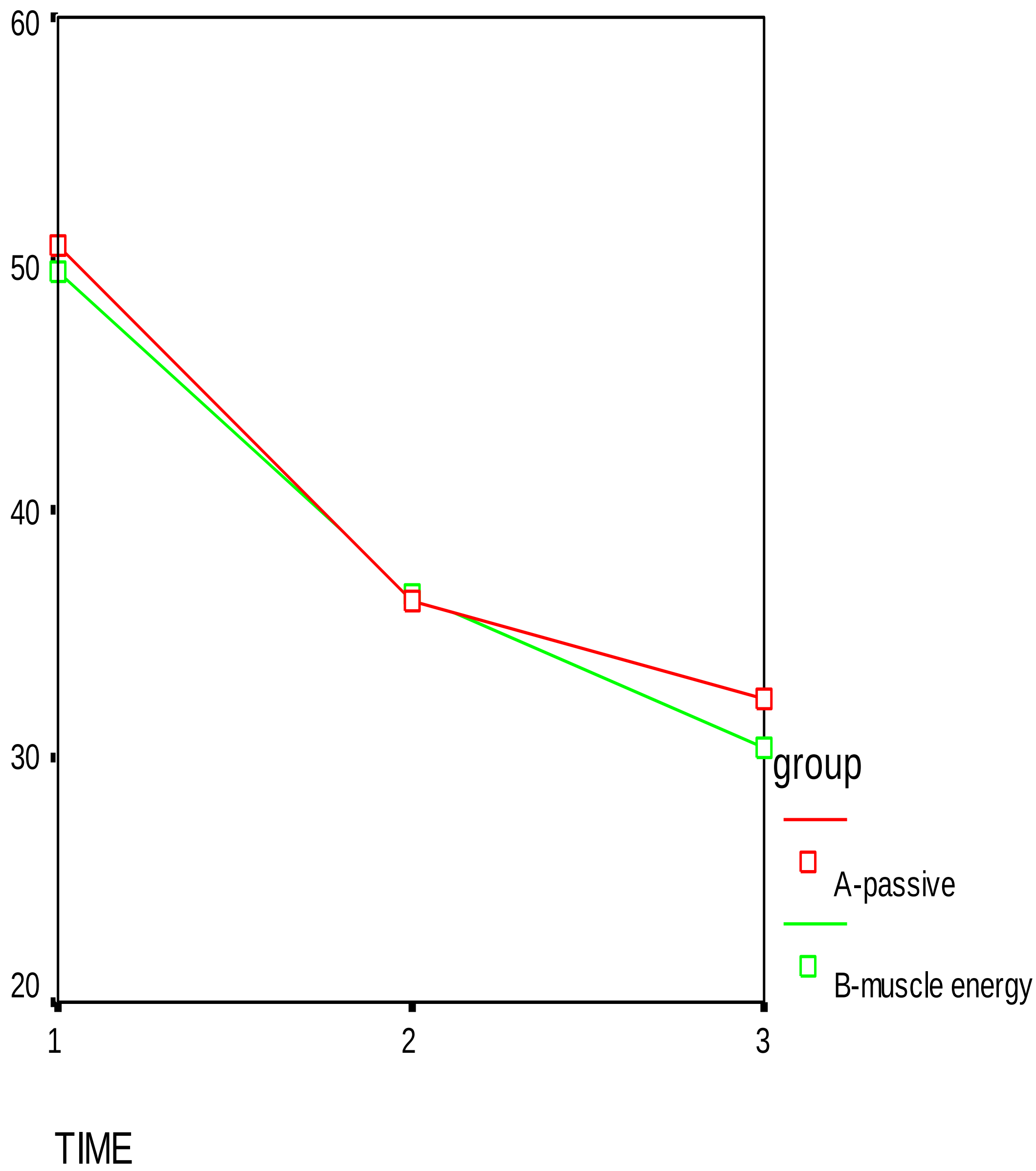


Figure 9: Mean NRS measurement by group over time

CHAPTER FIVE

DISCUSSION AND CONCLUSION

5.1 Discussion

5.1.1 The Demographic Data and Baseline Factors

The assumption of no difference between the two groups in terms of demographics and baseline factors was tested by comparing values between the groups. There was no difference between the proportions of males and females in the two groups (p=0.288). Table 1 shows that there was a non-significantly higher proportion of females in group A than males. In general low back pain seems to occur equally in men and women (Andersson, 1999: 584). However, Papageorgiou et al., (1995) found a slight female predominance in the incidence of low back pain, and so this study is in keeping with that finding. The mean age of the whole sample was 33 years (SD 6.93 years). Table 2 shows that there was no significant difference in mean age between the two treatment groups (p=0.176). The mean age for group B was slightly older than group A.
Each of the groups had a median of three fixations (range one to six). There was no significant difference in number of fixations between the two groups (p=0.152 –Table 3). Thus the treatment groups at baseline were comparable.

5.1.2 The Objective Data

The statistical data for lumbar range of motion and algometer readings can be found on Table 4 – Table 10 and Figure 1 – Figure 7.

Lumbar Range of Motion

Flexion: Figure 1 shows that the profiles of the two groups were almost parallel over time. While both groups showed an increase in values over time, the muscle energy group showed the steepest rise between time 1 and 2, while the control group showed the steepest rise between the latter two time points.

Extension: Figure 2 shows that the muscle energy group increased in a linear fashion over time while the control group showed a steep rise before the second time point, and leveled off thereafter. Even though the profiles do intersect in the second half of the plot, the time by group interaction is not statistically significant (p=0.258), thus there may be a non significant trend towards a treatment effect in favour of the muscle energy treatment.

Right lateral flexion: Figure 3 shows that the treatment effect is in favour of the control group, which showed a steeper increase between time 1 and 2 than the muscle energy group.

Left lateral flexion: Figure 4 shows that the control group showed the greater increase in mean values over time, however, the difference was not statistically significant.

Right rotation: According to Figure 5, the profiles of the two groups were parallel from time 2 to time3, but from time 1 to time 2 there was a slightly steeper increase in mean right rotation in the muscle energy group than the control group, however this interaction trend was not statistically significant (p=0.130).

Left rotation: Figure 6 shows that the profiles intersect in the first half (time 1 vs. time2). The muscle energy group showed the steepest increase in this phase, but the interaction is not quite statistically significant (p=0.156). Between time 2 and time 3 the muscle energy group showed a slight decrease in mean values.

Algometer

Algometer readings at respective joints increased over the treatment period. This indicated a statistically significant effect (p=0.002) for both treatment groups over time.

5.1.3 The Subjective Data

ODI and NRS – 101

There was a significant decrease in both ODI and NRS measurements for both the groups (p=0.001) which indicates that these scores improved over the treatment period. However, the treatment effects between the groups were not significant indicating that there was no additional benefit of MET over passive mobilization.

5.1.4 Analysis of Outcomes

With respect to overall range of motion, it was noted that there was a decrease in results between the second and third readings for both groups. This decrease is probably due to the one week follow up period between the fourth and fifth visits. Both MET and passive mobilization may not have been vigorous enough to resolve the muscle spasm that usually occurs with lumbar facet syndrome. The author thus suggests that when treating patients with acute and sub-acute low back pain one should increase the frequency and duration of treatment as well as incorporate other treatment modalities.

In terms of algometer readings, ODI and NRS – 101 scores, there was an overall improvement over the treatment period. It was however, noted that individuals pain perception varied in this study. Taking into consideration that this study included patients who rated their pain from 5-10 on the NRS, it allowed participants with a higher pain thresholds, who rated their pain from 5-7, to participate. Thus these patients would have responded better than those with a lower pain threshold. The author thus advises that the requirements for future studies on acute and sub-acute low back pain be narrowed further to include only those who rate their pain from 8-10 on the NRS. Some participants also did not consider their low back pain serious enough to interfere with their daily activity, hence their initial rating on the ODI was low, and thus improved the most with treatment.

This study found that pain and disability of patients improved with both MET and passive mobilization whereas range of motion did not, thus opening this theory to question. This study could not establish a direct link between the changes in pain and the changes in mechanical response of the spine. These findings may also suggest that a Hawthorn effect was produced in that patients responded well due to the stimulus of being singled out, involved and made to feel important, regardless of what treatment they received. This is understandable, as half the participants in this study worked in a state hospital under stressful conditions and in the past had very little attention payed to their low back pain.

5.2 Recommendations

- To ensure more accurate results and decrease researcher bias, measurements should have been taken by an independent observer, who was blinded to which treatment group patients were allocated to.

- Patient compliance is imperative as well as the consistency between treatments. Due to extenuating circumstances, public holidays and weekends, appointments were scheduled to when it was more convenient. Greater efforts should be made in future studies to ensure consistency between treatments.

- Patients in this study were not allowed to deviate from their normal routines. If an activity had caused or aggravated their low back pain, they were to still continue with their normal routine; hence this led to aggravations of pain between treatments. Therefore it would be best if measurements were taken before and directly after treatment, to note any significant changes.

- When measuring range of motion, especially rotation, patients tended to rotate their entire body. It is advisable to have one person stabilizing the patients' hips and another taking the reading. With lateral flexion, one must ensure that the patient is not flexing forward. Flexion and extension were relatively simple to measure.

- An algometer without a rubber tip was used; this on occassions hurt the patient and could have thus given an incorrect reading. A digital algometer with a soft tip should be used in future studies.

- Part of this study was conducted at a hospital. This meant that majority of these participants were people who are susceptible to low back pain on a daily basis, e.g. nurses, general assistants, orderly's and clerks. This group of participants also included predominantly Indian and Black individuals, mainly due to the location of the hospital. A conclusion about the effect of MET versus passive mobilization on the general population could not be drawn. It is therefore advisable to conduct future studies on specific race groups and on individuals of a particular profession.

5.3 Conclusion

In this study both MET and passive mobilization of the lumbar spine produced positive results. There was however, no statistical evidence of a benefit of muscle energy treatment over passive mobilization. The treatment was not harmful, but provided as much benefit as the control. Thus subjects who were exposed to passive mobilization recovered to the same extent as those treated with MET. Some objective outcomes showed a trend which suggested that there might have been an interaction if the sample size was larger, but some trends favoured the control group and some favoured the muscle energy group. Thus the conclusion from this research is that there was no difference between the treatments.

Schenk et al., (1994), conducted a randomized clinical trial on the effectiveness of MET on cervical range of motion in asymptomatic individuals and found that range of motion did improve. In concluding, the author suggested that MET may be more beneficial than a passive mobilization technique, however no empirical studies have been published in this area. This study thus adds support to the hypothesized effect of MET on a symptomatic population. It does validate the effectiveness of MET in the treatment of acute and sub-acute low back pain, however it was shown that it is just as effective as passive mobilization.

In concluding, both MET and passive mobilization can be used as a safe and effective alternative in instances where manipulation may be contra-indicated. It is however advised that to maximize treatment benefits, other treatment modalities should be implemented as well (IFC, TENS, Dry Needling, Therapeutic Ultrasound, Massage etc), and to keep treatments, especially in the acute phase, fairly consistent and close together to monitor patient response. The option of whether to use MET or passive mobilization should depend entirely on patient preference, i.e. which treatment they are more comfortable with. The author also suggests that if after three to four treatments there is no significant change in patient response, then alternate diagnoses and treatment options should be sought.

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APPENDIX A

APPENDIX B

APPENDIX C

APPENDIX D

APPENDIX E

APPENDIX F

APPENDIX G

APPENDIX H

APPENDIX I

APPENDIX J

Appendix I

Specific passive mobilization was based on the techniques found in Vertebral Manipulation (Maitland, 2001. 115-143p).

Patient Position

Sitting at the end of the table. Patient crossed arm on chest with hands on opposite shoulders.

Doctor Position

Standing behind patient in a high squatting stance, with torso supporting patients' thorax.

Indifferent Hand

Doctor reached in front of patient to contact their opposite shoulder or elbow.

Contact Hand

A pisiform contact was taken against the facet joint or spinous process at the fixated level.

Mobilization

After being screened by motion palpation, the fixated joint was locked in the direction of fixation. If joint pain was encountered at the beginning of range of motion, a grade 1 mobilization was performed with rhythmical movements of low amplitude. As pain free range increased, grade 2 and grade 3 mobilizations were performed with an increase in amplitude. If pain production shifted to end range of motion, low amplitude grade 4 mobilizations were used at the restrictive barrier. Passive oscillatory mobilizations were performed slowly, one every two seconds, for a period of ten seconds followed by a five second rest period. Three to five sets of mobilizations were performed.

Appendix J

The Muscle Energy Technique was performed according to the guidelines set out by Leon Chaitow (Muscle Energy Techniques, 1996).

Patient Position

Sitting at the end of the table. Patient crossed arm on chest with hands on opposite shoulders.

Doctor Position

Standing behind patient in a high squatting stance, with torso supporting patients' thorax.

Indifferent Hand

Doctor reached in front of patient to contact their opposite shoulder or elbow.

Contact Hand

A pisiform contact was taken against the facet joint at the fixated level.

MET Procedure

After being screened for a fixation by motion palpation, the fixated joint was locked in the direction of fixation. At this point the patients was instructed to take a deep breath in and hold it, and simultaneously try to return to normal position or 'push back' against the therapists hand gently. The patient was only required to use 20% of their strength. The contraction was held for ten seconds after which the patient was asked to breathe out and relax slowly for a period of five seconds. The restriction barrier was then re-engaged. This procedure was repeated three to five times and the examiner tested the joint for the restriction barrier each time.