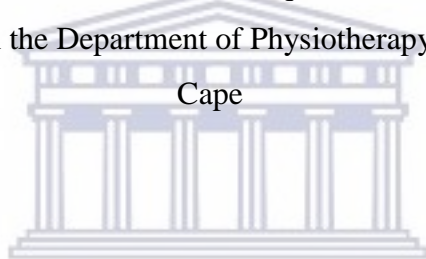


**THE EFFECTIVENESS OF DRY NEEDLING AS AN INTERVENTION FOR
ACUTE MYOFASCIAL LOW BACK PAIN**

A thesis submitted in partial fulfillment of the requirements for the degree of Magister Scientiae (Physiotherapy) in the Department of Physiotherapy, University of the Western

Cape



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ABSTRACT

Background

Myofascial pain syndrome is a condition caused by myofascial trigger points, which could occur in any area of the body, that affects a large number of the general population and is reported to impair mobility, cause pain, and reduce the overall sense of well-being. The prevalence of myofascial trigger points in low back pain is reported to be high, yet they receive little attention despite being an important source of the condition. Needling techniques such as acupuncture and dry needling, combined with conservative therapy for the treatment of myofascial trigger points, are becoming more popular. Numerous studies proving the use of acupuncture and dry needling in combination with other treatment techniques to treat chronic back ache exists, however in the case of acute myofascial low back pain evidence is sparse.

Aim

The current experimental, assessor blinded study aimed to investigate the effectiveness of dry needling, a minimally invasive technique, in combination with conservative physiotherapy techniques such as massage and stretching versus massage and stretching only in order to address myofascial trigger points, as it relates to intensity of pain, functional activity, level of disablement and lumbar range of forward flexion motion.

Methods

The study followed an experimental, single-blind, randomised controlled design. Sixty participants, including both sexes, between the ages of eighteen and sixty five years were recruited as from 1 April 2015 consecutively and randomly allocated to either the intervention- or control group by computer generated randomization schedule. Each group

consisted of thirty participants. Intensity of pain, functional activity, level of disablement and lumbar range of forward flexion was measured using VAS, RMDQ, ODI and the FFD test as it related to low back pain. The study was conducted at the physiotherapy department of Cradock District Hospital, Eastern Cape Province, South Africa. The inclusion criteria required for participants to be between ages 18 and 65; diagnosis of acute myofascial low back pain, myofascial trigger points in one or more of the muscles evaluated in the study (quadratus lumborum, gluteus maximus, gluteus medius, gluteus minimus and piriformis muscle) whether they were located unilateral or bilateral; a VAS baseline score of at least 5; participants agree not to receive additional conservative treatment for the condition or analgesics, unless the participants' condition worsened and a medical doctor then prescribed these; sound cognitive functioning and able to report appropriately on pain. The exclusion criteria entailed specific low back pain; pregnancy, skin lesions at trigger point site; phobia for needles; individuals younger than 18 or older than 65 years and individuals with decreased or impaired ability to report appropriately on pain or follow instructions. The assessor was blinded to the group allocation of the participants. The participants were recruited from the Physiotherapy Department at Cradock Hospital.

Written informed consent was obtained from all participants that met the inclusion criteria.

Participants in both groups were educated on their condition, verbally. Massage techniques (transverse friction and ischemic compression) were administered to both groups and muscle specific stretching exercises were demonstrated and taught to participants depending on the muscles that were afflicted in each individual. The intervention group had the addition of myofascial trigger point dry needling to their treatment plan. This technique was administered to myofascial trigger points in the specific muscles they were identified in.

The VAS (intensity of pain) served as the primary outcome measure while RMDQ (functionalability), ODI (level of disablement) and FFD (lumbar forward flexion motion) test

served as secondary outcome measures and was administered at baseline, measurement 2 (4 weeks immediately post treatment) and measurement 3 (8 weeks immediately post treatment). Repeated Measures MANOVA was applied to determine both time effect (within differences) and time by group interactions (between group differences). In addition where statistical significance are found post hoc test (Tukeys HSD) was conducted to determine where the difference lies.

Results

The outcome of this study showed that both groups improved significantly overtime within themselves as univariate analysis of within subjects effects for measurement levels were $F(1.85, 855.38) = 673.31, p < .001$ on VAS; $F(1.27, 2256.88) = 289.42, p < .001$ on RMDQ; $F(1.34, 14441.05) = 156.06, p < .001$ on ODI and $F(1.09, 5763.17) = 143.70, p < .001$ on FFD. Output of the univariate analysis for measurement level and treatment interaction were $F(1.85, 17.22) = 13.56, p < .001$ on VAS; $F(1.27, 83.91) = 10.76, p = .001$ on RMDQ; $F(1.34, 818.21) = 8.84, p = .002$ on ODI and $F(1.09, 365.03) = 9.10, p = .003$ on FFD. The between-participant analysis of treatment revealed that a statistically significant difference resulted on VAS in favour of the intervention group ($p = .001$) but not on RMDQ ($p = .409$), ODI ($p = .199$) or on FFD ($p = .442$). However, despite obtaining statistically non-significant results on the last three outcome measures, clinically meaningful results were obtained as the intervention group showed greater improvement than the control group and improvements were beyond that of the minimum clinical important differences.

Conclusion

The results of the current study suggest that dry needling, added to massage and stretching in order to treat acute myofascial low back pain, significantly decreased symptoms of pain in the participants. It enhanced improvement on functional activity, level of disablement and lumbar range of forward flexion motion in the participants.

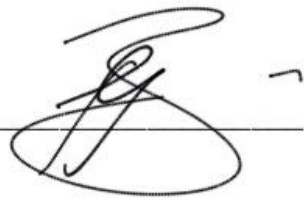
Declaration

I declare that “*THE EFFECTIVENESS OF DRY NEEDLING AS AN INTERVENTION FOR ACUTE MYOFASCIAL LOW BACK PAIN*” is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by means of complete references.

Glynis Liezl Bruinders

December 2017

Signed:



ARhoda

Witness:.....



Dedication

This thesis is dedicated to my parents Errol and Johanna Bruinders, the role models I look up to and the driving force behind me. Dad, even though you are no longer with us, I promise to strive to make you and mom proud...always. I love you.



Acknowledgements

Heavenly Father, nothing is possible without You. Thank you for Your endless mercy and grace throughout the years. *“I can do all things through Christ who gives me the strength!”*
Phillipians 4:13.

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I would like to thank the entire Physiotherapy team, my colleagues and friends at Cradock Hospital 2015, as well as the staff members who assisted with translations in the study. Thank you for being ready to assist at all times and especially for the role that each one of you played towards the completion of this study.

To every patient that was recruited and enrolled in this study, thank you for bringing me closer toward realising this goal one step at a time.

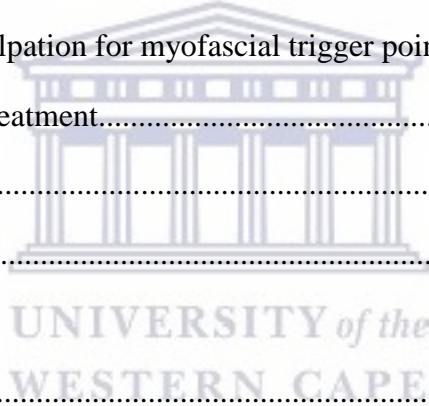
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CHAPTER 1

INTRODUCTION

1.1 Background

Recent studies reported low back pain (LBP) to be a major escalating health problem globally (Liu, Skinner, McDough, Mabire and Baxter, 2015; Lela and Frantz, 2012). According to Murray and Lopez (2013), LBP is a disabling condition documented as one of the top ten causes of disability-adjusted life-years attributed to the burden of disease. According to the Global Burden of Disease 2010, disability is synonymous with any short-term or long-term health loss (Murray et al., 2013).

LBP can occur due to numerous factors including: individual characteristics, working conditions such as heavy physical work, awkward static and dynamic working postures, as well as manual handling and lifting, lifestyle factors and psychological factors (Duthey, 2013). A minority of LBP cases results from trauma to the back, osteoporosis or prolonged corticosteroid use and even fewer cases of LBP occur as result of vertebral infections, tumours and bone metastasis, which fall under causes of specific LBP (Duthey, 2013). Non-specific LBP (low back pain that cannot be attributed to a specific disease or spinal abnormality reliably) however, is often more difficult to identify and can therefore be a major problem for diagnosis and treatment (Duthey, 2013; Blanchette, Bussi eres, Stochkendahl, Boruff, Harrison, 2015). Blanchette et al., (2015), reported that it may be due to the difficulty in reliably identifying specific diseases and anatomical structures in non-specific LBP that relatively few treatment modalities for the management of non-specific LBP achieve superior and sustained improvements in pain, physical function, and disability.

Among the etiologies that could contribute to LBP are alterations in the facet joint articulations, the intervertebral disk, and the nerve roots - in addition, degeneration, neoplasia

and pain as a result of myofascial origins can also occur (Coelho, Barbosa, Pavan, de Oliveira, Bevilaqua-Grossi, Defino, 2014).

As stated earlier, LBP may be of myofascial origin (Coelho et al., 2014). Myofascial Pain Syndrome (MPS) is a disorder that causes musculoskeletal pain which could be acute or chronic, regional or generalised (Furlan, van Tulder, Cherkin, Tsukayama, Lao, Koes and Berman, 2008). The myofascial disorder could be caused by myofascial trigger points (MTrPs) which are exquisitely tender spots or nodules within tight bands in the muscle fascia, and can occur in any area of the body including the low back region (Eng-Ching Yap, 2007; Bron, Dommerholt, 2012; Coelho et al., 2014). Coelho et al., (2014), reported that the prevalence of trigger points in various clinical conditions are very high, they afflict more than 85% of the individuals in tertiary clinics and have received less attention despite being an important source of LBP. MTrPs are hyper-irritable spots in skeletal muscle that are associated with a hypersensitive palpable nodule in a taut band (Dommerholt, del Moral and Gröbli, 2006; Zaky, El Nahass and El Zawahry, 2010; Mayoral, Salvat, Martin, Martin, Santiago, Cotarelo and Rodríguez, 2013). Previous studies indicate that acute trauma or repetitive microtrauma, a lack of physical activity, remaining in bad postures for prolonged periods of time, as well as articular dysfunction can predispose the individual to develop consequent myofascial dysfunction (Coelho et al., 2014). The pain and consequent functional alterations experienced with this condition could lead to socio-economic disabilities in individuals with LBP, rendering them incapable of performing daily activities as well as work activities (Coelho et al., 2014). LBP could therefore also occur as a result from MPS. LBP has been reported to be a self-limiting condition which has a tendency to improve over time but for many people back pain could become a chronic or recurrent problem (Furlan, van Tulder, Cherkin, Tsukayama, Lao, Koes, Berman, 2005).

Various techniques are used in order to treat and manage MPS including patient education, bio-feedback, management of predisposing factors, medical therapies with analgesics, myorelaxants, anti-depressants, stretch and spray therapy, ischemic compression, therapeutic massage, transcutaneous electrical nerve stimulation (TENS), hot pack therapy, ultrasound (US), interferential current (IFA), low-energy light amplification by stimulated emission of radiation (LASER), extra-corporeal shock wave therapy (ESWT), trigger point injections, dry needling (DN) and acupuncture (Koca and Boyaci, 2014; Sharan, Mohandos, Rajkumar, Ranganathan, 2014; Jafri, 2014). Although a broad spectrum of pharmacologic and non-pharmacologic therapies are available for the treatment of acute LBP, the effectiveness of most of these interventions is yet to be established (Lee, Choi, Lee, Lee, Shin and Lee, 2013). Cagnie, Castelein, Pollie, Steelant, Verhoeyen and Cools, (2015), reported dry needling as a technique that has gained popularity over the last few years in both clinical practice and for research purposes. According to the systematic review conducted by Cagnie et al., (2015), ischemic compression and dry needling are the most commonly used techniques to inactivate myofascial trigger points. Moderate evidence exists for the use of ischemic compression, as a means to treat myofascial trigger points while evidence for the use of dry needling is reported to be strong (Cagnie et al., 2015). Renan-Ordine, Albuquerque-Sendín, Rodrigues De Souza, Cleland, Fernández-de-las-Peñas, (2011), also reported that manual soft tissue trigger point therapies in addition to stretching programs, produces superior results than stretching programs alone for the treatment of myofascial trigger points. Traeger, Hübscher, Henschke, Moseley, Lee, McAuley, (2015), reported that by educating patients about their condition or problem, by means of clearly explaining their symptoms to them, they can be reassured and therefore reduce fears and concerns about the illness that are known to influence physical health, consulting behaviour and diminish the need for patients to seek expensive and inappropriate interventions. Massage therapy, forms part of the compendium of manual

therapy and is also known as soft tissue therapy (Brukner, Bahr, Blair, Cook, Crossley, McConnell, McCrory, Noakes, Khan, 2007). Massage is a popular option chosen by physiotherapists to help in the reduction of pain, increase or improve range of motion, facilitating and improving the relaxation of soft tissues as well as joint structures (Brukner et al., 2007). Furthermore, manual therapy also facilitates faster healing rate of soft tissues, improves the extensibility thereof, facilitate movement and improve general physical function (Brukner et al., 2007).

Stretching, implies that a movement either by external or internal force has been applied in order to increase the range of motion of a joint (Apostolopoulos, Metsios, Flouris, Koutedakis, Wyon, 2015). Forms of stretching comprise active, passive, dynamic, static, ballistic as well as proprioceptive neuromuscular facilitation (PNF) (Apostolopoulos et al., 2015). Stretching exercises has traditionally been used by sport coaches and medical professionals as a means to enhance performance and prevent injury by regaining joint range of motion or flexibility (Apostolopoulos et al., 2015). Shortened and contracted soft tissues are therefore targeted to be lengthened and elongated and cause subsequent relief of tension within these tissues (Musculino, 2009).

Needling therapies comprise of trigger point injection, acupuncture and dry needling (DN). Trigger point injection therapy is known as an intramuscular technique and involves the direct injection of medicinal substances such as local anaesthetics, corticosteroids and saline into an MTrP for relief of symptoms (Cotchett, Landorf, Munteau, 2010; Koca et al., 2014; Sharan et al., 2014). Acupuncture is an important component of traditional Chinese medicine and has become a large complementary in the West together with conventional medicine (Demir, 2012). Meridians and the flow of vital energy is the theoretical foundation on which acupuncture is based upon (Brukner et al., 2007). The use of acupuncture dates back to ancient times and is still traditionally used in Chinese medicine (Brukner et al., 2007).

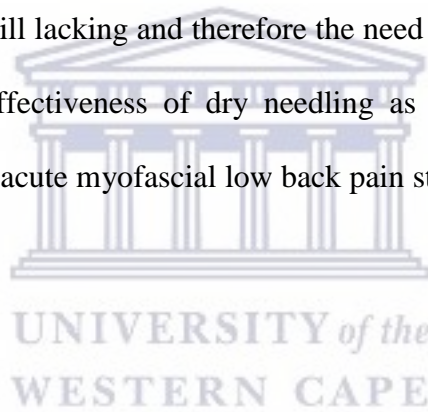
Acupuncture is accepted as a scientific treatment method that enables the body to restore the balance in flow of vital energy (known as qi) by means of stimulating special acupuncture points on the body with needles and consequently restore health (Brukner et al., 2007; Demir, 2012; Sharan et al., 2014). The term “acupuncture” is derived from the Latin word “acus” (the needle) which means puncturing of bodily tissue in order to bring about pain relief (Brukner et al., 2007). Myofascial trigger point dry needling (MTrPDN), is a minimally invasive technique in which a needle (often an acupuncture needle) is used to penetrate the skin and muscle and is often used in combination of other physiotherapy techniques (Kalichman and Vulfson, 2010; Bubnov, 2012). While performing this technique (MTrPDN) the acupuncture needle is inserted directly into the MTrP in order to inactivate it (Kalichman et al., 2010; Sharan et al., 2014). Dommerholt, Mayoral del Moral and Gröbli, (2006), reported that patients may erroneously refer to MTrPDN as a form of acupuncture. However, MTrPDN did not originate as part of the practice of traditional Chinese medicine (Dommerholt et al., 2006). Dry needling therefore is aimed at neuromuscular or musculoskeletal conditions and the relief of their symptoms and not at restoring or balancing energy throughout the body as it flows through pathways known as meridians in traditional Chinese medicine. Gabriella and Jian, (2013); Furlan et al., (2005); Furlan et al., (2008), reported that evidence was insufficient to make any clear recommendations with regards to acupuncture or DN for acute low back pain (ALBP). Acupuncture was proven to be more effective for pain relief for chronic low back pain (CLBP) compared to no treatment or sham treatment in measurements that were taken up to three months (Gabriella et al., 2013; Furlan et al., 2005; Furlan et al., 2008). Acupuncture was reported to be more effective for short term improvement of function compared to no treatment however, not more effective or superior to other conventional and alternative therapies (Gabriella et al., 2013; Furlan et al., 2005; Furlan et al., 2008). The addition of acupuncture to conventional therapies did reflect

greater pain relief and improved function when compared to conventional therapies alone and further benefits included reductions in consumption of pharmacologic substances and possible side effects (Gabriella et al., 2013).

1.2 Rationale

Recent evidence suggests that myofascial trigger points have a high prevalence in musculoskeletal conditions and are very often overlooked (Coelho et al., 2014; Shah, Thaker, Heimur, Aredo, Sikdar, Gerber, 2015). As trigger points can develop due to various reasons in any area of the body, the low back region is also not spared of this affliction (Eng-Ching Yap, 2007; Coelho et al., 2014). Current evidence indicates that active trigger points are associated with a high symptom burden which consequently has a negative impact on function (Shah et al., 2015). Low back pain is known to have a disabling or debilitating effect by influencing function and lumbar range of motion and can therefore influence the execution of activities of daily living and work activities by reducing productivity as well as quality of life and thus result in socio-economic disabilities, increase absenteeism at work and also increase number of visits to medical doctors (Coelho et al., 2014; Shah et al., 2015). Conservative methods or techniques have been utilized for decades to address myofascial trigger points (Shah et al., 2015). Among these, some massage techniques such as transverse friction in combination with muscle specific stretching exercises have been used to treat myofascial trigger points among physiotherapists (Shah et al., 2015). Conventional methods are not always successful in treating low back pain as the desired effects are not always reached which could leave patients frustrated (Rooney, 2008). Lately the minimally invasive technique, dry needling, has become a popular selection among physiotherapists as part of treatment plans to address myofascial trigger points as well (Cagnie et al., 2015; Shah et al., 2015).

From personal experience, the author observed that large numbers of patients are referred to physiotherapy for low back pain and on evaluation found that one of the main contributing factors is myofascial trigger points within muscles in the lumbar- as well as gluteal region. Previous published literature suggested that no clear recommendations could be made with regards to acupuncture and dry needling for acute low back pain based on poor methodological quality and small sample sizes (Furlan et al., 2005; Furlan et al., 2008; Gabriella et al., 2013). More recent evidence however reports that acupuncture (using fixed or traditional acupuncture points) can be used to treat acute myofascial low back pain (Liu, Chiu, Chang, Lee, Chen, Chang, Lee and Lo, 2015). However, recent studies reporting more conclusive evidence with higher methodological quality regarding dry needling for acute myofascial low back pain is still lacking and therefore the need for it still exists. The author's decision to investigate the effectiveness of dry needling as an adjunct to massage and stretching for the treatment of acute myofascial low back pain stemmed from the above stated facts.



1.3 Problem Statement

Approaches to trigger point therapy are mainly divided into invasive and non-invasive techniques (Huguenin, 2004). Non invasive techniques comprise techniques that have traditionally been used by physical therapists and manual therapists (Huguenin, 2004). In recent years there has been a marked increase in the use of invasive techniques, in particular, dry needling to manage trigger points in clinical practice as well as research (Huguenin, 2004; Cagnie et al., 2015). Massage or soft tissue therapy (ischemic compression and transverse friction) and stretching exercises, , are techniques which have been documented as techniques used by physiotherapists to effectively treat myofascial trigger points. Myofascial Trigger Point Dry Needling (MTrPDN), a minimally invasive technique, falls within the

scope of physical therapy and/or physiotherapy practice in numerous countries such as Canada, Chile, Ireland, the Netherlands, South Africa, Spain, and the United Kingdom (Dommerholt, del Moral and Gröbli, 2006). These qualified professionals do practice MTrPDN and use this technique in combination with other physical therapy interventions which include massage and stretching exercises to address MTrPs (Dommerholt et al., 2006). Although DN is a technique commonly used by physiotherapists nationally and internationally for the treatment of myofascial pain in various areas of the body and also chronic LBP there is currently insufficient evidence for the use of DN in the management of acute MLBP (Furlan et al., 2008; Gabriella et al., 2013). Therefore, the current study embarked to investigate the effectiveness of dry needling as an adjunct to massage and stretching compared to massage and stretching alone in the treatment of acute myofascial low back pain. The current research study further aims to add to the body of knowledge by determining the effect of dry needling on intensity of pain, functional status, level of disablement and lumbar range of forward flexion for acute myofascial low back pain as adjunct to massage and stretching compared to massage (ischemic pressure and transverse frictions) and stretching techniques alone.

1.4 Research Question

Is Dry Needling (DN) combined with massage and stretching more effective than massage and stretching alone in improving pain, lumbar range of motion (forward flexion) and function in patients with myofascial low back pain?

1.5 Aim

The aim of the study is to investigate the efficacy of Dry Needling as an adjunct to massage and stretching on acute (two weeks or less) myofascial low back pain (MLBP), lumbar range

of forward flexion motion, level of disablement and function compared to massage and stretching alone in patients presenting with AMLBP.

1.6 Objectives

The objectives of the study are:

- To determine participants' intensity of pain, lumbar range of forward flexion motion, functional activity and level of disablement at baseline (pre-intervention);
- To determine the participants' intensity of pain, lumbar range of forward flexion motion, functional activity and level of disablement:
 - At four weeks post baseline (measurement 2); and
 - At eight weeks post baseline (measurement 3);
- To compare the mean value of the primary outcome measure which is intensity of pain between the experimental and control group at baseline, measurement 2 and measurement 3;
- To compare the mean value in secondary outcome measures, functional activity, level of disablement as well as range of lumbar forward flexion between the experimental group and the control group at baseline, measurement 2 and measurement 3.

1.7 Outline of chapters to follow:

Chapter Two comprises the literature review. In this chapter the definition of low back pain, types of low back pain and chronicity; the definition of myofascial pain syndrome, myofascial trigger points, classification of myofascial trigger points, pathophysiology of myofascial trigger points; the management and physiotherapeutic techniques used to treat myofascial low back pain in this study will be discussed, followed by a brief summary of the chapter.

Chapter Three consists of the methodology section of this study in which the research setting, research design, population and sampling, the inclusion criteria, exclusion criteria, outline of muscles to be examined for myofascial trigger points, data collection instruments or rather outcome measures, data collection procedure, data analysis and ethics are explored and discussed.

Chapter Four comprises the output of results in this trial. Demographic and clinical data of participants at baseline are displayed by means of a table. Graphic presentation of the scores obtained on the outcome measures over time as well as output of statistical tests used to analyse data are also displayed. These are followed by a summary of the results chapter.

Discussions of graphical presentation of change in scores over time as well as the output of statistical tests together with limitations of the results are dealt with in Chapter Five.

Lastly, Chapter Six consist of a brief general summary of the trial, implications of the results, the conclusion drawn and recommendations pertaining to this study are also reported on.

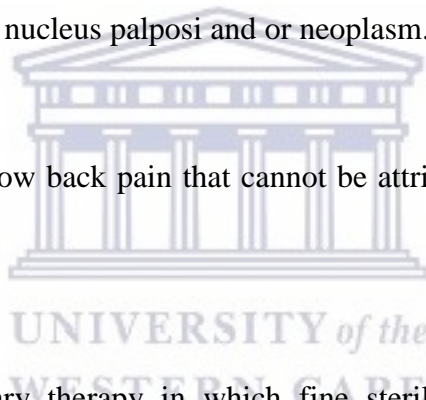
1.8 Definition and explanation of terms:

Trigger point: a focal area of hyperirritability that is locally sensitive to pressure and can refer symptoms (usually pain) to other areas of the body. Trigger points are reported to exist in soft tissue of the body, which includes muscle, muscular fascia, periosteum, ligament and skin.

Myofascial Trigger Point: this is a term that is used to describe trigger points that exist in skeletal muscle tissue or skeletal muscular fascia.

Specific low back pain: low back pain caused by specific pathological entities such as metastatic diseases, cancer, infection, fractures, inflammatory oedema, osteoarthritis, rheumatoid arthritis, herniated nucleus palposi and or neoplasm.

Non-specific low back pain: low back pain that cannot be attributed to a specific disease or spinal abnormality reliably.



Acupuncture: a complementary therapy in which fine sterile monofilament needles are inserted into the skin at specific points on the body in order to maintain energy balance in the body.

Dry needling: minimally invasive technique using monofilament sterile acupuncture needles which is inserted into muscle and connective tissue to address myofascial trigger points.

Acute: describing a disease or condition of rapid onset, severe symptoms and of brief duration.

Chronic: describing a disease or condition of long duration involving very slow changes. Such disease is often of gradual onset. The term does not imply anything about the severity of the disease.

Blind study: An experimental study in which subjects do not know the treatment they are receiving; investigators may also be blind to the treatment subjects are receiving.

Analysis of Variance (ANOVA): A statistical procedure which determines whether any differences exist between two or more groups of subjects on one or more factors.

Multiple Analysis of Variance (MANOVA): an advanced statistical method that provides a global test when there are multiple dependent variables and the independent variables are nominal. It is analogous to analysis of variance with multiple outcome measures.

Random sample: a sample of n subjects (or objects) selected from a population so that each has a known chance of being in the sample.

Randomization: the process of assigning subjects to different treatments (or vice versa) by using random numbers.

Randomized controlled trial (RCT): An experimental study in which subjects are randomly assigned to treatment groups.

Bilateral: relating to or affecting both sides of the body or of a tissue or organ or both of a pair of organs.

Unilateral: relating to or affecting one side of the body or one side of an organ or other part.

Inclusion Criteria: a set of predefined characteristics used to identify subjects who will be included in a research study.

Exclusion Criteria: characteristics which disqualify prospective subjects from inclusion in a study.

Phobia: a pathologically strong fear of an event or thing.

Minimum clinically important difference (MCID): the smallest difference in score in the domain of interest which patients perceive as beneficial and which would mandate, in the absence of troublesome side effects and excessive cost, a change in the patient's management.

Statistical significance: generally interpreted as a result that would occur by chance eg, 1 time in 20, with p value less than or equal to 0.05. It occurs when the null hypothesis is rejected.

Minimally invasive treatment: this is a procedure that requires for the skin to be pierced or punctured or have minimal surgical incisions in order to reduce trauma to the body. It is usually performed with thin needles and an endoscope to visually guide the surgery.

Non-invasive treatment: this is a procedure that does not require incision into the body or puncturing of the skin or removal of tissue.

Intramuscular: within a muscle. An intramuscular injection is made into the muscle.

Conservative treatment: treatment aimed at preventing a condition from becoming worse in the expectation that either natural healing will occur or progress of the disease will be so slow that no drastic treatment will be justified.



1.9 List of abbreviated terms throughout study:

Low Back Pain: LBP

Myofascial Pain: MP

Myofascial Pain Syndrome: MPS

Myofascial Trigger Points: MTrPs

Local Twitch Response: LTR

Dry Needling: DN

Visual Analogue Scale: VAS

Numerical Rating Scale: NRS

Roland Morris Disability Questionnaire: RMDQ

Oswestry Disability Index: ODI

Finger-to-Floor Distance Test: FFD

Acute Myofascial Low Back Pain: AMLBP

Chronic Low Back Pain: CLBP

Myofascial Trigger Point Dry Needling: MTrPDN

Focal Adhesion Kinase: FAK

Extracellular Signal-Related Kinase: ERK

Sarcoplasmic Reticulum: SR

Calcium ions: Ca⁺⁺

Minimum Clinical Important Difference: MCID

Analysis of Variance: ANOVA

Multiple Analysis of Variance: MANOVA



CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

LBP is regarded as a very common health problem which affects all age groups and yet its burden is considered to be trivial most often (Duthey, 2013). Duthey, (2013), also stated that LBP occurs in similar proportions in all cultures, interferes with quality of life as well as work performance, and is the most common reason for medical consultations. According to Duthey, (2013), back ache is a constellation of symptoms rather than a disease of which the origins is unknown in most cases, despite the identification of risk factors that relate to this condition.

Sub-divisions in this chapter that will be discussed further are the definition of LBP, types of LBP and chronicity, what is MPS, what are MTrPs, subdivision of MTrPs, pathophysiology of MTrPs, management of LBP and MTrPs, and the summary of the chapter.

2.2 Definition of LBP

LBP has been defined according to the area of pain, type of LBP, and chronicity. For the purpose of this study, the researcher will use the definition of early acute (two weeks or less) MLBP as pain experienced posteriorly, localised to the lower back or lumbosacral region between the lower margins of the 12th rib and the inferior gluteal folds which may be accompanied with aches, stiffness, fatigue, muscle weakness, limited lumbar range of motion with or without referred hip, leg or groin pain (excluding radiculopathy, pain caused by nerve root compression, positive straight leg raise at less than 45°, inflammation or injury to the spinal nerve root) due to MTrPs found in the quadratus lumborum, gluteus maximus, gluteus medius, gluteus minimus and piriformis muscles (Moosajee and Kalla, 2015; Van

Middelkoop et al., 2010; Duthey, 2013). These are muscles mainly afflicted by MTrPs that can relate to LBP (Coelho et al., 2014).

2.3 Types of LBP and Chronicity

Moosajee et al., (2015), reported LBP to be pain below the costal margin but above the inferior gluteal folds. According to Duthey, (2013), LBP may be experienced as aching, burning, stabbing, sharp or dull, well-defined, or vague with the intensity ranging from mild to severe and have a sudden or gradual onset. Non-specific LBP is defined as LBP not attributed to recognisable, known specific pathology such as infection, tumour, osteoporosis, ankylosing spondylitis, fracture, inflammatory process, radicular syndrome, or cauda equina syndrome (Duthey, 2013). Sub-types of LBP are classified into three categories: chronic, sub-acute (later acute) and early acute LBP. Chronic low back pain is low back pain that persists for longer than twelve weeks, or recurs intermittently and affects an individual over a prolonged period of time (Goertz, Thorson, Bonsell, Bonte, Campbell, Haake, Johnson, Kramer, Mueller, Peterson, Setterland, Timming, 2012). Sub-acute (later acute) low back pain is low back pain that has been present between two to six weeks (Goertz et al., 2012; Institute for Clinical System Improvement, 2012). Early acute low back pain is low back pain that has been present for two weeks or less (Goertz, 2012; Institute for Clinical System Improvement, 2012).

2.4 Definition of Myofascial Pain Syndrome (MPS)

Travell and Simons were the first authors to describe myofascial pain (MP) systematically and explain it to be as a result of the presence of myofascial trigger points (MTrPs) (Barbero, Cescon, Tettamanti, Leggero, Macmillan, Coutts, Gatti, 2013). According to Koca et al., (2014), MPS is the most common cause of musculoskeletal pain. MPS can be described as

acute, recurrent, or chronic forms of regional musculoskeletal pain whose mean prevalences among middle-aged (30-60 years) men and women are 37% and 65%, and 85% in elderly (>65years) individuals respectively (Giamberardino, Affaitati, Fabrizio and Constantini, 2011). MPS is defined as a complex of sensory, motor and autonomic symptoms that are caused by MTrPs (Lavelle et al., 2007; Giamberardino et al., 2011). The sensory disturbances that are produced are dysesthesias, hyperalgesias, and referred pain (Lavelle et al., 2007). Coryza, lacrimation, salivation, changes in skin temperature, sweating, piloerection, proprioceptive disturbances, and erythema of the overlying skin are autonomic manifestations of MP (Lavelle et al., 2007). MPS is a type of pain that results from MTrPs which can occur in any area of the body including the low back region (Eng-Ching Yap, 2007; Bubnov, 2012). The area of referred pain is the feature which differentiates MPS from fibromyalgia (Lavelle et al., 2007). It is integral that one must differentiate between MPS and Fibromyalgia Syndrome as these two entities may occur concomitantly and may greatly influence each other when found or diagnosed in the same patients (Giamberardino et al., 2011). MPS is reported to be a consequential painful disorder of the muscle resulting from MTrPs which has a peripheral origin while fibromyalgia involves multiple tender spots or tender points and is rooted in the central nervous system (Giamberardino et al., 2011).

2.5 Myofascial Trigger Points (MTrPs)

MTrPs are defined as local ischemic areas in muscles and myofascial tissues (Koca et al., 2014). MTrPs are discrete, focal, hyperirritable spots located in a taut band of skeletal muscle (Barbero et al., 2013). These spots are painful on compression and can cause referred pain and tenderness, abnormal sensitivity and motor dysfunction as well as vegetative phenomena like dizziness, numbness and dysesthesia (Bubnov, 2012). MTrPs could develop due to initial injury to muscle by means of acute muscle strain, muscle overload, trauma or micro-

trauma, prolonged habitual postures or repetitive activities which places abnormal tension on specific muscle groups (Lavelle et al., 2007; Giamberardino et al., 2011). The MTrP causes pain and tension in the muscle or muscle fibre (Lavelle et al., 2007). As the tension in the muscle increases, the muscle becomes fatigued and is rendered more susceptible to activation and or additional MTrPs (Lavelle et al., 2007). When predisposing factors combine with a triggering stress event, activation of a MTrP occurs (Lavelle et al., 2007). This is known as the “injury pool theory” (Lavelle et al., 2007). Koca et al., 2014, reported these predisposing factors which should be managed to be anatomical factors, medical factors, ergonomic factors, psychosocial factors, sleep disorders and para-functional problems.

2.5.1a Classification of Myofascial Trigger Points (MTrPs)

MTrPs are classified into two categories as being active or latent (Doraisamy, 2011). According to Doraisamy, (2011), an active MTrP causes a clinical pain complaint. Active MTrP are always tender, prevents full lengthening of the muscle, weakens the muscle, refers a patient-recognised pain on direct compression, mediates a local twitch response of the muscle fibres when adequately stimulated and when compressed within the patients’ pain tolerance produces referred phenomena and often autonomic phenomena generally in its pain reference zone and causes tenderness in the pain reference zone (Doraisamy, 2011).

Latent MTrPs are clinically dormant with regards to spontaneous pain (Doraisamy, 2011). A latent MTrP is only painful on palpation and may have all the other clinical characteristics of an active MTrP and always has a taut band that increases muscle tension and restricts range of motion (Doraisamy, 2011).

2.5.1b Common symptoms caused by Myofascial Trigger Points in Quadratus Lumborum, Gluteus Maximus, and Gluteus Medius, Gluteus Minimus and Piriformus muscle

Myofascial trigger points (MTrPs) in the quadratus lumborum muscle have a tendency to produce low back pain that is felt deeply with occasional sharp stabs of pain (Musculino, J., 2009). These symptoms could be experienced while at rest but is usually most severe when standing or while seated (Musculino, J., 2009). Difficulty is experienced with sleeping due to referred tenderness around the greater trochanter, turning over in bed, getting up out of bed or a chair, and intense pain when coughing and sneezing may also be experienced by the individual (Musculino, J., 2009). Reduced range of spinal forward flexion is noted as well as contralateral flexion, an ipsilateral elevated pelvis, and a scoliosis with convexity to the opposite side may occur (Musculino, J., 2009). Pain may also be referred to the groin as well as into the scrotum and testicles of a male (Musculino, J., 2009).

MTrPs in gluteus maximus muscle cause symptoms which include difficulty with sleep, restlessness with prolonged sitting, increased pain while walking uphill (especially while leaning forward), pain with lumbar forward flexion as well as increased pain on swimming crawl (Musculino, J., 2009).

Common symptoms experienced when MTrPs are present in gluteus medius muscle include pain when sleeping on (compressing) the affected side, reduced hip joint adduction, hip joint pain, antalgic gait, sciatica-like pain referral pattern as well as a posteriorly depressed pelvis which could result in scoliosis (Joseph, E., 2009).

MTrPs that are found in the gluteus minimus muscle generally produce the same symptoms as that found in gluteus medius however, the referral pattern often extends much farther distally (as far as the ankle joint) (Musculino, J., 2009). Pain is experienced on rising from a

chair; may be confused as radiculopathy and is often misdiagnosed as sciatica (Musculino, J., 2009). Pain caused by trigger points in gluteus minimus is often persistent and severe (Musculino, J., 2009).

Patients commonly experience pain that radiates into lateral buttock and upper third of posterior thigh when MTrPs are present in the piriformis muscle (Musculino, J., 2009). MTrPs may produce restlessness and dysfunction while sitting, lateral rotation of the thigh at the hip joint results in turn-out of the foot, restricted medial rotation of the hip, and sacroiliac joint dysfunction (Musculino, J., 2009).

2.5.2 Pathophysiology of Myofascial Trigger Points (MTrPs)

According to Bron and Dommerholt (2012), mechanical muscle overuse is consequent of muscle contractions that exceed muscle capacity. Capillary blood pressure ranges from approximately 35mmHg at the beginning (arterial side), to 15 mmHg at the end of the capillary beds (venous side), the capillary blood flow is temporarily obstructed during muscle contractions (Bron et al., 2012). The blood flow recovers immediately with relaxation, which in turn is consistent with its normal physiological mechanism (Bron et al., 2012). Intra-muscular blood flow is enhanced with dynamic rhythmic contractions due to the contraction-relaxation rhythms, also known as the muscular pump (Bron et al., 2012).

An MTrP could be seen as a dysfunctional site where an abnormal increase in the production and release of acetylcholine packets from the motor nerve terminal under resting conditions (dysfunctional endplate) is present (Giamberardino, 2011). This mechanism would be enhanced by initiating traumatic/ micro-trauma event (primary trigger point) or referral process (secondary trigger points), with increased motor end plate activity, persistent release of acetylcholine, and sustained depolarisation of the post-junctional membrane of the muscle

fibre (Giamberardino et al., 2011). This could, consequently cause continuous release and inadequate uptake of calcium ions from the local sarcoplasmic reticulum (SR), which then causes sustained shortening of sarcomeres (Giamberardino et al., 2011). A vicious cycle of hypoxia (with release of vasoactive/algogenic substances, responsible for local nociceptor sensitisation, and thus, hyperalgesia), failed Ca^{++} reuptake from the SR (due to energy impairment), and perpetuation of the contracture (“integrated hypothesis” of the original “energy crisis” hypothesis) would consequently be initiated (Giamberardino et al., 2011).

2.6 Management of Myofascial Low Back Pain (MLBP)

According to previous literature, there are numerous treatment techniques or therapeutic modalities used to treat MLBP and yet not one in particular has proven to be more effective than the rest. One single therapeutic technique does not reach the desired effect longed for by patients that suffer from myofascial pain syndrome (Koca et al., 2014). Physiotherapists have traditionally made use of conservative or non-invasive techniques in order to address myofascial trigger points (Huguenin, 2004). Previous literature reporting the benefits of combining non-invasive techniques and minimally invasive techniques such as dry needling do exist, especially for chronic low back pain however, evidence advocating the combination of these techniques for the treatment of acute myofascial low back pain is limited and insufficient in order to draw clear conclusions or recommendations (Gabriella et al., 2013). This study was therefore set out to explore the effect of combining some of the most frequently used conservative or non-invasive techniques such as ischemic compression and transverse friction (massage techniques) and stretching with dry needling to address acute myofascial trigger points in the low back region. In the following section treatment techniques used to treat MTrPs is discussed.

2.6.1 Discussion of various techniques used to treat MLBP:

According to Brighton (2012), acute pain is a normal biological response to tissue trauma. The patient's response to the pain stimulus integrates the physical component of pain, with psychological factors like anxiety and depression as well as the social aspect of interpersonal relationships such as the work environment and domestic issues (Brighton, 2012). Brighton (2012), reported that pain perception is profoundly influenced by emotional factors and therefore depression and anxiety lower patient's pain threshold.

2.6.1.1 Patient Education

Active patient participation in spine care is crucial for the success of treatment and therefore it is important for the patient to be educated on his or her condition and their role in avoiding re-injury (Arya, 2014; Koca et al., 2014). Reassurance is at the core of daily medical practice, as this removes patient fears and concerns about their illness (Traeger, Hübscher, Henschke, Moseley, Lee, McAuley, 2015). Fears and concerns are known to have a profound influence on physical health; it motivates the patient behaviour at consultation and may lead the patient to seek inappropriate and expensive interventions (Traeger et al., 2015). One way of patient reassurance is to clearly explain symptoms and educate the patient about their condition (Traeger et al., 2015). Traeger et al., (2015), provided moderate- to high- quality evidence that patient education can reassure patients suffering from acute low back pain (ALBP) and that the effects provided could be maintained for twelve months. Patient education can also have a positive effect in the reduction of number of health care visits related to LBP (Traeger et al., 2015).

2.6.1.2 Exercise (Stretching)

Stretching exercises are a powerful tool manual therapists and athletic trainers use to improve the health of their clients by lengthening and elongating soft tissues (Musculino, J., 2009). These soft tissues include muscles and their tendons (known as myofascial units), ligaments as well as joint capsules (Musculino, J., 2009). Stretching is done as a means to relieve increased muscle tension that may lead to soft tissue shortening and contractures (Musculino, J., 2009). In addition to stretching, relaxation and posture strengthening exercises are recommended most frequently (Koca et al., 2014). Muscle stretching techniques are effective when the sarcomere length through the involved muscle is equal which subsequently improves joint range of motion (Koca et al., 2014). Posture exercises are useful in reducing mechanical stresses on muscle (Koca et al., 2014). The physiological mechanism that brings about the positive effects of exercise is that exercise triggers the release of beta-endorphins from the pituitary gland (peripherally) and hypothalamus (centrally) which consequently enables the analgesic effects by peripheral and central activation of opioid receptors (Sharan et al., 2014). Exercise programmes including walking, cycling with a bicycle (with handle bars positioned high enough to keep the back straight) and swimming are recommended as these activities put minimal stress on the back (Brighton, 2012). Activities that are known to put mechanical stress on the spine should be avoided (Brighton, 2012). Some of the activities known to put more stress on the spine are lifting, prolonged sitting (especially in an unsupported chair), bending as well as twisting (Brighton, 2012). Simple conditioning exercises for trunk muscles as well as back extensors have also proven to be helpful (Brighton, 2012). According to Brighton (2012), these exercises may aggravate symptoms before relief is experienced.

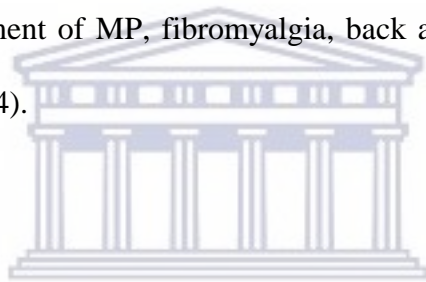
2.6.1.3 Massage

Massage therapy is reported to be effective in managing subacute and chronic low back pain, delayed onset of muscle soreness (DOMS), anxiety, stress and relaxation, and aids the wellbeing of patients with chronic as well as terminal diseases (Kenny and Cohen, 2011). Massage, is also defined as “manual soft tissue manipulation, which includes holding, causing movement and also applying pressure to the body” (Kenny et. al., 2011). Therefore, massage is based on techniques of physical touch that are utilised to manipulate soft tissues, influence body fluid movement and stimulate neuroendocrine responses (Musculino, J., 2009). Physiotherapists use massage for the following reasons: to improve or increase blood supply to an area; relieve tension in both muscles as well as surrounding connective tissues; release myofascial trigger points; relaxing the patient in order to ease tension caused by stress and anxiety; prepare muscles for stretching as well as sport and also to warm and relax areas of the body before treating it with passive mobilization and manipulation (activesportsandspinal.com.au). Ischemic compression and transverse friction are both entities that form part of manual therapies and are used to address myofascial trigger points, therefore myofascial trigger point release techniques (Fernández-de-las-Peñas, Alonso-Blanco, Fernández-Carnero, Miangolarra-Page, 2006; Sharan et al. 2014). According to Lavelle, Lavelle and Smith (2007), as well as Koca et al., (2014), ischemic compression is based on the principle that the application of pressure to a trigger point is applied to the extent to produce ischemia (meaning the flow of blood to that trigger point is interrupted), which is then released afterwards so that the incoming blood will remove pain causing toxins and bring pain relieving chemicals (endorphins) which subsequently resolves the trigger point.

2.6.1.4 Needling therapies

Acupuncture

Acupuncture is based on the theory of homeostatic equilibrium being the basis of health (Gabriella et al., 2013). Acupuncture focuses on the restoration of homeostasis by manipulation of the complementary and opposing elements yin and yang (Gabriella et al., 2013). Gabriella et al., (2013), suggested that pain relief may possibly be promoted by acupuncture through means of affecting the afferent nerve signalling, which in turn influence the release of endogenous opioids. Acupuncture (technique that involves the use of sterile needles to stimulate certain points on the body) is commonly used as an alternative therapy for MLBP (Sharan et al., 2014). Acupuncture is an adjuvant therapy and can be regarded as an alternative in the management of MP, fibromyalgia, back ache, osteoarthritis and lateral epicondylitis (Koca et al., 2014).



Dry Needling (DN)

DN has been practiced nationally and internationally for more than a decade already (Sharan et al., 2014). Dunning, Butts, Mourad, Young, Flannagan, Perreault,(2013) reported that DN is typically used to treat muscles, ligaments, tendons, subcutaneous fascia, scar tissue, peripheral nerves, and neurovascular bundles for the management of a variety of neuromusculoskeletal pain syndromes. DN is reported to be one of the fastest, most effective and efficient ways to deactivate MTrPs and help relieve the accompanied pain (Desai, Saini, Saini, 2013). Local injection therapies, often referred to as ‘wet needling’, use hollow-bore needles to deliver medicinal substances where as ‘dry needling’ refers to the insertion of thin monofilament needles, as used in the practice of acupuncture without the use of injectate (Dunning et al., 2013). The effectiveness of DN is also dependent on the ability of the clinician to locate MTrPs and needle these hyperirritable spots accurately through means of

palpation (Sharan et al., 2014). DN is performed by placing the needle into the MTrP using an in-and –out technique in multiple directions in order to deactivate the MTrPs (Desai et al., 2013). The therapeutic effect of DN is brought on by the mechanical disruption of sensory and motor components of the nerve endings which play a role in the MTrP activity, consequently facilitating local endorphin release and the gate-control mechanism (Koca et al., 2014). Garvey, Marks and Wiesel (1989), compared DN, lidocaine monotherapy, lidocaine combined with steroid injection, and acupressure combined with vapo-coolant in patients with LBP and found that all these techniques did significantly improve pain scores however no difference was indicated among the groups.



2.7 Summarising table of various treatment approaches used to treat MPS and MTrPs and outcomes found.

Author and year of publication	Type of study	Technique	Outcome
Traeger, Hübscher, Henschke, Moseley, Lee, McAuley, 2015 Level of Evidence: 1	Systematic Review and Meta Analysis	Primary care-based Education on reassurance	Moderate- to-high-quality evidence show proof that patient education in primary care can provide long-term reassurance for patients suffering from acute or sub-acute low back pain.
Koca et al., 2014 Level of Evidence: 1	Systematic review	Exercise	Stretching, relaxation and posture strengthening exercises are among the most common recommended therapies for Myofascial Pain Syndrome. Passive stretching is regarded as the only tolerable exercise on hypersensitive trigger points and plays a crucial role in the management of Myofascial Pain Syndrome due to the long-term resulting relaxation effect. Muscle stretching techniques are effective when the sarcomere length through the involved muscle is restored to equal length. As result, the vicious cycle can be terminated and range of motion is improved. Posture exercises reduce mechanical stresses on muscles. Post isometric relaxation has also been proven to be effective as the primary goals of this technique are muscle relaxation, pain relief, promotion of healthy synergism in agonist muscles as well as reciprocal link in antagonist muscles.
Renan-Ordine et al., 2015 Level of Evidence: 1	RCT	Stretching vs manual soft tissue techniques and stretching	Manual soft tissue techniques in addition to stretching produces superior results to stretching alone
Koca et al., 2014 Level of Evidence: 1	Systematic review	Ischemic compression	Ischemic compression along with hot pack therapy and active range of motion exercises proved to be effective in the management of Myofascial Pain Syndrome.
Cagnie et al., 2015. Level of Evidence: 1	Systematic Review	Ischemic compression	There is moderate evidence for the use of ischemic compression to have a positive effect on pain intensity.

<p>Koca et al., 2014</p> <p>Level of Evidence:1</p>	<p>Systematic review</p>	<p>Massage</p>	<p>Massage is more effective than hot pack therapy alone in the management of Myofascial Pain Syndrome. Techniques such as friction and petrissage may cause increased pain when applied over the hypersensitive trigger points directly and intensively. Significant improvement in clinical scores were found when massage and exercises were used in combination to manage Myofascial Pain Syndrome.</p>
<p>Koca et al., 2014</p> <p>Level of Evidence: 1</p> <p>Liu et al., 2015</p> <p>Level of Evidence: 2</p> <p>Vickers, Cronin, Maschino, Lewith, MacPherson, Foster, Sherman, Witt, Linde, 2012</p> <p>Level of Evidence: 1</p>	<p>Systematic review</p> <p>Overview of systematic reviews</p> <p>Meta-analysis</p>	<p>Acupuncture</p> <p>Acupuncture</p> <p>Acupuncture vs no-acupuncture control and sham acupuncture 29 RCTs (17922 individual patients)</p>	<p>Acupuncture is an adjuvant and can be considered as an alternative in the management of myofascial pain, fibromyalgia, back pain, osteoarthritis and lateral epicondylitis.</p> <p>Acupuncture used either in isolation or as an adjunct or conventional therapy provides short term improvements in pain and function for chronic low back pain.</p> <p>Acupuncture superior to both no-acupuncture control and sham acupuncture.</p>
<p>Koca et al., 2014</p> <p>Level of Evidence: 1</p>	<p>Systematic review</p>	<p>Dry Needling</p>	<p>Dry needling is considered to be an effective therapy. In an earlier study, dry needling was proven to be as effective as lidocaine monotherapy, lidocaine plus steroid injection and acupressure combined with vapocoolant in patients with back pain as the results showed that all the above mentioned modalities significantly improved pain scores. No significant differences were noted among these modalities.</p>

<p>Mayoral, Salvat, Martin, Martin, Santiago, Cotarelo, Rodriguez, 2013</p> <p>Level of Evidence: 1</p>	<p>Double blind placebo controlled RCT</p>	<p>Dry Needling vs placebo (40 participants)</p>	<p>Dry Needling superior to placebo.</p>
<p>Cagnie et al., 2015</p> <p>Level of Evidence: 1</p>	<p>Systematic Review</p>	<p>Dry Needling</p>	<p>There is strong evidence for Dry Needling to have a positive effect on pain intensity.</p>



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2.8 Summary:

LBP has a multifactorial etiology and could be related to a set of causes that may include social and demographic factors such as age, gender, income, and schooling, health status, lifestyle or behaviour factors (smoking, diet and sedentary lifestyle), as well as occupational factors such as heavy loadings and repetitive movements (Nascimento and Costa , 2015). LBP is not only defined by the anatomical area of the body but also by sub-types such as specific or nonspecific as well as phase of chronicity (acute, subacute or chronic) (Duthey, 2013). The origin of LBP could also be myofascial related. MPS is the most common cause of musculoskeletal pain (Koca et al., 2014). Koca et al., (2014), reported the primary goals of management to be relieving pain, improving range of motion and removing predisposing factors for MTrPs. According to Koca et al. (2014), the main management options include preventive treatment options such as patient education; the management of predisposing factors such as anatomical factors, medical factors, ergonomic factors, sleep disorders, psychological factors and para-functional problems; pharmacologic treatment as well as non-pharmacologic treatment. The non-pharmacological approaches are techniques commonly used by physiotherapists and comprise superficial heating, exercise, manual techniques, biofeedback, electrotherapeutic modalities and needling therapies (Koca et al., 2014). Despite the existence of numerous approaches or techniques to treat MTrPs and a multitude of studies that have been conducted, no specific treatment technique has been proven to be the most effective or superior universally to the rest (Liu et al., 2015). Monotherapy may be insufficient to achieve complete recovery in MPS patients (Koca et al., 2014). There is growing evidence that MTrP injections and DN, as well as stretching exercises are effective alternatives in the management of MPS (Koca et al., 2014). To date, numerous studies have been conducted using acupuncture and DN on different areas of the body including the low back area. Many studies have proven that acupuncture and DN can be used in combination

with other treatment techniques to treat CLBP however no recommendations could be made with regards to using DN for AMLBP (Furlan et al., 2008). Therefore there is no clear evidence to recommend or contraindicate the use of DN as an adjunct to massage and stretching for AMLBP (Furlan et al., 2008). In the current RCT the author aimed to determine the efficacy of DN as an adjunct to massage and stretching by using patient-reported outcome measures such as the visual analogue scale (VAS), which reflects the patients' perception of the intensity of their pain on the day of the treatment session, the Roland Morris Disability Questionnaire (RMDQ), which is a condition-specific outcome measure for physical disability due to low back pain, the Oswestry Disability Index, to identify disturbance of activities of daily living due to severity of back ache and, the Finger-to-Floor Distance test to measure lumbar forward flexion motion.

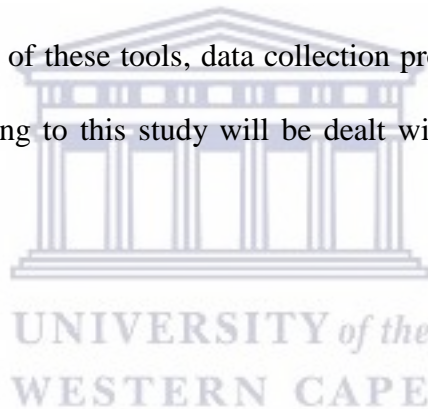


CHAPTER 3

METHODOLOGY

3.1 Introduction

Chapter three encompasses the methodology of this experimental study. This study investigated the effectiveness of dry needling as an adjunct to massage and stretching for the treatment of myofascial trigger points in muscles commonly involved in low back pain while still in the acute phase. This chapter explains methods used to conduct this randomised controlled trial. The research setting, research design, population and sampling, inclusion criteria and exclusion criteria, the muscles that were focused on in this study, data collection instruments and the reliability of these tools, data collection procedure, data analysis as well as the ethical aspects pertaining to this study will be dealt with throughout the rest of this chapter.



3.2. Research setting

The study was conducted at the physiotherapy department of Cradock Hospital. Cradock Hospital is an eighty-three bedded district hospital which serves the community of Cradock and the rest of the Inxuba-Yethemba sub-district within the Chris Hani district. Cradock is situated on the banks of the Great Fish River along the N10 National Road approximately 230 km north from Port Elizabeth in the Eastern Cape, South Africa.

Services that are available at Cradock District Hospital comprise of Out-patient Departments, Casualty, Medical Services, Surgical Services, Paediatrics, Maternity, Operating Theatre, Central Sterilising Service Department (CSSD), X-ray Services, Rehabilitation (Physiotherapy, Occupational Therapy, Speech Therapy, Dietetics), Social Services,

Pharmacy, Laboratory, Laundry, Food Services, and HIV/AIDS (ARV's) Services. Patients are required to consult, be examined and diagnosed by a medical doctor first before referral to physiotherapy. Six qualified physiotherapists employed at Cradock Hospital, of which five have been trained and certified to perform dry needling were incorporated as trial assistants. These professionals are required to do outreach on a regular basis. The outreach programme covers local and surrounding clinical facilities in the rest of the sub-district where physiotherapy services must be rendered at. These clinical facilities comprise the hospital wards (5), physiotherapy out-patients department (1), local clinics (4), clinics in other towns within the sub-district (13) are split amongst physiotherapists. Outreach programmes are planned so that wards are visited daily before or after outreach visits, different clinics and towns are visited on different days of the week, and also so that the out-patient department is not left unattended by physiotherapists. Patients are booked for treatment sessions as soon as possible by or with any available physiotherapist. However, for the purpose of this study participants were booked with physiotherapists who were able and have been certified to perform dry needling on the specific region of the human body (within the same week if not on the same day of referral). A total of approximately 219 patients suffering from low back pain were treated at the Physiotherapy Department during the study period from 1 April 2015 until end of July 2015, which rendered an average of 55 individuals per month.

3.3 Research Design

The study design undertaken was that of a quantitative, experimental, single-blind, randomized controlled trial in which the effectiveness of DN in conjunction with massage (transverse friction and ischemic compression) and stretching exercises was compared to massage and stretching exercises only in participants suffering from acute myofascial low

back pain (AMLBP). The reason for the choice of following a randomised controlled approach was due to two treatment approaches being compared to each other. The interventions involved massage and stretching for the control group; and massage, stretching as well as myofascial trigger point dry needling for the intervention group. By using an RCT approach, the two involved groups are compared while biases are eliminated and conclusions can be drawn about the causal effect of the treatment given. Randomised control trials are considered to be the gold standard in clinical research designs (Sullivan, 2011). According to Sullivan (2011), randomised control trials are quantitative, comparative, controlled experiments in which treatment effects could be determined with less bias than observational trials and are known to be the most powerful experimental design in clinical trials in which outcomes can be attributed to the intervention. The researcher made use of an experimental randomised controlled trial because it provides the strongest evidence for causation thus providing the best evidence that the result is due to the intervention (Rajagopalan et al, 2013). The researcher of the current trial therefore found it appropriate to conduct a randomised controlled trial because it tested the effectiveness of DN as an adjunct to massage and stretching versus massage and stretching only for acute myofascial low back pain (AMLBP) and, provided the best or strongest level of evidence due to causation of the intervention.

According to Akobeng, (2005), it is known that some research designs are more powerful than others with regards to their ability to answer research questions on the effectiveness of interventions and consequently has given rise to the concept of the “hierarchy of evidence” or levels of evidence. The hierarchy provides a framework for ranking the evidence provided by studies according to the specific study designs of health care interventions and indicates which studies should be given most weight in an evaluation where the same question has been examined using different types of study (Akobeng, 2005). The ranking of the hierarchy follows a pyramid shaped evolutionary order, moving from simple observational methods at

the bottom, through increasingly rigorous methodologies as it progresses to the top (Akobeng, 2005). The pyramid shape depicts the increasing risk of bias inherent in study design as one view the pyramid from top to bottom (Akobeng, 2005). The randomised controlled trial (RCT) is reported to provide the most reliable evidence on the effectiveness of interventions due to the processes used while the RCT is conducted which minimise the risk of confounding factors that could influence the results (Akobeng, 2005). The findings obtained by RCTs are likely to be closer to the true effect than those generated by other research methods (Akobeng, 2005). According to the Oxford Centre for Evidence Based Medicine, (2009), RCTs provide level 1b evidence with regard to answering research questions.

Randomisation is also used to create a control group that is as similar as possible to the treatment group through the elimination of selection bias and balancing known and unknown confounding factors (Akobeng, 2005). According to Rajagopalan, Deodurg and Srikanth (2013), strengths and weaknesses of RCTs are as follows: Strengths of RCT: most like an experiment; the only effective method known to control selection bias; able to directly estimate risk; controls confounding bias without adjustment; permits the use of probability theory to express the likelihood that any difference in outcome between treatment groups merely indicates chance; provides strongest evidence for causality in relation to temporality and control for unknown “confounders” ; allows comparisons of multiple outcomes; similar distribution of baseline characteristics in comparison groups; fulfills the basic assumption of statistical hypothesis tests; protection of confounders known and unknown; similar distribution of baseline characteristics in comparison groups.

Weaknesses of RCT: subjects are often a highly selected group (selected for willingness to comply with treatment regimen), level of health and volunteers may differ from population of interest (which could mean that generalisability may suffer); not suitable for rare outcomes;

not suitable for outcomes requiring long or extensive follow-up; adherence/withdrawal issues; limitations of external validity; narrowing of the studies question sometimes impossible or impractical to conduct; complex, expensive, time consuming, sometimes ethically questionable (Rajagopalan et al., 2013).

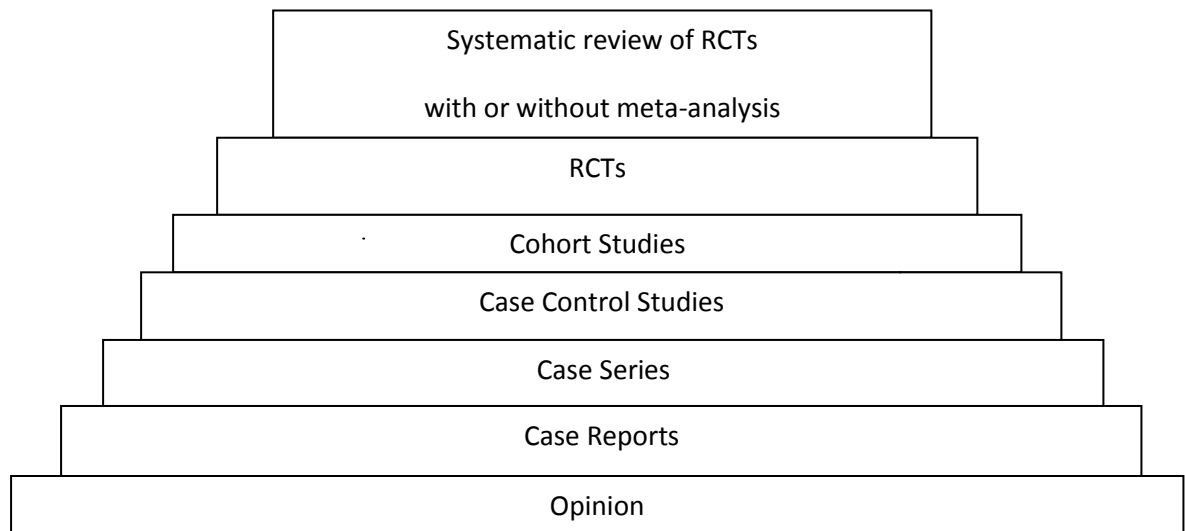
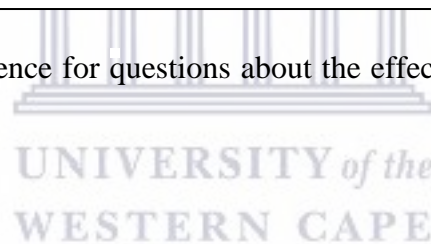


Figure 3.1. Hierarchy of evidence for questions about the effectiveness of an intervention or treatment (Akobeng, 2005).



Blinding was also incorporated as a means to further eliminate bias in the generated outcome of this study. Blinding, also known as masking, refers to the practice of preventing study participants, health care professionals, and individuals collecting and analysing data from knowing which group the participant is allocated to in order to avoid them from being influenced by this knowledge (Akobeng, 2005). Akobeng, (2005), also reported that although blinding helps prevent bias, its effect in doing so is weaker than that of allocation concealment and, unlike allocation concealment, blinding is not always appropriate or possible. Even though it may be impossible to blind study participants or health care professionals to the assigned intervention, it may still be possible to blind assessors or statisticians incorporated to analyse the data generated by the study (Akobeng, 2005). This

study followed a single-blind approach as the outcome assessor was blinded. Blinding could not be maintained for participants as they had to be informed of the treatment protocol, nor could it be maintained for the treating physiotherapist as they knew which treatment group the participant belonged to after the initial treatment session and treatment remained the same for the remainder of the trial.

3.4 Study population and Sampling

The study population comprised of individuals suffering from acute myofascial low back pain (AMLBP) who were referred to physiotherapy as an out-patient via physicians as from 1 April 2015. With reflection on monthly statistics, the author found that large numbers of clients were being referred to physiotherapy for low back pain and on evaluation in most cases, myofascial trigger points were found to be a major contributing factor to the clients' condition. The results of a study conducted by Coelho et al., (2014), reported myofascial dysfunction to be present in 90% of low back pain sufferers and the muscles most commonly involved were quadratus lumborum, iliopsoas, gluteus maximus, gluteus medius, gluteus minimus and piriformis muscle. Coelho et al., (2014), therefore concluded that the prevalence of myofascial dysfunction is high in patients suffering from low back pain and that it deserves specific attention. Therefore, by taking this evidence into account, the researcher was motivated to conduct the current research study.

3.4.1 Sample:

Participants who were included in this study were individuals suffering from acute myofascial low back pain who met the inclusion criteria.

3.4.1.1 Inclusion Criteria

The inclusion criteria required that participants had early acute (two weeks or less) MLBP with MTrPs identified in one or more muscles involved in the study (quadratus lumborum, gluteus maximus, gluteus medius, gluteus minimus and piriformis-see appendix for descriptions, where they are found, where trigger points are palpated commonly and their referral patterns) as diagnosed by a physician firstly and confirmation of diagnosis by one of five qualified physiotherapists (treatment administrators), whether it was unilateral or bilateral; a baseline VAS score of at least 5; tight band or local tightness in muscle with an exquisitely tender spot or palpable nodule within tigh muscle band; participants' pain could be recognized and replicated on palpation; pain was experienced in the expected referral pattern or distribution; participants agree not to receive additional conservative treatment for the condition, such as chiropractic, other physiotherapy modalities, pilates training as well as analgesics and NSAID's unless prescribed by a physician in the event of condition being worsened; participants had to be between the age of 18 years-65years, be of sound cognitive ability, alert and able to report appropriately on pain. Participants were required to sign the written informed consent form to be enrolled into the study.

3.4.1.2 Exclusion Criteria

The exclusion criteria encompassed individuals that were pregnant, had skin lesions at MTrP site; if symptoms were caused by specific pathological entities such as infection and inflammatory oedema, metastatic disease, neoplasm, osteoarthritis, rheumatoid arthritis, fractures and nerve root compression (due to herniated nucleus palposi or positive straight leg raise at less than 45°, decreased lower limb force, diminished reflexes), foraminal stenosis as determined by a medical doctor; individuals who would not have been able to maintain the appropriate position in which MTrPs would have to be evaluated for. Patients with cognitive

alterations, a phobia for needles as well as those younger than 18 years of age were excluded too.

3.4.2 Sample size

The formula used for sample size calculation by means of a scientific calculator was: $n = f(\alpha, \beta) \cdot 2s^2 / \delta^2$ where α is the significance level (using a two sided test) which was set at 0.05, $1 - \beta$ is the power of the test (which was 0.2 or 80%), $f(\alpha, \beta)$ is a value calculated from α and β (7.9), δ is the smallest difference regarded as important to be able to detect (15mm) and s is the standard deviation (20mm) of what is being measured and is usually estimated from previous literature (Tekin, Akarsu, Durmuş, Çakar, Dinçer, Kiralp, 2012; Cornish, 2006). Therefore the sample size was calculated to be twenty-eight (28) individuals per group at the least.

Billingham, Whitehead and Julious, (2013), reports that all trials should have sample size justification. Sample size justification is important for feasibility but for pilot trials however, a formal calculation may not always be appropriate (Billingham et al., 2013). Billingham et al. (2013), as well as van der Tweel, Askie, Vandermeer, Ellenberg, Fernandes, Saloojee, Bassler, Altman, Offringa and van der Lee (2012), recommends using a sample size of thirty (30) individuals per arm with a continuous end point in order to calculate results of statistical significance. Sixty individuals in total were therefore selected for this study and were divided into two groups of thirty individuals each. Thirty individuals were randomised to the experimental group and thirty were randomised to the control group. The experimental group received DN in conjunction with massage and stretching exercises while the control group only received massage and stretching exercises for AMLBP.

3.4.3 Randomization, group allocation and concealment

The researcher made use of the simple random sampling method because, with this sampling method, every subject in a clearly defined population has an equal chance or probability of being selected for the study (Teddlie and Yu, 2007). Participants that met the inclusion criteria were invited to participate in the study and thereafter written informed consent was obtained. As from this point the treating physiotherapist contacted the third party independent from the study, that was responsible for randomization and group allocation by means of a computer generated random allocation sequence schedule. Participants were randomly allocated to either the intervention group or the control group. Each group consisted of 30 participants. Participant allocations were concealed after enrolment into the study was established. The independent third party from the study who was responsible for computer generated randomized allocation, made use of opaque envelopes that were numbered sequentially in advance. The paper indicating which group the participant is allocated to was sealed in the opaque envelope after pressure sensitive carbon paper was placed inside in between two sheets of foil, rendering deciphering impossible by holding the envelope up to bright burning light (Dettori, 2010). Each participant's details were written on the outside of the envelope and were opened sequentially to reveal allocation. Socio-demographic factors or patient information (age, gender and employment status) were collected after informed written consent was obtained on the first day of treatment, before treatment commenced.

Figure 3.4.3.1: Flow diagram of participant recruitment and flow of study.

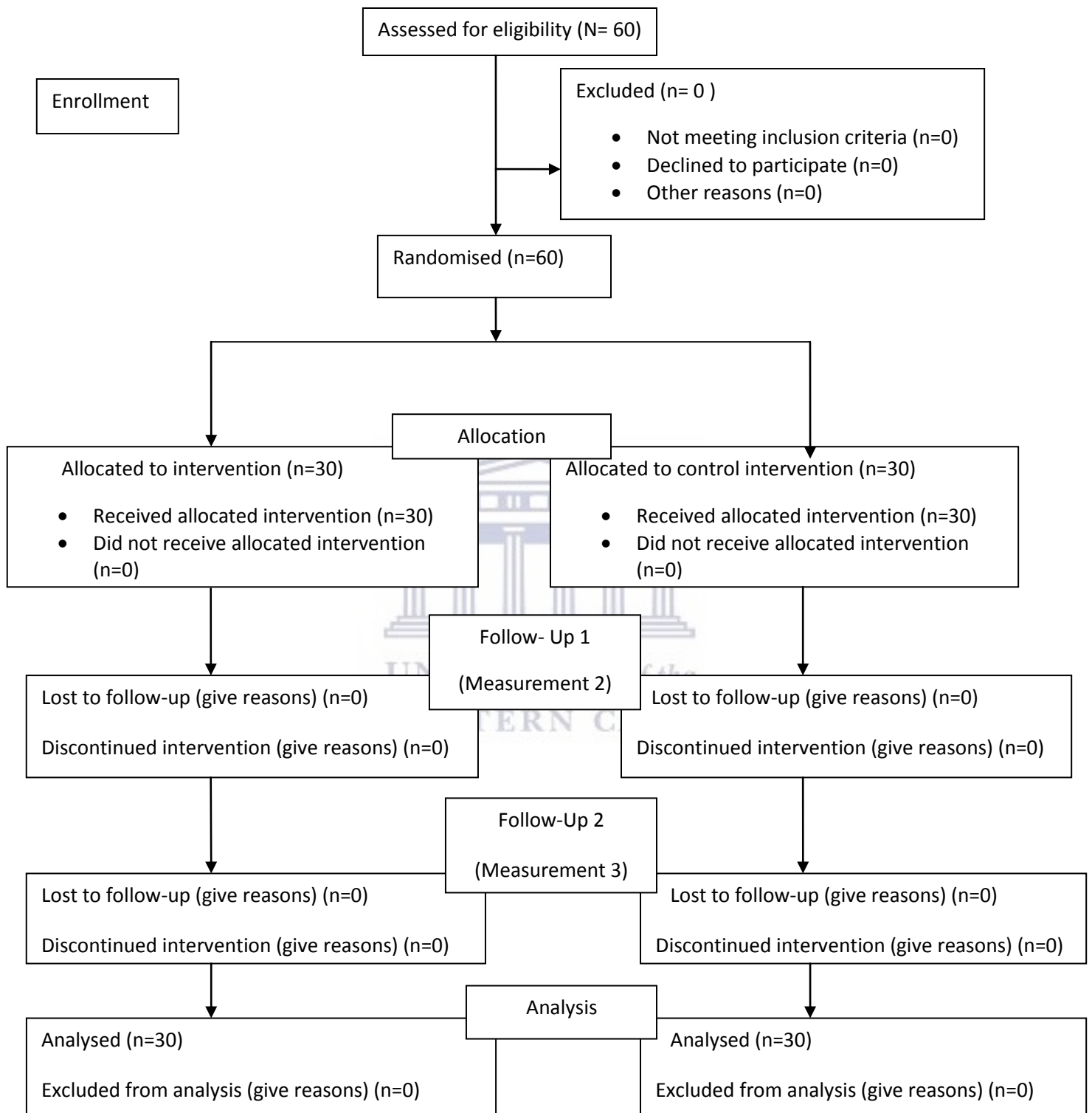


Diagram 3.4.3.1 is a study flow diagram of the current clinical trial, according to the “CONSORT transparent reporting of trials” 2010 Flow Diagram. This diagram includes sample size as from participant recruitment, enrolment, randomisation and group allocation into intervention group or the control group as well as points of measurement over time (Measurement 2 and Measurement 3 post treatment).

No participants were excluded since physicians eliminated specific low back pain, diagnosed non-specific low back pain and AMLBP. Physiotherapists confirmed diagnosis before enrolment into the study. Participants could therefore be recruited and enrolled consecutively. All participants that were recruited for the study completed the trial as there were no drop-outs.

3. 5 Data Collection Instruments (Outcome Measures)

Patient education is reported to be an important tool which can be used as a means to reassure and inform patients about their condition and consequently lead to greater success obtained with treatment given. In this study, each participant was educated and informed about their condition verbally during the treatment sessions. The reasons for the onset of acute myofascial low back pain differed amongst participants and the muscles afflicted from person to person differed as well, as determined during assessment and history taking by the treating physiotherapist. It was not a requirement for participants to have myofascial trigger points in each of the involved muscles nor was it a requirement for myofascial trigger points to be allocated bilaterally. Education given was adapted according to the afflicted muscles and the referral pattern of the myofascial trigger points found within these muscles. Education was therefore not given as a formal standardised tool in the form of formal classes or booklets in this study as the researcher’s focus was directed to the outcome of the investigation of the physical treatments given to the intervention and control group.

The researcher incorporated three subjective outcome measures namely the visual analogue scale (VAS), Roland Morris Disability Questionnaires (RMDQ), Oswestry Disability Index (ODI) and one objective measure, the fingertip-to-floor distance (FFD) test to monitor change in scores and patient progress throughout this clinical trial.

According to literature, a 15mm difference on the visual analogue scale (VAS) is considered a score of minimum clinical important difference (MCID) (Ostelo, Deyo, Stratford, Waddell, Croft, Von Korff, Bouter and de Vet., 2008). Ostelo et al., (2008), also reported that when the baseline score is taken into account, a 30% improvement could be considered as a useful threshold for identifying clinically meaningful improvement on each of the outcome measures of which VAS, Roland Morris Disability Questionnaire (RMDQ) as well as the Oswestry Disability Index (ODI) is amongst. According to Vela, Haladay and Degenar, (2011), the VAS, RMDQ, ODI are valid, reliable and responsive outcome measurements with established values for minimum clinically important difference (MCID). These instruments document important changes in disablement and health-related quality of life in patients with low back injury and also demonstrates treatment outcomes (Vela et al., 2011).

3.5.1a Visual Analogue Scale (VAS)

According to Vela et al., (2011), pain intensity refers to a patient's perception of the level of pain they experience. Pain may be quantified by using a visual analogue scale (VAS) or numeric rating scale (NRS) and both are simple tools that are useful in determining a patient's status (Vela et al., 2011).

The VAS is a self-reported, subjective measure that asks the participant to mark the intensity of his or her pain along a 10cm line with one end of the line representing no pain (0), and the other indicates maximal pain (10) (Vela et al., 2011). The line may be horizontal or vertical

and may include hatch marks or numbers to further help patients mark their pain intensity (Vela et al., 2011). This tool was used as a primary outcome measure to collect data and record changes in score over time, on the participant's perception of the intensity of their pain on the day of measurement, in this study.

3.5.1b Reliability of VAS

The reliability and to a lesser extent validity of the VAS has been well established, (Vela et al., 2011). Vela et al., 2011, reported reliability of VAS to be .97-.99. Ostelo et al., (2008), reported the MCID on VAS to be 15mm or 30% improvement when baseline score is taken into account. According to Mannion, Balagué, Pellisé and Cedraschi, (2007), on pain measurement scales, the most appropriate time frame for measurement varies depending on the circumstances. For instance, for the assessment of acute pain or postoperative pain on the ward, current pain is most appropriate while for chronic pain, with its day-to-day fluctuations, an average rating over the following weeks (between 1 and 4) is recommended, with the precise period being influenced, in part, by the duration of any planned intervention and timing of the next follow-up (Mannion et al., 2007).

The 3.5.2 RMDQ and ODI

Vela et al., (2011), reported the RMDQ and ODI as two of the most frequently used multidimensional, patient-reported (subjective) instruments in research studies examining LBP. Expert Panels have recommended using either the RMDQ or ODI for pain-related disability in patients with LBP (Vela et al., 2011). The RMDQ was used in this study in order to determine what the patients' perception of how levels of physical functional activity have been affected by LBP on the day of measurement (Longo, Loppini, Denaro, Maffulli, Denaro, 2010). The ODI was used to establish the patient's perception of level of disablement in general as it relates to the extent to which the intensity of LBP affects how patients manage

activities of daily living in general (Longo et al., 2010). The same questionnaires are used repeatedly at the different measurement points in time to determine change in scores of functional activity and level of disablement.

3.5.2a The Roland Morris Disability Questionnaire (RMDQ)

The Roland Morris Disability Questionnaire (subjective measure) was used to determine functional ability of the participants as they perceive it on the particular day on which the measurements are taken. The RMDQ is a 24-item questionnaire that is used to evaluate the effect of pain on functional activity. Participants are asked if the statements made in the questionnaire apply to them on the specific day of measurement, within the last 24 hours (Longo et al., 2010). Scores are measured on a scale that ranges from 0-24, with higher scores indicating greater levels of disability (Vela et al., 2011). Scores are interpreted as the higher the score the greater the degree of disablement. (Smeets, Köke, Chung-Wei, Ferreire, Demoulins, 2011).

3.5.2b Reliability of RMDQ

The RMDQ is reliable with coefficient ranging from .43-.96, valid, and responsive to change (Vela et al., 2011). Both the ODI and RDQ measure activity limitations and participation restrictions associated with LBP therefore they are both considered clinically meaningful outcomes instruments that help the clinicians understand the full impact of injury on patient status and progress (Vela et al., 2011). According to Ostelo et al., (2008), the MCID cut off value for RMDQ is 5 points or 30% improvement when baseline scores are taken into account. According Roland and Fairbank, (2000), the quoted test-retest correlations for the RMDQ include 0.91 for the same day, 0.88 at one week, 0.83 at three weeks' interval and for chronic low back pain a correlation of 0.72 was reported for scores taken thirty-nine (39) days apart.

3.5.3a The Oswestry Disability Index (ODI)

The ODI (subjective measure) assesses the extent to which pain intensity limits various activities of daily living and affects patients' ability to manage in everyday life (Vela et al., 2011; Longo et al., 2010). The ODI is a performance-and capacity-based outcomes instrument that consists of ten (10) questions assessing the extent to which pain intensity limits various activities of daily living and affects patients' ability to manage in everyday life, generally (Vela et al., 2011; Longo et al., 2010). Participants are requested to check which statement applies to them with regard to activities of daily living in general (Longo et al., 2010). The ODI was therefore used to assess level of disablement as it related to participants' low back pain in this study. According to Longo et al., (2010), score range form 0-50 (with a higher score indicating a higher level of disablement) and are transformed into percentage score: $(\text{total score} / 50) \times 100$ (Vela et al., 2011). Scores are interpreted as the higher the score the higher the degree of disablement (Smeets et al., 2011). Ostelo et al., (2008), reported MCID cut off value for ODI to be ten (10) points or a 30% improvement in mean score when taking the baseline score into account.

3.5.3b Reliability of the Owestry Disability Index (ODI)

Vianin, (2008), reported that the ODI's test-retest reliability has been shown to be high. Values range from $r = 0.83$ to 0.99 and vary according to the time interval between measurements however the longer the wait between repeated measures is, the lower score becomes (Vianin, 2008). Vianin, (2008), also reported that the suggested time interval for readministration of the ODI is six (6) weeks.

3.5.4a The Finger- to- Floor Distance Test (FFD)

Robinson and Mengshoel, (2014), reported the finger-to-floor distance (FFD) test as one of the most commonly used and well accepted assessment methods for lumbar range of motion in research as well as in the clinical setting. The FFD test is an objective measure used to test the extensibility of lumbar extensors and the flexor range of movement (Robinson et al., 2014). Equipment needed to perform the test is a tape measure and, for individuals who are able to touch the floor on the initial attempt and block of about 15cm in height is necessary to stand on (Robinson et al., 2014). As recommended by Robinson et al., (2014), the FFD test was performed with the subjects standing in their own decided neutral position without shoes, and feet spaced hip width apart. Participants had to stand with their sides towards the wall onto which the tape measure was attached and make two attempts to bend forward as far as possible (within the limits of pain) while keeping their knees, arms and fingers fully extended (Robinson et al., 2014). The first attempt was a trial and therefore measurement was taken on the second attempt (Robinson et al., 2014). The vertical distance between the tip of the third finger and the floor was measured by placing a ruler under the third finger perpendicularly to the tape measure on the wall; smaller distance measured indicated greater lumbar flexion range of motion and therefore showed an improvement of lumbar forward flexion motion (Robinson et al., 2014). With instances where the participant was already able to touch the floor on the initial attempt, the test was repeated with the participant standing on a 15cm high platform, as recommended by (Robinson et al., 2014). The distance was a negative measure in such cases which proved lumbar forward flexion motion improved (Robinson et al., 2014). Ekedahl, Jönsson, Frobell, (2012), demonstrated that a change in the FFD test was significantly correlated to the one month and one year change in the Roland Morris Disability Questionnaire and also concluded that for patients with LBP the FFD had good validity.

3.5.4b Reliability of the FFD

The finger to floor distance test is one of the most popular tests used to evaluate flexibility of the lumbar spine (Knapik, Szuszkiewicz, Mateja, Rzetecki, Niewiadomska-Matula, 2015). The FFD test has been studied and results proved to correlate with the mobility of the upper ($r= 0.79$) and lower ($r= 0.70$) level of the lumbar spine (Knapik et al., 2015). Therefore the FFD test has proven to be a reliable way to assess movement ability of the lumbar spine (Knapik et al., 2015). The According to Robinson et al., 2014, the intraclass correlation coefficient (ICC) for the FFD is 0.93, indicating excellent inter-tester reliability.

3.6 Assessment

Assessments was conducted by a blinded assessor (qualified physiotherapist who was not trained to perform dry needling at the time that the study was conducted) at baseline (before treatment), measurement 2 (fourth week immediately post treatment) and measurement 3 (eighth week immediately post treatment). This person obtained scores on VAS, took measurements for the Finger-to-Floor Distance test, administered the RMDQ and ODI questionnaires and calculated the scores of responses obtained. The assessor remained blinded throughout the trial.

3.7 Data Collection Procedure

First, the researcher obtained ethical clearance from the Senate Committee of the University of the Western Cape for this study to commence after the proposal was accepted. The researcher then obtained permission to conduct the study at Cradock Hospital from the Matron, Medical Superintendent, Hospital Manager and Chris Hani District Manager as well

as the Research and Epidemiology Committee and Superintendent General of the Department of Health in the Eastern Cape.

Physicians employed at Cradock Hospital were informed about the clinical trial. They were requested to determine whether the cause of the patients' LBP was specific, non-specific and also whether the condition is of myofascial origin. Six qualified physiotherapists (G.B., C.C., M. v Z., R.H., N.M., A.J.) employed at Cradock Hospital at the time, were recruited as study assistants. Five of these physiotherapists had already been trained and certified to identify MTrPs and perform DN safely. Each one of these qualified physiotherapist had experience and were practicing DN for at least one year and longer. Before commencement of the study, the physiotherapists responsible for administering treatment agreed that each one of them would administer treatment to twelve participants each. This was decided on by dividing the sample size between the number of treating physiotherapists. These therapists were blinded to which treatment they would administer to the participant until concealed randomized allocation was revealed. The same therapist administered the same treatment to the same participants throughout the eight week period. The other qualified physiotherapist (A.J.) had not been trained in performing DN at the time and was then recruited and trained on obtaining ratings for intensity of pain on VAS, administering RMDQ and ODI questionnaires, calculating the scores of these questionnaires and taking measurements when FFD test was performed in the physiotherapy room before initial treatment session (baseline), at four weeks (measurement 2) and at eight weeks (measurement 3). This physiotherapist (assessor) was blinded throughout the study as to which treatment participants received.

3.7.1 isiXhosa Translation of Questionnaires

Two qualified health professionals (independent individuals from the trial), a pharmacist and a professional nurse, who are both fluent in speaking, writing and understanding English as

well as isiXhosa were recruited as study assistants and were asked to translate the English versions of the Roland Morris Disability Questionnaires as well as the Oswestry Disability Index, into isiXhosa. These two health professionals initially did translations separately and afterwards cross checked the translations with each other. Disagreements were solved through discussions with each other until mutual agreement was met.

3.7.2 Randomisation

The same researcher was also recruited to do sequence generated computer randomisation and keep the schedule with them in order to eliminate or minimise chances of bias with regards to allocation of participants, to either the experimental or the control group in the study. After participants were diagnosed by physicians, they were referred to physiotherapy for treatment. Any one of the five physiotherapists that were trained to identify myofascial trigger points and perform dry-needling, with experience of no less than one year, could assist and tend to the participants. After the physiotherapists assessed and confirmed diagnosis of MTrPs in one or more muscles commonly involved in low back pain (quadratus lumborum, gluteus maximus, gluteus medius, gluteus minimus and piriformis), participants were informed about the study and invited to participate. Participants were given the freedom of choice to agree or not agree to be recruited and enrolled into the study without being subjected to prejudice should they not want to participate. Those who met the inclusion criteria and agreed to participate were randomly allocated to the respective treatment groups after written informed consent was obtained. Group allocations were concealed. Before the study commenced, the therapists involved agreed on the number of participants each one would treat before they reviewed, discussed and reached uniform agreement on: educating the participant on their condition (verbally); the criteria to identify myofascial trigger points;

positioning of the patient to needle and massage (ischemic compression with transverse friction) the various muscles; the lengths of the needles to be used for each particular muscle as related to anatomical depth to the surface of the skin; the angles at which to perform dry needling technique safely; the massage techniques used to relieve myofascial trigger points and stretching exercises of the muscles that had myofascial trigger points.

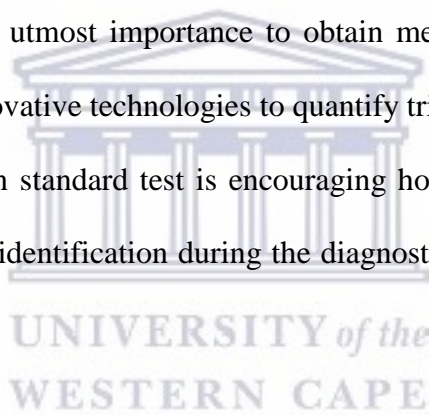
3.7.3 Criteria to identify myofascial trigger points

Myofascial trigger points were identified by means of palpation in this study. The criteria according to which myofascial trigger points were identified and diagnosed were with transverse palpation of tight bands (palpable taut band identified when a taut cord-like band could be observed whilst palpating) found in the muscle fibres; with an exquisite tight and painful spot (identified when the participant complained of pain during palpation) within the tight band; the participants' pain could be reproduced and was recognized by the individual when digital (thumb) pressure was exerted on the trigger points; pain was not only experienced locally at the site of the myofascial trigger point but also in the expected pain referral or distribution pattern; jump sign (characteristic behaviour response to pressure on a trigger point and identified when participants withdrew from digital pressure); decreased muscle range of motion, local twitch response (transient contraction of the palpable or taut band and can be visualized or palpated through the skin of the participant) when muscles fibres were stimulated adequately (Bron et al., 2011).

3.7.3a Reliability of palpation for MTrPs

Al-Shenqiti and Oldham, (2005), reported that certain clinical diagnostic characteristics should be looked for during examination in order to confirm the presence of myofascial

trigger points. These characteristics include: the taut band, a tender spot within the taut band, jump sign (patient trying to withdraw from stimulus), pain recognition, referred pain, and local twitch response (Al-Shenqiti, Oldham, 2005). Lucas et al., (2008), reported that physical examination is the only means by which to establish the diagnosis and consists of firm digital pressure applied to the muscle to identify the diagnostic criteria and elicit feedback from the patient. Gerwin, Shanon, Hong, Hubbard and Gevirt, (1997); Iglesias-González, Muñoz-García, Rodrigues-de-Souza, Albuquerque-Sendin and Fernández-de-las-Peñas, (2013), reported this criterion to have very good interexaminer reliability (kappa) ranging from 0.84 to 0.88 when applied by a trained assessor. Although the reliability of trigger point identification has seriously been criticized throughout the years, the reliability of physical signs remains of the utmost importance to obtain meaningful clinical information (Al-Shenqiti et al., 2005). Innovative technologies to quantify trigger point characteristics and establish a diagnostic criterion standard test is encouraging however, manual palpation still stands central to trigger point identification during the diagnostic process (Myburgh, Larsen, Hartvigsen, 2008).



3.7.4 Evaluation and treatment

The following section explains how participants were positioned to facilitate the evaluation for possible myofascial trigger points and their needling positions in the involved muscles by means of palpation; the required needle length; massage technique used as well as muscle specific stretch exercises.

Quadratus Lumborum Muscle



Fig. 3.7.4.1 Quadratus Lumborum deep MTrP palpation

Palpation of the quadratus lumborum was performed with the participant positioned on the unaffected side and the arm on the side to be examined lifted towards the top end of the table behind the participants head (Coelho et al., 2014). The knee on top (affected side) was positioned behind the knee immediately in contact with the supporting surface (unaffected side), creating the appropriate space to be examined in search of trigger points (Coelho et al., 2014). This muscle has three regions where trigger points commonly located (Coelho et al 2014). Site 1 is deep, and located at the angle in which the iliac crest and paravertebral muscular mass meet (Coelho et al., 2014) In order to examine this region, a deep pressure was applied above the iliac crest, anterior to the paravertebral muscles, in the direction of the lumbar transverse processes (Coelho et al., 2014). Site 2 is located along the internal part of

the iliac crest where iliocostal fibres are attached (Coelho et al., 2014). Site 3 is located at the angle in which the paravertebral muscle and the 12th rib meet (Coelho et al., 2014). Finger pressure was applied deeply in the direction of the transverse processes of L1 and L2 (Coelho et al., 2014).



Fig. 3.7.4.1a Quadratus Lumborum MTrP Dry Needling

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Needling position: participant is positioned on the unaffected side with a pillow under the waist. The superficial fibres are located by flat palpation and a 25mm needle is required to needle at the origin and insertion to rib and iliac crest respectively (Coelho et al., 2014). Deep fibres- are needled perpendicularly to the plane of the back in the lumbar region (Coelho et al., 2014). Needle placement is directly anterior to lateral edge of the iliocostalis muscle, with needle direction perpendicular towards transverse process of L3 (Coelho et al., 2014). Needle insertion at the iliolumbar angle will allow probing of the attachments to L4 and the iliolumbar ligament (Coelho et al., 2014).

Massage techniques used: ischemic compression combined with transverse friction applied with the thumb or fingers across the muscle fibres where myofascial trigger points are found. This was applied for up to 1 minute per trigger point.

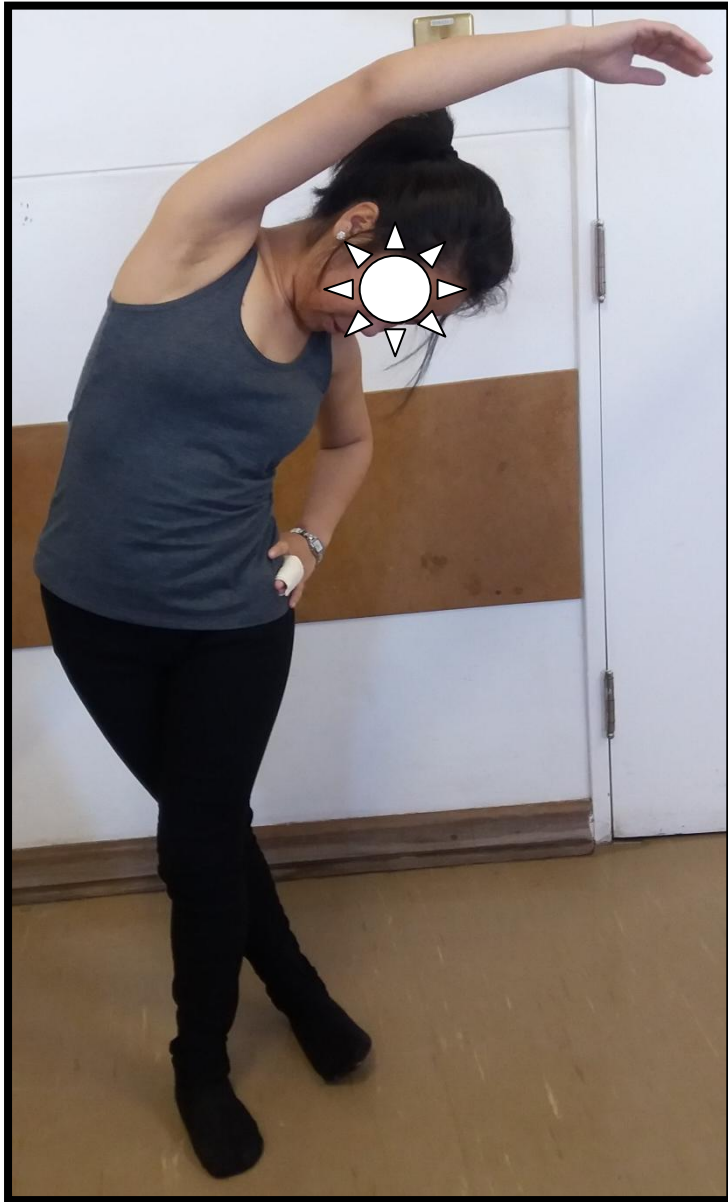


Fig. 3.7.4.1b Quadratus Lumborum Stretch

Stretch exercise: the participant was asked to stand and cross the leg on the affected side behind the leg of the unaffected side while performing sideflexion of the trunk toward the unaffected side (Musculino, 2009). The arm on the affected side is raised overhead (Musculino, 2009).

Gluteus Maximus Muscle



Fig. 3.7.4.2 Gluteus Maximus MTrP Palpation

Gluteus maximus: patient is positioned in side lying (with hips and knees bent) on non-afflicted side with afflicted side on-top (Coelho et al., 2014). Trigger points can develop in three areas of this muscle (Coelho et al., 2014). Site 1 is located laterally to sacral insertion of gluteus maximus while site 2 is located slightly cranial to ischial tuberosity (Coelho et al., 2014). Both these sites were palpated with transverse finger movements across the muscle fibres (Coelho et al., 2014). Site 3 is located in the lower border of the muscle and the trigger points were palpated on the plane against the ischium (Coelho et al., 2014).



Fig. 3.7.4.2a Gluteus Maximus MTrP Dry Needling

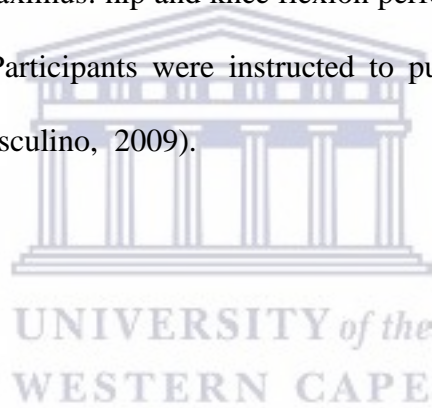
Needling position: Sidelying with affected side on top, pillow between knees with hip flexed at 45 degrees. Site 1 and 2 are found with flat palpation while pincer grip is used for site 3. 40-50mm x 30mm needle is inserted obliquely for trigger points 1 and 2 and perpendicular into pincer palpation at site 3.

Massage technique used: ischemic compression with transverse friction of the thumb or fingers across muscle fibres. This technique was performed for up to 1 minute per trigger point. If the trigger point tenderness persisted, the process was repeated. Pincer grip technique was used on site 3.



Fig. 3.7.4.2b Gluteus Maximus Stretch

Stretch exercise for gluteus maximus: hip and knee flexion performed with medial rotation of the hip (Musculino, 2009). Participants were instructed to pull knee up and across chest toward opposite shoulder (Musculino, 2009).



Gluteus Medius Muscle



Fig. 3.7.4.3 Gluteus Medius MTrP Palpation

Gluteus medius was evaluated with participants positioned in hip and knee flexion, on the unaffected side, painful side on top (Coelho et al., 2014). This muscle also has three regions to be palpated (Coelho et al., 2014). Site 1 is located more posteriorly and close to the sacrum while site3 is located in anterior region of the muscle (Coelho et al., 2014). Site 2 is located between the two regions (Coelho et al., 2014). The muscle fibres were rolled against the bone with transverse movements of the fingers and or thumb (Coelho et al., 2014).



Fig. 3.7.4.3a Gluteus Medius MTrP Dry Needling

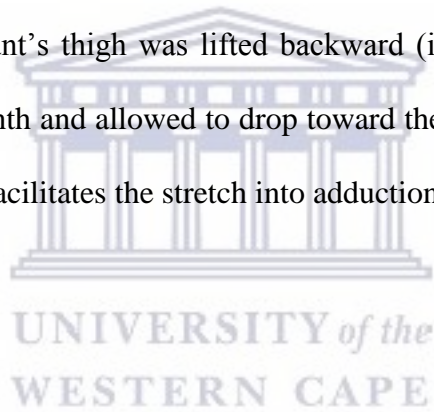
Needling position: participant is positioned in sidelying, affected side on top, with a pillow between knees (Coelho et al., 2014). Trigger points of this muscle are deep therefore 75-100mm needle should be used. The needle is inserted and aimed towards the trigger point. Palpate for trigger points 2-3 finger breadths below iliac crest.

Massage technique used: ischemic compression with transverse friction across muscle fibres where trigger point is found (Coelho et al., 2014). Technique is performed for up to 1 minute per trigger point.



Fig. 3.7.4.3b Gluteus Medius Stretch

Stretch exercise: the participant's thigh was lifted backward (into hip and knee extension), eased over the edge of the plinth and allowed to drop toward the floor (Joseph, E., 2009). The gravitational force gradually facilitates the stretch into adduction (Joseph, E., 2009).



Gluteus Minimus Muscle

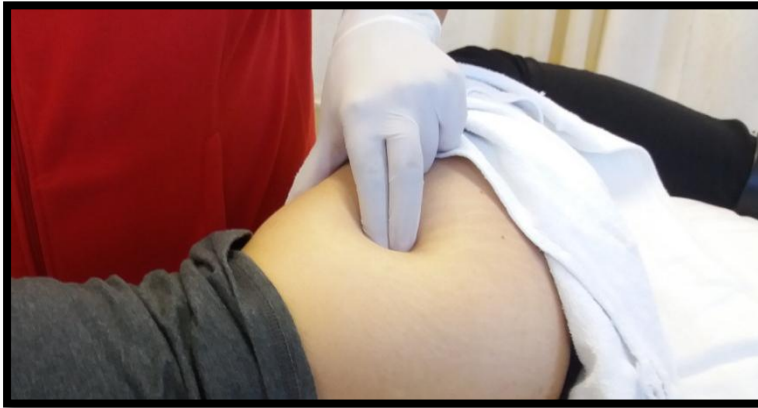


Fig. 3.7.4.4 Gluteus Minimus MTrP Palpation

Gluteus minimus has two regions for palpation where myofascial trigger points are commonly found (Coelho et al., 2014). Site1 is located more anteriorly (Coelho et al., 2014). The participant is positioned in supine with the hip of afflicted side in extension (Coelho et al., 2014). The tensor fascia lata can be identified when performing resisted internal rotation of the thigh (Coelho et al., 2014). The examiner can palpate the anterior fibres of the gluteus minimus anteriorly and posteriorly to the tensor fascia lata, distally to the level of the anterior superior spine (Coelho et al., 2014). Site2 is located in the posterior fibres of the gluteus minimus (Coelho et al., 2014). Participants were positioned on the non-afflicted side with the thigh on top adducted and slightly flexed (Coelho et al., 2014). The trigger points were found above the line of the piriformis between its middle point and the junction of its medial and lateral third (Coelho et al., 2014).



Fig. 3.7.4.4a Gluteus Minimus MTrP Dry Needling

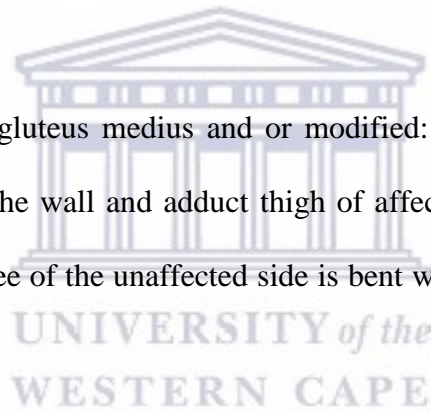
Needling: Gluteus maximus and gluteus medius should be cleared first. The anterior trigger point is needled in with participant in supine. The needle is inserted disto- lateral to ASIS but medial to Tensor Fascia Latae. The Posterior trigger points are needled in sidelying with hips flexed to 45 degrees and a pillow is placed between the knees. Needle insertion is above the piriformis line to avoid the sciatic nerve. Needle length required is 75mm.

Massage technique used: ischemic compression with cross friction performed for up to 1 minute per trigger point.



Fig. 3.7.4.4b Gluteus Minimus Stretch

Stretching exercise: same as gluteus medius and or modified: participant is asked to stand with affected side closest to the wall and adduct thigh of affected lower limb behind body. While performing this, the knee of the unaffected side is bent while using the wall as support (Musculino, J., 2009).



Piriformis Muscle



Fig. 3.7.4.5 Piriformis MTrP Palpation

In the piriformis evaluation, the participant was positioned on the unaffected side with the hip on top flexed 90 degrees (Coelho et al., 2014). A line was traced on the top border of the greater trochanter which passed through the sacroiliac extremity of the major ischial foramen (Coelho et al., 2014). Trigger points were located in a region located laterally to the junction of the medial and lateral thirds of the piriformis line (Coelho et al., 2014). Site 1 was more medial in relation to site 2 (Coelho et al., 2014).



Fig. 3.7.4.5a Piriformis MTrP Dry Needling

Needling position: Needling is performed in sidelying with the upper leg in 90 degrees hip flexion, dropped into adduction with the bottom leg straight. Draw a line from the sciatic foramen to the greater trochanter. Needle insertion is just superior to this line at the junction of the lateral and middle third. Needle length required 50-75mm.

Massage technique used: ischemic compression with transverse friction across muscle fibres in which trigger points are found.



Fig. 3.7.4.5b Piriformis Muscle Stretch

Stretch exercise: the affected leg was crossed in the front of the unaffected thigh. Next, the participants were asked to use their hands and pull the thigh of unaffected side up towards their chest (hip flexion). Due to the hip being flexed so much, the piriformis (a medial rotator) is stretched by the action of lateral rotation.

According to Lucas, Macaskill, Irwig, Moran and Bogduk, (2009), the reliability of the test used to make the diagnosis is fundamental to accurate diagnosis of a condition. Various procedures have been used in the investigations of MTrPs such as microdialysis, biopsy, imaging techniques, and electromyography, but none of these are definitive or have been accepted as a reference standard (Lucas et al., 2009). Lucas et al., (2009), as well as Bron, de Gast, Dommerholt, Stegenga, Wensing, and Oostendorp, (2011), reported that physical examination is the only means by which diagnosis can be established and consist of firm digital pressure applied to muscle to identify the diagnostic criteria and elicit feedback from the patient. The physiotherapists involved in this study made use of physical palpation and applying digital pressure to identify, locate and treat MTrPs in the low back area. They bore

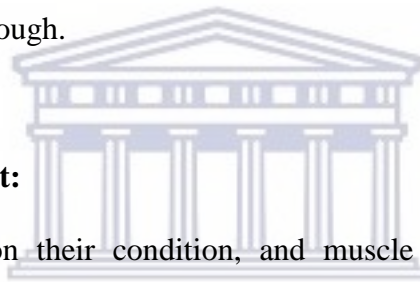
no prior knowledge as to which treatment they would administer to subjects before the envelope containing this information was opened by them. Subjects were blinded as to what treatment they will be given until the envelope was opened by treating physiotherapist and the initial treatment was administered.

Recruitment for the trial commenced as from 1 April 2015. Each participant was informed that the trial spanned over a period of eight weeks (as from their date of recruitment) and that they would receive treatment once a week. Therefore, each subject received eight treatment sessions, regardless of which group they were allocated to. Participants were educated on their condition (verbally) and encouraged to ask questions regarding any queries they may have had with regards to their condition and the treatment that they received as from the first treatment session. After eight weeks, participants were given the option to continue with physiotherapy or not or, given the choice to continue with the treatment they have received as is or either add or choose not to receive dry needling as an adjunct to massage and stretching. The first treatment session at baseline, lasted an hour and each session thereafter was thirty minutes long. After each treatment session the next follow-up appointment was made in the subject's presence and participants were given appointment cards as reminders thereof. Participants were requested to re-schedule appointments within the same week if they could no longer attend on the specific given date or time. Since this study focused on AMLBP and that participants had to have been enrolled into the study within the first two weeks since the onset of pain by definition, and also due to the fact that this study measured short term effects of dry needling as an adjunct to massage and stretching there was insufficient time to allow for a window period between recruitment, enrolment and the point where baseline measurements were taken. Recruitment and the establishment of enrolment, group allocation

as well as baseline measurements and the initial treatment session were performed on the same day.

Interventions:

Each participant was educated on their condition verbally. The physiotherapists responsible for the administration of treatment agreed that education given verbally would be best suited and that the information given during education would be muscle specific according to the muscles afflicted in each participant to avoid confusion with regards to pain referral patterns caused by myofascial trigger points as well as stretching exercises. This took place as from the first treatment session and was repeated during follow-up sessions. Participants were encouraged to ask questions regarding their condition in the event of misunderstanding or information not being clear enough.



Intervention group treatment:

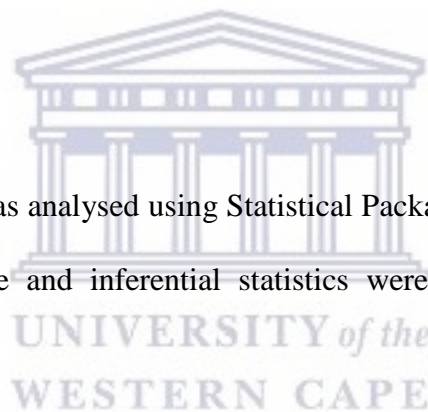
Participants were educated on their condition, and muscle specific stretching exercises according to the afflicted muscles per person, verbally. Transverse friction was applied to myofascial trigger points while ischemic compression was maintained, as forms of massage techniques. The treating physiotherapists applied these for 30 seconds per trigger point. Once resistance in the muscle eased, the treating physiotherapists increased the pressure exerted and repeated the initial treatment technique. Myofascial trigger point dry needling followed the massage techniques. The acupuncture needles were aimed and directed toward the myofascial trigger point. Needles were inserted to the depth of where the local twitch response was elicited then moved in and out in different directions as a means to deactivate the myofascial trigger point. The dry needling technique was followed by gentle full range muscle specific stretching exercises for the afflicted muscles per participant. Each participant was instructed to maintain each stretch for at least 20-30 seconds.

Control group intervention:

As with the intervention group, participants in the control group were educated on their condition and the specific muscles afflicted with myofascial trigger points. Participants were taught muscle specific stretching exercises according to the muscles afflicted with myofascial trigger points per participant, that contribute to low back pain. The control group also received transverse friction and ischemic compression as forms of massage techniques used to address myofascial trigger points for the same length of time as the above mentioned intervention group. Muscle specific stretching exercises followed the massage techniques and for this, participants were also instructed to maintain each stretch for a minimum of 20-30 seconds.

3.8 Data Analysis

Data collected in this study was analysed using Statistical Package for Social Sciences (SPSS version 21). Both descriptive and inferential statistics were used in analysing the data generated in this study.



Descriptive statistics

Participants' demographic features of gender and employment status are presented in frequencies, as age was presented in mean and standard deviation. Baseline and post intervention scores of all included outcomes measures were also analysed using mean and standard deviation.

Inferential statistics

To determine the effect of intervention on the multiple outcome measures in this study and because measurements were conducted at intervals of pre-intervention, immediate post

intervention period at four weeks and immediate post intervention at eight weeks periods Repeated Measures MANOVA to determine both time effect (within differences) and time by group interactions (between group differences). The analysis therefore, included pain intensity, functional activity, disablement level and lumbar range of movement (using VAS, RMDQ, ODI and FFD). Generally, output characteristics following MANOVA may indicate significance where means were found to suggest that, however, specific pattern or location between groups or time are not indicated (Abdi and William, 2010), therefore where statistical significance are found post hoc test (Tukeys HSD) was conducted to determine where the difference lies. Both multivariate and univariate tests were generated from the modelled statistics. The multivariate components explains the overall test model outcome, while the univariate gives individualised outcome for each variable for both time effect and time by group interactions (Rossi et al., 2007). To determine the magnitude of difference (Sullivan and Feinn, 2012) following intervention at both levels time effect and time by group interaction Cohen's rules of thumb for effect size was used. In this study effect sizes of about 0.20 represent small effects, those of 0.50 are moderate or medium effects and those of 0.80 and greater are considered to be large effects (Williams, Morlock and Feltner, 2010). All effect sizes used of perfect eta generated from the SPSS output.

3.9 Ethics

Ethical clearance was obtained from the Faculty Higher Degrees Committee as well as the Ethics Committee of the University of the Western Cape. Permission was obtained from the Department of Health in the Eastern Cape. Written informed consent was obtained from the participants and they were assured of confidentiality and anonymity during the conduction of the study. No names were used during the capture, analysis and publication of the data. The captured data was kept in files that were locked away in a locker which only the researcher

had access to. Participation in the study was voluntary and the participants' well-being and safety was emphasised and respected while the study commenced. The participants had the right to withdraw from the study at any time and this did not influence their access to services or result in prejudicial treatment. Participants were also appropriately referred to the relevant health professionals if there was a need. The results of the study will be made available to the relevant parties.



CHAPTER 4

RESULTS

4.1 Introduction

This chapter presents the results obtained for this study in which the effectiveness of dry needling used in conjunction with massage and stretching in order to address myofascial trigger points as a cause of acute myofascial low back pain, over the eight week period the study was conducted as captured and analysed using SPSS version 21.

Section 4.2 contains sociodemographic information of the participants as it related to gender, age, employment status and baseline clinical data as it related to intensity of pain (VAS), functional activity (RMDQ), level of disablement (ODI) and lumbar forward range of motion.

Section 4.3 encompasses figures and tables depicting the participants' responses at the three points of measurement for all variables, baseline, measurement 2 and measurement 3 and therefore displays the change in mean scores over time as measured on the outcome measures (VAS, RMDQ, ODI, FFD).

Section 4.4 consists of tables displaying the output of the data analysis, on the effects of treatment received by both the intervention group and the control group according to the statistical tests that were applied.

Section 4.5 is a brief summary of the results obtained in this study as it related to the interventions that were received by the respective intervention group and the control group and the effects it had on the outcome measures.

4.2 Demographic Status of the Participants

Sociodemographic information collected of each participant in the respective treatment group they were allocated to included their gender, employment status, nature of work duties as well as age.

Table 4.2.1 Demographic and baseline clinical data

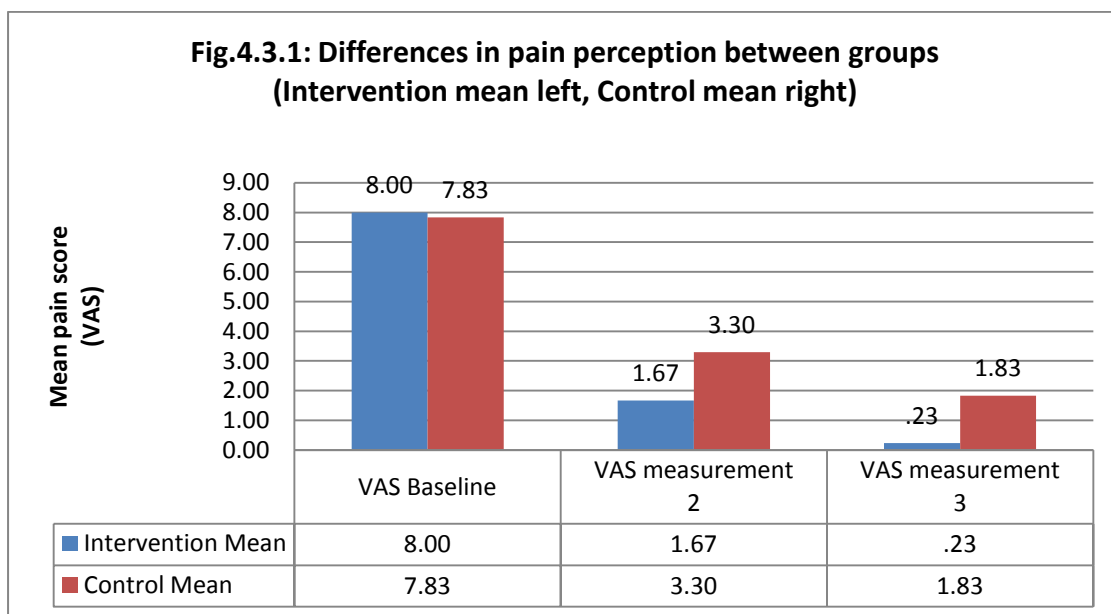
Demographic data of subjects		Intervention group	Control group	Total	P values
		(n=30)	(n=30)		
Gender	Male	8	11	19	
	Female	22	19	41	
Employment status	Employed	23	26	49	
	Unemployed	7	4	11	
Nature of work duties	Physical	14	19	33	
	Non-Physical	9	7	16	
Age	Mean(SD)	39.93(12.03)	38.53(13.29)	39.23(12.59)	
Outcome Measures	VAS: mean(SD)	8.00(1.29)	7.83(1.32)	7.92(1.29)	0.622
	RMDQ: mean(SD)	12.10(4.91)	10.63(4.73)	11.37(4.84)	0.243
	ODI: mean(SD)	31.67(17.06)	27.60(13.09)	29.63(15.22)	0.305
	FFD: mean(SD)	21.68(12.92)	19.47(13.24)	20.58(13.02)	0.514

Findings indicated no significant between group differences at baseline in all outcome measures ($p > 0.05$). The mean differences between the two group include: age = 1.3, VAS = 0.17, RMDQ = 1.47, ODI = 4.07 and FFD = 2.21. The largest mean difference (4.07) was noted in the ODI scores between the two groups.

The following figures and tables depict participants' responses at the three points of measurement for all variables, baseline, measurement 2 and measurement 3.

4.3.1 Pain Intensity

The visual analogue scale (VAS) was used as the primary outcome measure in this study. The changes in mean VAS (pain intensity) scores over time (baseline, measurement 2 and measurement 3) are depicted in figure 4.3.1.



The above figure indicated that both intervention and control group show decreased VAS scores which indicates reduction in pain among participants. The greater decline in intensity of pain is demonstrated by the intervention group.

4.3.2 Functional Activity

The Roland Morris Disability Questionnaire was used as a secondary outcome measure to indicate functional ability as it changed over time in this study.

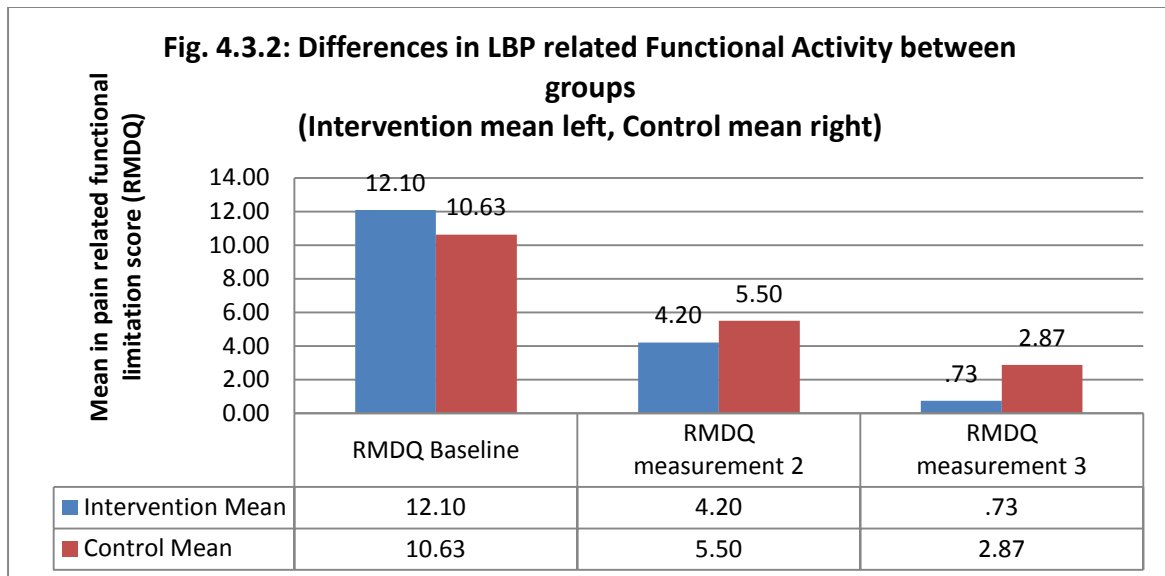
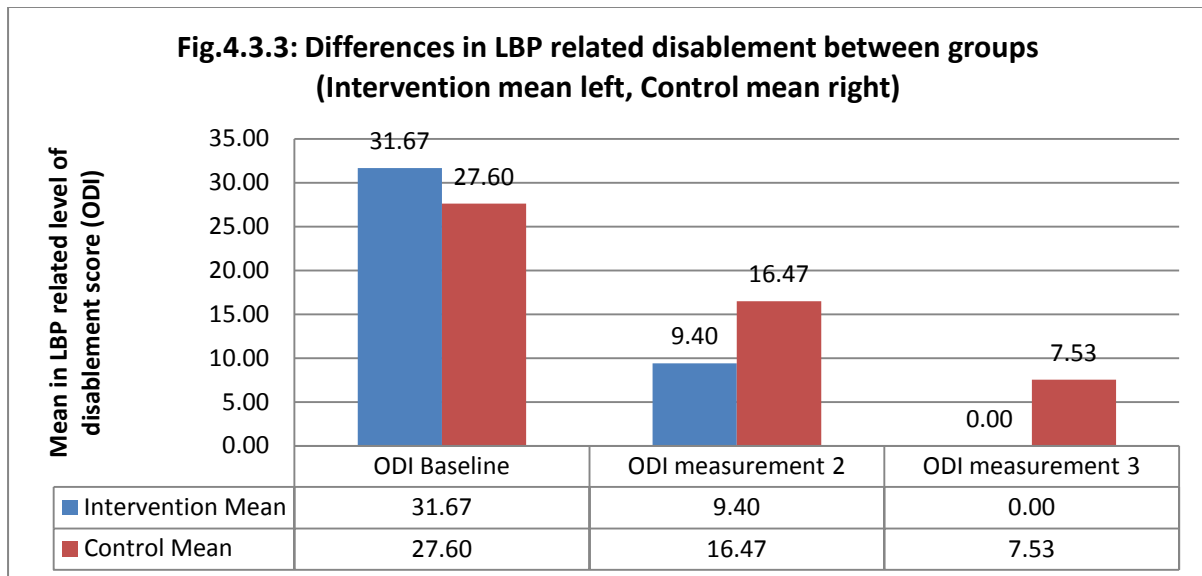


Figure 4.3.2 (above) showed a consistent decline in functional limitation on the Roland Morris Disability Questionnaire scores, which suggest improved function in both groups. The decline seems to be more pronounced at measurement 3 with the intervention group's score being lower than that of the control group.

4.3.3 Level of disablement related to LBP

The Oswestry Disability Index was used as secondary outcome measure to record changes in level of disablement over time as it related to low back pain in this study.



In Figure 4.3.3 (above) showed the level of disablement following LBP (as measured with ODI), the result demonstrated how participants' condition improved with the decline in scores over time. Decrease in scores on levels of disablement is greater in the intervention group than the control group.

4.3.4 Lumbar range of forward flexion

The finger-to-floor distance test was also used as secondary outcome measure to indicate change in range of lumbar forward flexion motion over time as it related to low back pain in this study.

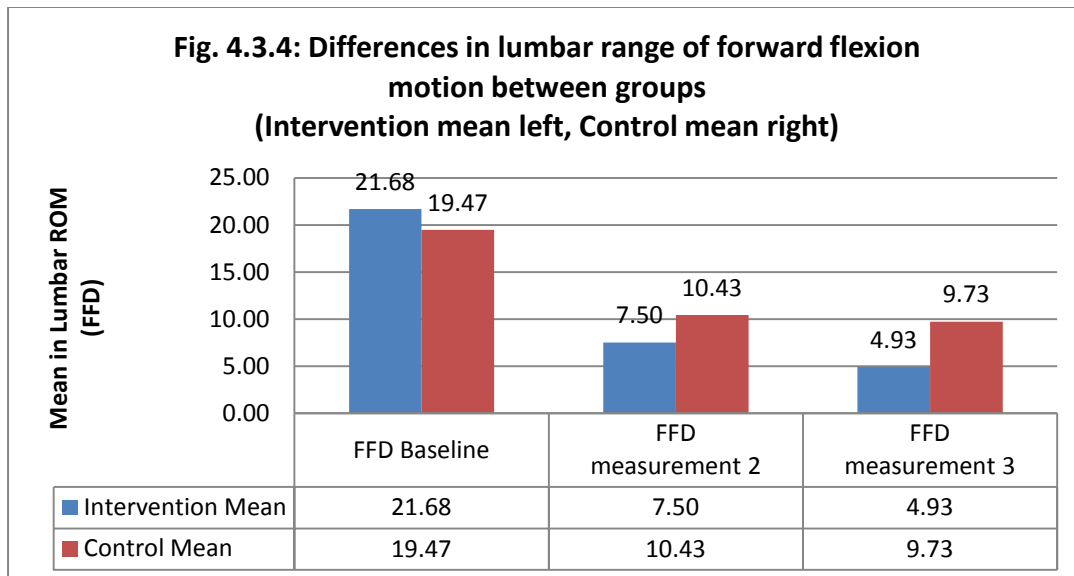


Fig. 4.3.4. Participants showed improved lumbar range of forward flexion movement suggested by the reduced distance between finger tip to floor. Both groups show improvement over time, by means of reduction in distance between finger tip to floor (the lower the score, the greater the improvement in lumbar forward flexion). The pattern indicate closely related performance between intervention and control in this measure at measurement 2, however, at measurement 3 greater improvement is noted in the intervention group.

4.4.1 Omnibus Multivariate test: Within and Between Subjects Effects for the tested outcome measures

Multivariate test statistics indicated significant time effect (from baseline to eight week post-intervention period) for changes in pain intensity, functional activity, level of disability and range of forward flexion *Wilks' λ , $F(8.00, 226.00) = 90.21, p = 0.0001$* , with a large effect size $\eta = 0.76$; suggesting change following intervention overtime. In between group effect findings show significant group interaction following multivariate test statistics, *Wilks' λ , $F(4.00, 55.00) = 3.61, p = 0.011$* , with a small effect size $\eta = 0.21$; implying that change may be trivial between groups.



Table 4.4.2: Summary of Univariate test for time effect and treatment effect within subjects

Variables	Intervention (M±SD)	Control (M±SD)	F _{TE}	Prob _{TE}	η ² _{TE}	F _{TRE}	Prob _{TRE}	η ² _{TRE}
VAS(pain)								
Baseline	8.00 (1.29)	7.83 (1.32)	673.31	0.0001	0.92	13.56	0.0001	0.19
Four weeks	1.67 (1.47)	3.30 (2.05)						
Eight weeks	0.23 (0.63)	1.83 (1.42)						
RMDQ								
Baseline	12.10 (4.91)	10.63 (4.73)	289.42	0.0001	0.83	10.76	0.001	0.16
Four weeks	4.20 (2.86)	5.50 (3.49)						
Eight weeks	0.73 (1.31)	2.87 (2.66)						
ODI score								
Baseline	31.67 (17.06)	27.60 (13.09)	156.06	0.0001	0.73	8.84	0.001	0.13
Four weeks	9.40 (8.27)	16.47 (10.33)						
Eight weeks	2.00 (4.03)	7.53 (4.97)						
FFD score								
Baseline	21.68 (12.92)	19.47 (13.24)	143.70	0.0001	0.71	9.10	0.003	0.14
Four weeks	7.50 (7.44)	10.43 (8.94)						
Eight weeks	4.93 (6.75)	9.73 (8.51)						

F_{TE} = Factor test output at measurement level, *Prob_{TE}* = Significant level at measurement level, *η²_{TE}* = Effect size at measurement level, *F_{TRE}* = Factor test output at measurement level by treatment *Prob_{TRE}* = Significant level at measurement level by treatment *η²_{TRE}* = Effect size at measurement level by treatment

Table 4.4.2: Univariate test statistics for all the outcome measures used in this study

Univariate test for within subjects effects indicated statistical significance in the main effect of time at measurement level for VAS, $F(2, 106) = 673.31, p = 0.0001$, with a very large effect size $\eta^2 = 0.92$, suggesting improvement in pain across the three test periods, for time by group effect VAS also indicated significance $F(2, 106) = 13.56, p = 0.0001$, with a small effect size $\eta^2 = 0.19$, suggesting minimal change in pain for group interaction. In RMDQ result showed significance in main effect of time $F(1, 76) = 289.42, p = 0.0001$, with a very large effect size $\eta^2 = 0.83$, suggesting improvement in function across the three test periods, for time by group interaction result indicated significance, $F(1, 76) = 10.76, p = 0.001$, with a small effect size $\eta^2 = 0.16$, suggesting minimal improvement in function in group interaction. Findings for ODI showed significance at the level of main effect of time and time by group interaction, $F(1, 80) = 156.06, p = 0.0001$, and $F(1, 80) = 8.84, p = 0.001$ respectively, however, the effect sizes indicated large effect $\eta^2 = 0.73$ and $\eta^2 = 0.13$ respectively; implying more obvious change across the three test periods, and minimal change in time by group

interaction for ODI. In FFD findings indicated significant main effect of time, $F(1, 64) = 143.70$, $p = 0.0001$, and a large effect size $\eta^2 = 0.71$, implying huge change across the three test periods, for time by group interaction result indicated significance, $F(1, 64) = 9.10$, $p = 0.003$, and a small effect size $\eta^2 = 0.14$, this suggest a minimal group interaction. Post hoc test for both time effect and time by group interaction generally indicated better and significant ($p < 0.05$) improvement at the eight week post intervention in all the outcome measures.

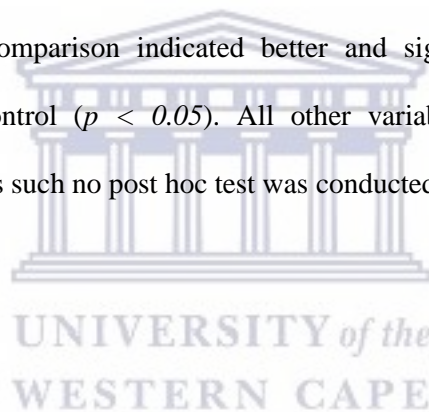


Table 4.4.3: Summary of Univariate test for between subject effects

Measure	Groups	Mean	Std. Error	95% Confidence Interval		F_{BSE}	$Prob_{BSE}$	η^2_{BSE}
				Lower Bound	Upper Bound			
VAS	Intervention	3.300	0.204	2.892	3.708	0.001	12.59	0.18
	Control	4.322	0.204	3.915	4.730			
RMDQ	Intervention	5.678	0.557	4.563	6.793	0.409	0.69	0.01
	Control	6.333	0.557	5.219	7.448			
ODI	Intervention	14.356	1.548	11.256	17.455	0.199	1.69	0.03
	Control	17.200	1.548	14.101	20.299			
FFD	Intervention	11.372	1.681	8.008	14.736	0.442	0.60	0.01
	Control	13.211	1.681	9.847	16.575			

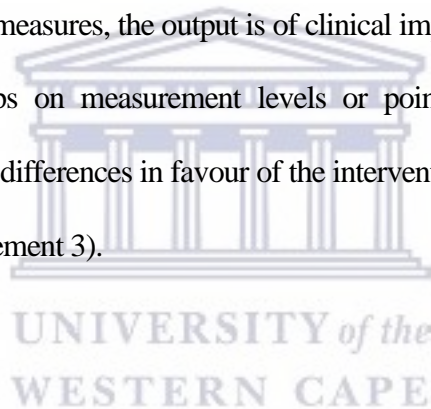
Table 4.4.3: Univariate test for between subject effects

Table 4.4.3 above present univariate between subject effect, the outcome of which suggested that at group levels (type of intervention) participants only showed significant difference in pain (VAS) ($p < 0.05$). A follow-up pairwise comparison indicated better and significant pain reduction in the intervention group than the control ($p < 0.05$). All other variables do not indicate significant differences between group and as such no post hoc test was conducted for them.



4.5 Summary of results

Generally, the graphical presentation showed that both groups reflected remarkable differences over time as compared to baseline however, the intervention group demonstrated greater improvement compared to the control group with regards to intensity of pain, functional activity, the level of disablement and lumbar range of forward flexion motion. Summarising tables of repeated measures MANOVA reflect that statistically significant and clinically meaningful differences occurred on variables over time within each group though greater improvement was noted in the intervention group. Pairwise comparisons tests between the two groups (comparing the treatments received) revealed statistically significant difference on pain intensity however; non- significant results were obtained on all other measures in this test. Despite statistically non-significant results being obtained in the three secondary outcome measures, the output is of clinical importance. Furthermore, contrast tests performed between groups on measurement levels or points of measurement over time indicated statistically significant differences in favour of the intervention group on all measures from baseline to eight weeks (measurement 3).



CHAPTER 5

DISCUSSION

5.1 Introduction

In this chapter, the change in scores over time that resulted on all the outcome measures (VAS, RMDQ, ODI, FFD) according to the data analysis will be discussed.

5.2 Discussion of current study

The present experimental randomized controlled, assessor-blinded clinical trial was used to measure the effect of dry needling used as an adjunct to massage and stretching on pain intensity, functional activity, level of disablement and lumbar range of forward flexion motion in participants suffering from acute myofascial low back pain in comparison to massage and stretching alone. The findings of the study show that dry needling improves intensity of pain significantly when compared to conventional therapy alone, however with regards to functional activity, level of disablement and lumbar forward flexion motion, no statistically significant difference was obtained between the two treatment groups though improvements were significant within each group. This could be due to the natural pathology of the condition, as acute low back pain does have a tendency to improve over time for many individuals while for others the condition may develop into a chronic problem. Working conditions that require strenuous or heavy physical work, awkward static and dynamic working postures as well as manual handling and lifting are amongst the factors that most frequently contribute to low back pain Duthey, (2013). These factors can also contribute to the formation of myofascial trigger points. The demographic data obtained in this study regarding employment status and nature of work (of those who are employed) revealed that

work duties of majority of the participants (55%) are of physical or arduous nature. Participants whose nature of work was more sedentary formed 27%, while those who were unemployed formed 18%. Although no statistical difference existed between groups with regards to the three latter outcome measures and both interventions showed vast improvement on all outcome measures, outcome scores were in favour of the group that received dry needling as well. Therefore it seems that by adding DN to the standard intervention procedure, effects of treatment will be enhanced. The participants in both groups improved similarly over time and both groups improved by more than the suggested MCID values or at least by 30% when taking their baseline scores into account. However, greater improvement was shown in favour of the intervention group. On VAS the required MCID was 15mm or 30% from baseline. The intervention group improved by an average of 78mm and the control group by 60mm. On RMDQ the required MCID was 5 points or 30% from baseline. The intervention group improved with 11.4 points, while the control group improved by 7.8 points. On ODI the required MCID was 10 points or 30% improvement from baseline. The intervention group improved with 29.7 points and the control group with 20.1 points. On the FFD a 30% improvement from the baseline scores was accepted as the MCID which was 6.5 points for the intervention group and 5.84 for the control group. The intervention group improved with 16.8 points, while the control group improved by 9.7 points.

The Within Subjects Effects main effect of time or measurement level revealed great improvement and statistically significant changes over time in both groups however, the group that received the intervention showed greater extent of improvement.

When looking at the Between Subjects Effects for treatment the findings of this experimental study suggest that using MTrPDN in addition to massage and stretching for trigger points that cause AMLBP has a statistically significant effect on intensity of pain ($p = .001$) but not on functional activity ($p = .409$), level of disablement ($p = .199$) or lumbar range of forward

flexion motion ($p = .442$) when compared to massage and stretching only. Although statistically significant results were obtained for VAS only (on between subjects effects for treatment) clinically meaningful results were obtained on all outcome measures. However when looking at the between subjects effects for measurement level (points in time that measurements were taken), a statistically significant difference was indicated in favour of the intervention group at all measurement levels.

It is hypothesized that excessive acetylcholine release from motor end plates results in the sustained sarcomere contracture, which leads to increased metabolic needs and suppressed capillary circulation (Shah and Gilliam, 2008). As a result of reduced blood flow and reduced sources of adenosine triphosphate (ATP), muscle fibres are locked in a contracture with insufficient energy to return Ca^{2+} to the sarcoplasmic reticulum and restore a polarized membrane potential (Shah et al., 2008). In addition to the local hypoxic conditions and energy crisis a release of neuroreactive substances and metabolic by-products may be elicited that could sensitize peripheral nociceptors (Shah et al., 2008). According to Shah et al., (2008), needling therapies such as DN, and manual therapies such as massaging and stretching, are targeted at releasing contracted muscle fibres and surrounding connective tissue. DN releases analgesic endorphins, increases blood flow, and improves chemical environment in the immediate vicinity of the active MTrPs (Shah et al., 2008). Therefore by inactivating MTrPs, symptoms of MLBP may significantly be reduced (Mahmoudzadeh, Rezaeian, Karimi and Dommerholt, 2016).

According to Mahmoudzadeh et al., (2016), MTrPs may change muscle activation patterns in muscles and may activate muscle nociceptors. DN may alter movement and activation patterns in muscles involved in LBP by means of deactivating MTrPs and therefore pathological movement disorders would gradually fade and be replaced by new patterns (Mahmoudzadeh et al., 2016). The LTR at the MTrP site is thought to stretch the muscle

fibres at the location and the consequent relaxation of the muscle is thought to relieve constriction of the capillaries which restores the microcirculation (Jafri et al., 2014). The muscle is re-oxygenated at the site of the MTrP which then breaks the positive feedback (Jafri et al., 2014). Therefore, as the local energy crisis, microcirculation and re-oxygenation, as well as the sarcomere length is restored participants do experience pain relief and improvement on functional activity, level of disablement as well as lumbar forward flexion range of motion.

The findings of this study were also similar to that of Itoh, Ktasumi, Hirota and Kitakoji, (2006), with regard to effect of treatment being maintained over time. The effects of repeated treatment tended to accumulate over time on pain intensity, functional activity, level of disablement and lumbar range of forward flexion motion as scores on outcome measures decreased steadily (indicating improvement) from baseline until the last measurements were recorded (Itoh et al., 2006). Previous literature reports that a statistically significant relationship exists between increased leisure time activity and improved LBP outcomes and that lower levels of sporting activity were associated with higher levels of pain and disability (Hendrick, Milosavljevic, Hale, Hurley, McDonough, Ryan and Baxter, 2011). Therefore by implication of the results of this study, DN used as an adjunct to massage and stretching for the treatment of AMLBP could also improve functional activity, levels of disablement and lumbar range of forward flexion as related to the intensity of low back pain and consequently have the favourable effect of easing the general execution of activities of daily living as well as facilitate an earlier return to work and leisure activities.

5.3 Limitations

Results of this study should be interpreted with caution due to a number of limitations inherent to it. Blinding could not be maintained for the treating therapists as they knew which

treatment was to be given after opening the envelope containing the information of group allocation of the patient. Blinding could not be maintained for the participants after the initial treatment was given as participants then knew which treatment group they were allocated to. A strong placebo effect of DN could not be ruled out nor could the natural pathology or nature of the condition since neither sham needling, nor a control group that received no treatment at all was not part of the selected treatment program. An assessment of any medication taken by the participants was also not made, this could have affected the outcome of the study although being relevant to both the intervention and control groups. Measurements were only taken while the trial was actively conducted and no follow up period followed after the last measurements were taken.

Itoh et al., (2006), reported that MTrPDN or acupuncture appear to provide immediate pain relief, that the effects thereof accumulate with repeated treatment and that MTrPDN may be more effective on low back pain than at traditional acupuncture points. In the current study, clinical results indicated that the application of DN to MTrPs in addition to massage and stretching has a greater analgesic effect and consequently greater improvement in functional activity, level of disablement and lumbar forward flexion range of motion than massage and stretching only. Findings of the current study are in line with previously published literature (Itoh et al., 2006; Inoue et al., 2006; Tellez-Garcia et al., 2014) which suggests that scores on subjective measures of intensity of pain, functional activity, level of disablement and the objective measure of lumbar range of forward flexion would show greater improvement when MTrPDN is used as an adjunct to massage and stretching in the treatment of AMLBP.

CHAPTER 6

SUMMARY, CLINICAL IMPLICATIONS, CONCLUSION AND RECOMMENDATIONS OF STUDY

6.1 Summary

LBP has an etiology that consists of numerous facets or contributing factors which could be of social and demographic nature (Nascimento et al., 2015). LBP is not only defined by the anatomical area of the body but also by sub-types as well as chronicity (Duthey, 2013). The origin of LBP could also be myofascial related as MPS is the most common cause of musculoskeletal pain (Koca et al., 2014). Although numerous approaches or techniques are used to treat MTrPs, no specific treatment technique is said to be the most effective or superior universally than the rest (Liu et al., 2015). According to Koca et al., 2014, monotherapy may be inadequate to achieve complete recovery in patients suffering from MPS. The growth of evidence on the use of needling techniques combined with conservative therapy in order to manage and treat MPS is on the rise (Koca et al., 2014). Many studies have proven that acupuncture and DN can be used in combination with other treatment techniques to treat chronic back ache however, due to lack of literature and evidence no clear recommendations or contraindications could be made with regards to the use of these techniques for AMLBP (Furlan et al., 2008; Gabriella et al., 2013). In the current RCT the researcher aimed to determine the effectiveness of DN as an adjunct to massage and stretching in order to treat AMLBP. The outcome measures used were the visual analogue scale (VAS), which reflected intensity of pain on the day of treatment, the Roland Morris Disability Questionnaire (RMDQ), which reflected the patients' perception of functional

activity or limitation thereof on the day of treatment, the Oswestry Disability Index (ODI), to determine perceived level of disablement by identifying disturbance of activities of daily living in general due to severity of back ache and, the Finger-to-Floor Distance test to measure lumbar forward flexion motion.

As stated earlier, the aim of this study was to investigate the efficacy of dry needling added to massage and stretching on intensity of pain, functional activity, level of disablement and lumbar range of forward flexion compared to massage and stretching alone in patients presenting with acute (less than two weeks) MLBP. The objectives were to determine and compare whether differences in mean value as it relate to outcome measures VAS (intensity of pain), RMDQ (functional activity), ODI (level of disablement) and FFD (lumbar range of forward flexion motion) exist between the intervention group and control group. Statistically significant difference was indicated between the intervention group and the control group on pain intensity but not on functional activity, level of disablement or lumbar range of forward flexion motion at the end of the trial on the between subjects effects for treatment. Effect sizes that were obtained on the outcome measures on this model were small (VAS: $\eta^2=.178$ or 18%; RMDQ: $\eta^2= .012$ or 1%; ODI: $\eta^2=.028$ or 3% and FFD: $\eta^2= .010$ or 1%). Therefore, the magnitude of the effect of the interaction between measurementlevel and treatment, attributed to by each other is small.

6.2 Clinical Implications of study

Physiotherapy is commonly sought for the relief of pain intensity, functional limitation, level of disablement and the restriction of range of motion as these factors could drastically affect the well-being and performance of people whether at home or at work. These factors play an important role in the planning and selection of treatment techniques used to treat physiotherapy patients. Often, the relief longed for with regards to the above mentioned

symptoms and limitations are not obtained by stretching and massage alone but with the addition of complementary therapies such as acupuncture or DN. This study suggests that adding DN to conventional therapy techniques in order to treat AMLBP may result in more effective and greater relief of symptoms inherent to the condition.

6.3 Conclusion

This study investigated the effectiveness of dry needling as part of a treatment regimen for AMLBP and how the patients' perception of the intensity of their LBP relating to their perceived functional activity, level of disablement and lumbar range of forward flexion are affected by it. The results of the current study suggest that dry needling, added to massage and stretching in order to treat acute myofascial low back pain, significantly decreased symptoms of pain in the participants. It enhanced improvement on functional activity, level of disablement and lumbar range of forward flexion motion in the participants.

6.4 Recommendations:

Using DN as an adjunct to massage and stretching to treat AMLBP was found to enhance the effects of massage and stretching in the afflicted muscles and is therefore recommended to be incorporated in treatment programs. Therapists should be trained and skilled in the use of this technique. Future studies may benefit from conducting trials where control groups which include sham needling as well as "no treatment" is included to rule out placebo effects and the natural course of the condition in order to give more clarity on the effectiveness of DN being used for AMLBP. It may also be more beneficial to recruit subjects within the first few days of onset of acute myofascial low back pain in order to set up an adequate short term and even long term follow up period. .

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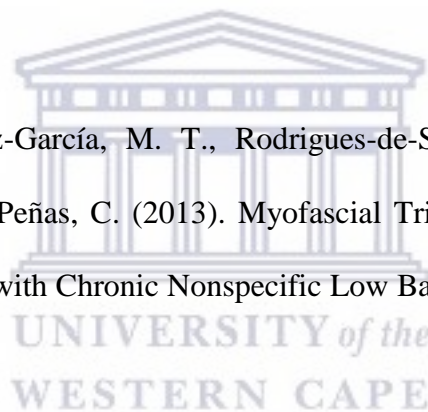
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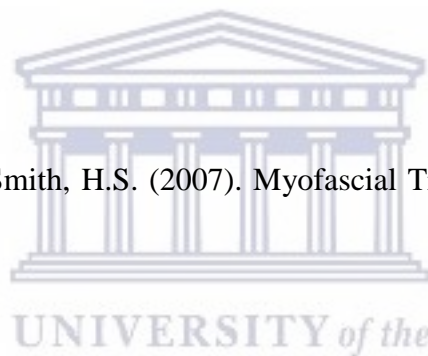
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Appendix1

INFORMATION SHEET

Project Title: The effectiveness of dry needling as an intervention for acute myofascial low back pain

What is this study about?

This is a research project being conducted by Glynis Bruinders at the University of the Western Cape. We are inviting you to participate in this research project because you have been diagnosed with myofascial low back pain. The purpose of this research project is to investigate the efficacy of dry needling in conjunction with massage and stretching for acute myofascial low back pain compared to massage and stretching for myofascial low back pain only.

What will I be asked to do if I agree to participate?

Participants will be requested to sign an informed consent form.

Participants will be requested to come for follow up visits once a week for the period of time the study commences (8 weeks).

Subjects will be asked to: be willing to undress appropriately, allow the physiotherapist to touch and massage the lumbar (lower back) area and buttocks, be subjected to dry-needling (insertion of needles into muscles) to the myofascial trigger points (tight, painful areas in the muscles causing the pain) and be given stretching exercises to do after treatment and at home as well.

In the initial session participants are asked to rate their levels of pain on a 100mm scale before treatment; stand on a level area and perform lumbar forward flexion before treatment, so that distance between finger tips and floor will be measured with a measuring tape in centimetres, and to answer two interview questionnaires before treatment. Participants will be asked to rate their levels of pain again on the 100mm scale immediately after the first session and also, to perform lumbar forward flexion again. At four weeks and at eight weeks again, participants will be required to rate their levels of pain, perform lumbar forward flexion and to complete the two interview questionnaires after the treatment session.

Please find copies of questionnaires and VAS forms attached.

Would my participation in this study be kept confidential?

We will do our best to keep your personal information confidential. To help protect your confidentiality, your information will be locked in a filing cabinet at Cradock Hospital to which the researcher has sole access.

If we write a report or article about this research project, your identity will be protected to the maximum extent possible.

In accordance with legal requirements and/or professional standards, we will disclose to the appropriate individuals and/or authorities information that comes to our attention concerning child abuse or neglect or potential harm to you or others.

What are the risks of this research?

There may be some risks from participating in this research study.

Drop in blood pressure for several minutes

Bleeding and bruising when blood vessel has been punctured (venepuncture)

Damage to the soft tissue and nervous tissue minimal injury induced by needling

Nausea, vomiting and excessive sweating in patients who are very tense, nervous or tired (rarely occurs)

Fainting may occur in patients who are tense, nervous or tired (rarely occurs)

Muscle memory-needling stress muscles may lead to emotional release due to somatisation of unpleasant events.

Embarrassment/ self-conscious due to area that therapist must treat

Pain and discomfort lasting for the rest of the day and following day post treatment.

Pneumothorax (when needling over the thoracic area/ over lungs)

Bent needle may be caused by patient moving while the needle is in the muscle or; by a strong local twitch response of the muscle while the needle is in the muscle (which is a good/positive response)

Stuck needle may occur in patient that is very nervous or due to spasm or trigger point in muscle.

What are the benefits of this research?

Improvement in symptoms of pain, lumbar range of forward flexion and function.

This research is not designed to help you personally, but the results may help the investigator learn more about the efficacy of dry needling for acute myofascial low back pain. We hope that, in the future, other people might benefit from this study through improved understanding of dry needling for acute myofascial low back pain.

Do I have to be in this research and may I stop participating at any time?

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized, treated differently, nor will your future therapy sessions be negatively affected.

Subject's participation will be terminated immediately on grounds of the following:

Harassment: inappropriate behaviour of any sort including touching the investigators or other participants inappropriately and by making inappropriate comments.

Participation in the study will also be terminated immediately if subjects pose any form of danger to the researcher and any or all of the individuals involved in the study.

Participation will be terminated too if subjects arrive under the influence of alcohol and narcotics/drugs.

Consequences: subjects will be informed verbally that their participation is terminated from the study with immediate effect.

Is any assistance available if I am negatively affected by participating in this study?

If a subject is negatively affected by participating in the study, subjects will be referred for the appropriate care such as the medical doctor, counselling and psychology

What if I have questions?

This research is being conducted by *Glynis Liezl Bruinders Physiotherapy Department* at the University of the Western Cape. If you have any questions about the research study itself, please contact Glynis Bruinders, glynis.bruinders@gmail.com.

Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

Head of Department: Professor A. Rhoda

Dean of the Faculty of Community and Health Sciences:

University of the Western Cape

Private Bag X17

Bellville 7535

This research has been approved by the University of the Western Cape's Senate Research Committee and Ethics Committee.



(isiXhosa translation of information sheet)

Iphepha Lenkcazelo

Igama Lohlolisiso: Ukusebenza ngempumelelo kwenkqubo yokusebenzisa iinaliti ezingenayeza ekunyangeni iintlungu zezihlunu emazantsi omqolo.

Luquka ntoni olu hlolisiso?

Olu hlolisiso luqhutywa nguGlynis Bruinders use University of the Western Cape. Siyakumema ukuba uthabathe inxaxheba koki hlolisiso ukuba ufunyaniswe unengxaki yezihlunu ezibuhlungu emazantsi omqolo. Injongo yolu hlolisiso kukuhlola impumelelo yenkqubo yonyango lokuhlaba ngeenaliti ezingenanto kudityaniswe nokuphulula kunye nokolula izihlunu ezibuhlungu emazantsi omqolo xa kuthelekiswa nokuphulula nokolula izihlunu ezibuhlungu emazantsi omqolo kuphela.

Ndiza kubuzwa ntoni ukuba ndithabatha inxaxheba kolu hlolisiso?

Abo bathabatha inxaxheba baya kucelwa batyobele isivumelwano sokuthabatha inxaxheba kolu hlolisiso. Abo bathabatha inxaxheba baya kucelwa babuyele ukwa kufumana unyango,veki nganye iiveki ezi8. Baya kucelwa bakhulule, bavume ukuphathwa nokuphululwa amazantsi omqolo neempundu, ukuhlatywa ngeenaliti ezingenayeza kwizihlunu ezibuhlungu (iindawo apho iintlungu zezihlunu zisuka khona) baze baboniswe indlela yokolula izihlunu ngomthambo emva konyango naxa besekhaya.

Xa besiza okokuqala, abathabatha inxaxheba, baya kucelwa bachaze/ benze isilinganiso sobungakanani beentlungu, besebenzisa isikali se 100mm ngaphambi konyango, beme kwindawo esithabazi benze umthambo ngokutyhalela amazantsi omqolo ngaphambili, ngaphambi konyango ukuze isithuba esiphakathi kweentupha zeminwe nomgangatho silinganiswe ngetape yokulinganise, baze bazalise amaxwebhu emibuzo yohlolisiso amabini, ngaphambi konyango. Baya kuvelwa kwakhona ukwenza isilinganiselosobungakanani beentlungu besebenzisa isikali se 100mm kwakhona emva konyango lokuqala.

Emva kweeveki ezine neeveki ezisibhozo abathabatha inxaxheba baya kucelwa bachaze ubungakanani beentlungu abazivayo benze umthambo wokutyhalela amazantsi emqolo phambili baze bazalise amaxwebhu emibuzo amabini emva konyango.

Iikopi zamaxwebhu emibuzo nesikali sokulinganisa iintlungu zidityaniswe apha kolu xwebhu.

Ngaba ukuthabatha inxaxheba kwam koluhlolisiso kuyo kugunwa kudimfihlo?

Siya kuzama kangangoko sinako ukugcina inkcazelo yakho iyimfihlo. Le nkcazelo iya kugcinwa kwikhabhathi etshixiweyo eSibhedlele e Cradock, apha iya kufikelelwa ngumqhubi wohlolisiso kuphela.

Ukuba sibhala iziphumo zolu phando, asiyi kuziquka iinkcukacha ezinokubangela ukuba uqondakale.

Ngokulandela umthetho karhulumente kunye nemithetho elawula umsebenzi wethu siya kudlulisela kubantu okanye amagunya afanelekilego kuphela inkcazelo engokuphathwa kakubi kwabantwana, ukungakhathalelwa okanye ukuba sesichengeni sokwenzakala kwakho nabanye abantu.

Ziziphi iingozi ezinokubakho kolu hlolisiso?

Kukho iingozi ezinokubakho kwabo bathabatha inxaxheba kolu hloliso:

Ukuhla koxinezeleko lwegazi (blood pressure) kangangemizuzu ethile.

Ukophakathi nokophela ngaphakathi xa kunokuhlatywa imithambo yegazi ngempazamo.

Ukusenzakala kwezihlunu ezithambileyo nezihlunu zemithambo-luvo (nerves) okunokubangelwa kukuhlatywa ngenaliti.

Isicaphu-caphu, ukugabha nokubila kakhulu kubantu abaxinezelekileyo, aboyikayo okanye abadiniwayo (ayifane yenzeke).

Ukufa isiqaa (fainting) kunokwenzeka kubantu aboyika nabadinwe kakhulu (ayifane yenzeke).

Ukuba neentloni ngenxa yendawo olwenziwa kuyo emzimbeni unyango.

Intlungu ngemini yonyango nosuku olulandelayo.

Ukungenwa ngumoya esifubeni nasemiphungeni (xa uhlatywe ngeenaliti esifubeni nangasemiphungeni).

Inaliti inokugoba xa umntu eshukuma ngoxa inaliti ihlatywe esihlunwini okanye ngoxa isihlunu sishukuma ngamandla ngoxa inaliti isesihlunwini (indlela ebonisa ukuphumelela konyango).

Inaliti inokubambeka esihlunwini xa umntu esoyika kakhulu okanye ngenxa yesihlunu esirhwaqeleyo.

Ziyintoni iingenelo zolu hlolisiso?

Ukudamba kweentlungu nokukwazi ukugobela amazantsi omqolo ngaphambili.

Injongo yolu hlolisiso asikokunceda wena ngokobuqu kodwa iziphumo zolu hlolisiso ziya kunceda umqhubi wohlolisiso afunde ngakumbi ngokuphumelela kwenkqubo yonyango kusetyenziswa iinaliti ezingenayeza ukunyanga iintlungu zezihlunu ezisemazantsi omqolo. Sinethemba lokuba, kwixa elizayo, abanye abantu baya kungenelwa kolu hlolisiso ngenxa yolwazi olungakumbi ngenkqubo yokuhlaba ngeenaliti ezingenayeza ekunyangeni izihlunu ezibuhlungu emazantsi omqolo.

Ngaba ndiyanzelekile ukuba ndithabathe inxaxheba kolu hlolisiso? Ngaba ndinako ukurhoxa nanini na?

Uthabatha inxaxheba ngokuzithandela. Ungazikhethela ukuthabatha inxaxheba okanye ungayithabathi inxaxheba. Ukuba ugqiba ekubeni ubandakanyeke kolu hlolisiso, ungayeka nanini na. Ukuba akufuni kuthabatha inxaxheba kolu hlolisiso okanye uyeke, akusayi kohlwaywa, uphathwe ngendlela eyahlukileyo okanye unyango lwakho olulandelayo lungenziwa ngendlela efanelekileyo.

Ukuthabatha inxaxheba kuya kuyekiswa kwezi meko zilandelayo:

Ukuphathwa kakubi: Xa umqhubi wohlolisiso okanye abanye abathabatha inxaxheba kolu wohlolisiso bekuphatha okanye bethetha ngendlela engafanelekanga

Xa omnye wabathabatha inxaxheba ebeka umqhubi wohlolisiso okanye abanye abathabatha inxaxheba befika bephantsi kwempembelelo yotywala okanye iziyobisi

Imiphumo: Abathabatha inxaxheba baya kuxelelwa ukuba bayarhoxiswa ngoko nangoko.

Ngaba lukho uncedo endiya kulufumana ukuba ndiye ndenzakala okanye ndafumana imiphumo emibi ngenxa yokuthabatha inxaxheba?

Ukuba ukuthabatha inxaxheba kuye kwanemiphumo emibi okanye eyingezi, abobachaphazekileyo baya kufumana uncedo olufanelekileyo njengokubonwa ngugqira, ukululelekwa/ ukucetyiswa nokunyangwa ngokwasengqondweni.

Kuthekani ukuba ndinemibuzo?

Olu hlolisiso luqhatywa nguGlynis Liezl Bruinders, Physiotherapy Department, kwi University of the Western Cape. Ukuba unemibuzo ngolu hlolisiso ungaqhagamshelana naye kule dilesi: Glynis Bruinders, glynis.bruinders@gmail.com

Ukuba unemibuzo malunga namalungelo akho ngoxa uthabatha inxaxheba kolu hlolisiso okanye ufuna ukuchaza nayiphi na inxaxheba oye wahlangabezana nayo kolu hlolisiso , qhagamshelana no:

Head of Department: Professor A. Rhoda

Dean of the Faculty of Community and health Sciences: Professor J. Frantz

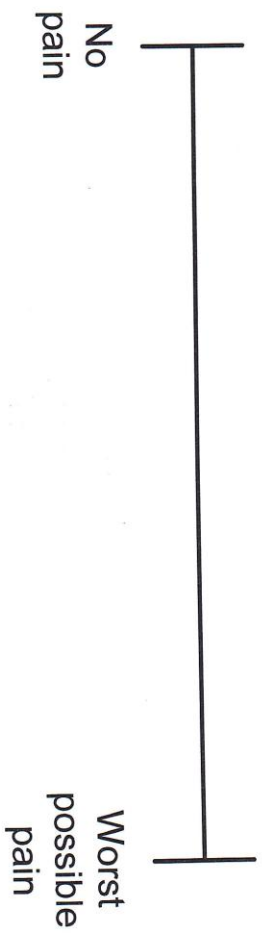
University of the Western Cape

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Bellville 7535

Olu hlolisiso luvunywe ngokusemthethweni yiWestern Cape's Senate Research Council committee neEthics Committee.

Visual Analog Scale



Appendix3

The Roland-Morris Low Back Pain and Disability Questionnaire
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Patient name: _____ File # _____ Date: _____

Please read instructions: 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.

- I stay at home most of the time because of my back.
- I change position frequently to try to get my back comfortable.
- I walk more slowly than usual because of my back.
- Because of my back, I am not doing any jobs that I usually do around the house.
- Because of my back, I use a handrail to get upstairs.
- Because of my back, I lie down to rest more often.
- Because of my back, I have to hold on to something to get out of an easy chair.
- Because of my back, I try to get other people to do things for me.
- I get dressed more slowly than usual because of my back.
- I only stand up for short periods of time because of my back.
- Because of my back, I try not to bend or kneel down.
- I find it difficult to get out of a chair because of my back.
- My back is painful almost all of the time.
- I find it difficult to turn over in bed because of my back.
- My appetite is not very good because of my back.
- I have trouble putting on my sock (or stockings) because of the pain in my back.
- I can only walk short distances because of my back pain.
- I sleep less well because of my back.
- Because of my back pain, I get dressed with the help of someone else.
- I sit down for most of the day because of my back.
- I avoid heavy jobs around the house because of my back.
- Because of back pain, I am more irritable and bad tempered with people than usual.
- Because of my back, I go upstairs more slowly than usual.
- I stay in bed most of the time because of my back.

Instructions:

1. The patient is instructed to put a mark next to each appropriate statement.
2. The total number of marked statements are added by the clinician. Unlike the authors of the Oswestry Disability Questionnaire, Roland and Morris did not provide descriptions of the varying degrees of disability (e.g. 40%- 60% is severe disability).
3. Clinical improvement over time can be graded on the analysis of serial questionnaire scores. If for example, at the beginning of treatment, a patient's score was 12 and, at the conclusion of treatment, their score was 2 (10 points of improvement), we would calculate an 83% ($10/12 \times 100$) improvement.

(isiXhosa) Roland-Morris Low Back Pain and Disability Questionnaire:

Igama Lesgulana:..... Ifayili;..... Umhla:.....

- Ndihlala ndisekhaya ixesha elininzi ngenxa yomqolo.
- Ndihlala nditshintsha tshintsha indlela zokuhlala ukwenzela lula umqolo wam.
- Ndihamba kencinci kunesiqhelo ngenxa yomqolo.
- Andisawenzi umsebenzi endiqhele uyenze ekhaya ngenxa yomqolo.
- Ndisebenzisa (handrail) xa ndinyuke (istairs) ngenxa yomqolo.
- Ngenxa yomqolo ndilala ixesha elininzi kuba ndiziphumza.
- Ngenxa yomqolo wam, kufuneka ndibambebele entweni ndikwazi ukuphakama kwistulo esilula.
- Ngenxa yomqolo ndicela obanfu ukundenzela ezinye izinto.
- Ndiyachotha ukuzinxibise ngenxa yomqolo
- Ndim ixesha elincinci ngexesha yomqolo.
- Ngenxa yomqolo ndizama ukhungathobi nokuguqa.
- Ndiyasokola ukuphaskama esitulweni ngenxa yomqolo.
- Umqolo wam uqaqamba ngalo lonke ixesha.
- Ndiguquka nzima ebhedini ngenxa yomqolo.
- Andityi kakuhle ngenxa yomqolo.
- Ndibanenxakhi yokunxhiba ikawusi zam ngenxa yentlungu emqolo.
- Ngenxa yentlungu zomqolo ndikwazi ukuhamba kwindawo ezikufutshane.
- Ndilake kakuhle ixesha elincinci ngenxa yomqolo.
- Ngenxa yentlungu zomqolo ndicendiswa ngomnye umntu ukuxhiba.
- Ndiyahlala ixesha elininzi ngenxa yomqolo.
- Ngenxa yomqolo imisebenzi yasekhaya enzima andiyenzi.
- Ngenxa yentlungu zomqolo ngoku ndidikeka msinyane ngabantu kunakuqala.
- Xa ndinyuka izistepsi ndichotha kakhulu kunesiqhelo.
- Ndibesebhedini ixesha elininzi ngenxa yomqolo.

Appendix 4

Oswestry Low Back Pain Disability Questionnaire

Instructions

This questionnaire has been designed to give us information as to how your back or leg pain is affecting your ability to manage in everyday life. Please answer by checking ONE box in each section for the statement which best applies to you. We realise you may consider that two or more statements in any one section apply but please just shade out the spot that indicates the statement which most clearly describes your problem.

Section 1 – Pain intensity

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

Section 2 – Personal care (washing, dressing etc)

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

Section 3 – Lifting

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

Section 4 – Walking*

- Pain does not prevent me walking any distance
- Pain prevents me from walking more than 2 kilometres
- Pain prevents me from walking more than 1 kilometre
- Pain prevents me from walking more than 500 metres
- I can only walk using a stick or crutches
- I am in bed most of the time

Section 5 – Sitting

- I can sit in any chair as long as I like
- I can only sit in my favourite chair as long as I like
- Pain prevents me sitting more than one hour
- Pain prevents me from sitting more than 30 minutes
- Pain prevents me from sitting more than 10 minutes
- Pain prevents me from sitting at all

Section 6 – Standing

- I can stand as long as I want without extra pain
- I can stand as long as I want but it gives me extra pain
- Pain prevents me from standing for more than 1 hour
- Pain prevents me from standing for more than 3 minutes
- Pain prevents me from standing for more than 10 minutes
- Pain prevents me from standing at all

Section 7 – Sleeping

- My sleep is never disturbed by pain
- My sleep is occasionally disturbed by pain
- Because of pain I have less than 6 hours sleep
- Because of pain I have less than 4 hours sleep
- Because of pain I have less than 2 hours sleep
- Pain prevents me from sleeping at all

Section 8 – Sex life (if applicable)

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

Section 9 – Social life

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

Section 10 – Travelling

- I can travel anywhere without pain
- I can travel anywhere but it gives me extra pain
- Pain is bad but I manage journeys over two hours
- Pain restricts me to journeys of less than one hour
- Pain restricts me to short necessary journeys under 30 minutes
- Pain prevents me from travelling except to receive treatment

*Note: Distances of 1 mile, ½ mile and 100 yards have been replaced by metric distances in the Walking section

(isiXhosa translation of the Oswestry Low Back Pain Disability Questionnaire)

Imibuzo Malunga Nentlungu Zomqholo:

Imiqathango

Lemibuzo yenzelwe ukusinika incakaka zokuba intlungu zomqholo okanye zomlendze zicaphazela njani impilo yakho ngensuku zonke. Sicela uphendule ngoku-tikisha kwibokisi ibenye kwi candela nganye. Siyayazi kungakhona izinto ezinintsi kunanye kwi candela nganye, kungakho sicela uphendule ngale icacisa ngakhona ingxakhi yakho.

Icandelo 1: Ubukhulu bentlungu

- Andinazo intlungu ngoku
- Zivakala kancinci intlungu ngoku
- Ziya ziqiniseka intlungu ngoku
- Ziyavakala intlungu ngoku
- Zivakala ziqiniseka intlungu ngoku
- Zivakala kakhulu intlungu ngoku

Icandelo 2: Ukuzinakekela (ukuhlamba)

- Ndiyakwazi ukuzinakekela ngaphandle kokuzivisa ubuhlungu
- Ndiyakwazi ukuzinakekela kodwa bukhona ubuhlungu
- Kubuhlungu ukuzinakekela kwaye ndiyacotha nangakho ndi
- Ndiyaludinga uncedo kodwa ndiyakwazi ukuzinakekela ngokunokwam
- Ndidinga uncedo ngentsuku zonke ngokuzinakekela
- Andinxibi, ndihlamba ngobunzima ndihlate ebedini.

Icandelo 3: Ukuphakamisa

- Ndiyakwazi ukuphakamisa izinto ezinzima ngaphandle kobuhlungu
- Ndiyakwazi ukuphakamisa izinto ezinzima kodwa zindivisa ubuhlungu
- Intlungu zindenza ndingakwazi ukuphakamisa

izinto ezinzima ngaphandle kokuba zibekwe kwindawo efikelekayo, umzelelo itafile

- Intlungu zindenza ndingakwazi ukuphakamisa izinto ezinzima kodwa ndiyakwazi ukuphakamisa izinto ezinganzimanga kakhulu
- Ndiyakwazi ukuphakamisa izinto ezinganzimanga kakhulu
- Andikwazi ukuphakamisa nokubamba izinto

Icandelo 4: Ukuhamba

- Intlungu azikucaphazeli ukuhamba kwam
- Andikwazi ukuhamba umnga ongange 2km ngoba ndiphethwe zintlungugoba
- Andikwazi ukuhamba umnga ongange 1km ngoba ndiphethwe zintlungu
- Andikwazi ukuhamba umnga ongange 500m ngenxa yentlungu.
- Ndikwazi ukuhamba ngenduku zokusimelela qha.
- Ndilele ixesha elinitsi

Icandelo 5: Ukuhlala

- Ndiyakwazi ukuhlala nakusiphi na isitulo
- Ndikwazi ukuhlala kwisitulo esithandwa ndim qha
- Andikwazi ukuhlala ixesha elingange yure enye ngenxa yentlungu
- Andikwazi ukuhlala ixesha elingange mizuzu 30 ngenxha yentlungu
- Andikwazi ukuhla ixesha elingange mizuzu eyishumi ngenxha yentlungu
- Andikwazi ukuhlala ngenxha yentlungu

Icandelo 6: Ukuma

- Ndiyakwazi ukuma ixhesha elide ngaphandle kwentlungu
- Ndiyakwazi ukuma kakhulu kodwa zibakhona intlungu
- Andikwazi ukuma ixhesha elingange yure ngenxha yentlungu
- Andikwazi ukuma ixhesha elingange mizuzu ya amashumi amathathu ngenxha yentlungu
- Andikwazi ukuma ixhesha elingange mizuzu elishumi ngenxha yentlungu

- Andikwazi ukuma nakanjani

Icandelo 7: Ukulala

- Ubuthongo bam abuphazanyiswa zintlungu
- Ubuthongo bam buyapha zanyiswa zintlungu
- Andikwazi ukulala iyure zintandathu ngenxha yentlungu
- Andikwazi ukulala iyure ezine ngenxha yentlungu
- Andikwazi ukulala iyure ezimbini ngenxha yentlungu
- Andikwazi ukulala ngenxha yentlungu

Icandelo 8: Ubomi Ngokwezesondo

- Ukukho 'ntlungu kubomi bam ngokwezesondo
- Zikhona intlungu kubomi bam ngokwezesondo
- Zikhona kakhulu intlungu kubomi bam ngokwezesondo
- Ziyaqiniseka intlungu kakhulu kubomi bam ngokwezesondo
- Buphantstlungu ubomi bam ngokwezesondo ngenxha yentlungu
- Abukho ubomi ngokwezesondo bam ngenxha yentlungu

Icandelo 9: Ubomi Ngokwasentlalweni

- Bulungile ubomi bam ngokwasentlalweni ngaphandle kwentlungu
- Ubomi bam basekuhlaleni bucaphazwa zintlungu
- Intlungu aziwucaphazeli ulami bam basentlalweni kodwa andikwazi ukuhlala kakhulu ngenxha yentlungu
- Andiphumi kakhulu ngenxha yentlungu
- Ndihlala ekhaya ngenxha yentlungu
- Andinabo ubomi basentlalweni ngenxha yentlungu

Icandelo 10: Ukuya Ezindaweni

- Ndiyakwazi ukuya ezindaweni ngaphandle kwentlungu
- Ndiyakwazi ukuya ezindaweni kodwa zikhona intlungu
- Zikhona intlungu kodwa ndiyakwazi ukuhamba umnga ongange yure ezimbini

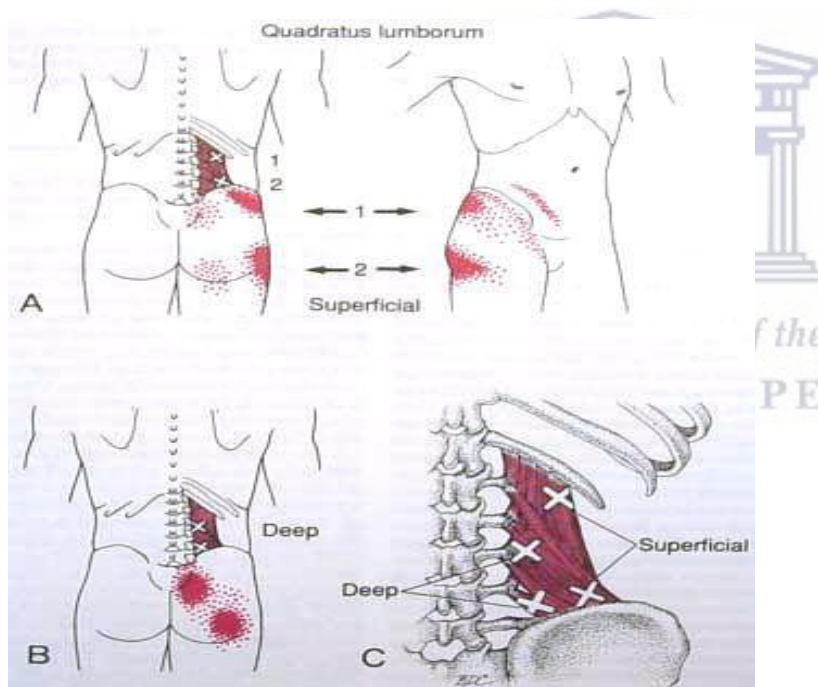
- Andikwazi ukugqithisela ukuhamba kwiyure enye ngenxha yentlungu
- Ndikwazi ukuhamba imizuzu yamashumi amathatu zikhona intlungu
- Andikwazi ukuya ezindaweni ngenxha yentlungu, kodwa ndiyakwazi ukuyolanda ipilisi (amayeza) wam.



Appendix 5

Muscles evaluated in current study:

5.1 The quadratus lumborum muscle originates from the iliolumbar ligament, iliac crest and occasionally from the upper borders of the transverse processes of the lower three or four lumbar vertebrae and inserts on the inferior border of the last rib and transverse processes of the upper four lumbar vertebrae (Kendall, McCreary, Provance, Rodgers and Romani, 2005). The quadratus lumborum assists with extension, lateral flexion of the lumbar vertebral column, depression of the last rib and when acting bilaterally with the diaphragm, fixes the last two ribs during respiration (Kendall et al., 2005).



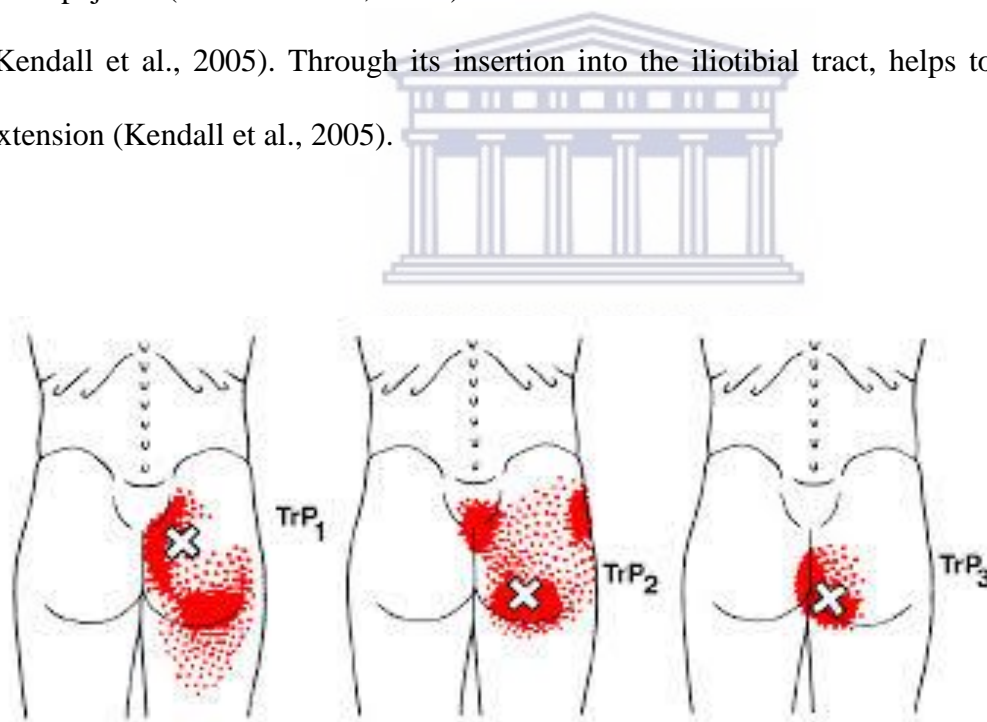
Quadratus Lumborum muscle and pain referral patterns of trigger points.

www.triggerpoints.net

The patient with active trigger points in this muscle may feel pain with activity and at rest. Patient may feel immobilised and even be unable to assume upright posture, may experience increased symptoms of pain with sneezing as well as coughing. Turning in bed may also be

painful. Satellite trigger points may be caused in the gluteal muscles and cause for pain to be referred down the leg and mimic sciatica (Simons et al., 1999).

5.2 The gluteus maximus muscle originates from the posterior gluteal line of the ilium and portion of the bone superior and posterior to it, posterior surface of the lower part of the sacrum, side of the coccyx, aponeurosis of the erector spinae, sacrotuberous ligament and gluteal aponeurosis (Kendall et al., 2005). The gluteus maximus muscle inserts on the larger proximal portion and superficial fibres of the distal portion of the muscle into the iliotibial tract of the fascial lata while the deep fibres of the distal portion into the gluteal tuberosity of the femur (Kendall et al., 2005). The gluteus maximus muscle extends and laterally rotates the hip joint (Kendall et al., 2005). The lower fibres of this muscle assist in abduction (Kendall et al., 2005). Through its insertion into the iliotibial tract, helps to stabilize knee extension (Kendall et al., 2005).

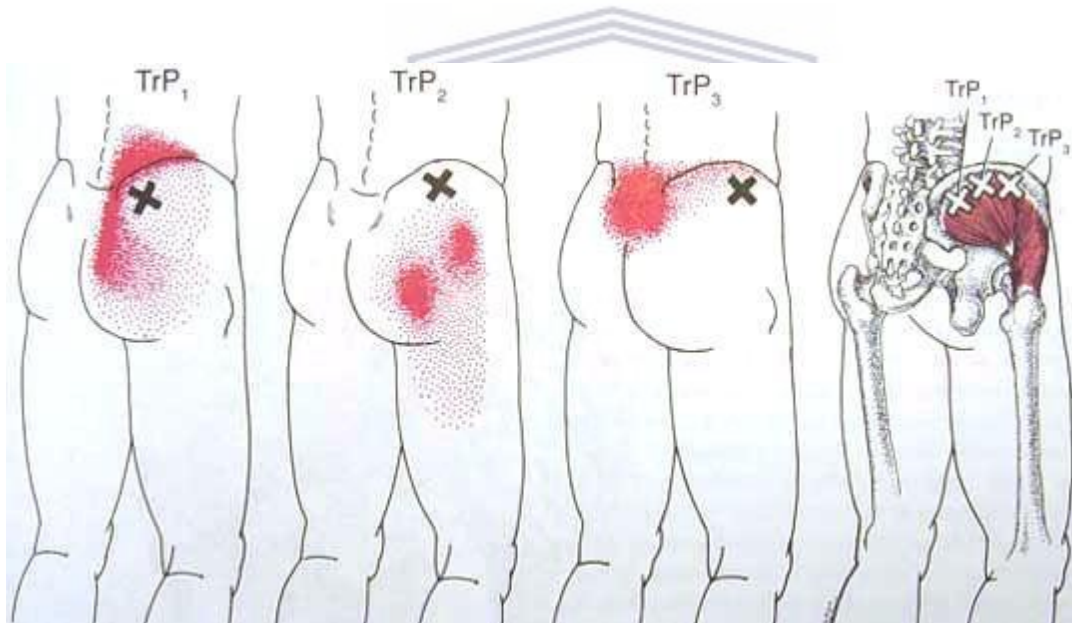


Gluteus Maximus trigger point referral patterns www.triggerpoint.net

The pain referral pattern of the gluteus maximus muscle is along the inferior or inferior-lateral aspect of the sacrum, the gluteal fold, or insertion along the the iliotibial tract. Trigger points in the gluteus maximus muscle can imitate sacroiliac pain (Simons et al., 1999).

The patient is required to be prone with a pillow under the abdomen or side lying. The muscle is needled with flat palpation perpendicular to the muscle along the area of the trigger point. Strong depression of the subcutaneous tissue is required to reduce the distance from the skin to the muscle (Simons et al., 1999). Precaution needs to be taken not to needle the sciatic nerve (Simons et al., 1999).

5.3 The gluteus medius muscle originates from the external surface of the ilium between the iliac crest and posterior gluteal line dorsally and the anterior gluteal line ventrally and gluteal aponeurosis (Kendall et al., 2005). The gluteus medius muscle inserts on the oblique ridge on the lateral surface of the greater trochanter of the femur (Kendall et al., 2005). The action of the gluteus medius muscle is to abduct the hip joint (Kendall et al., 2005).



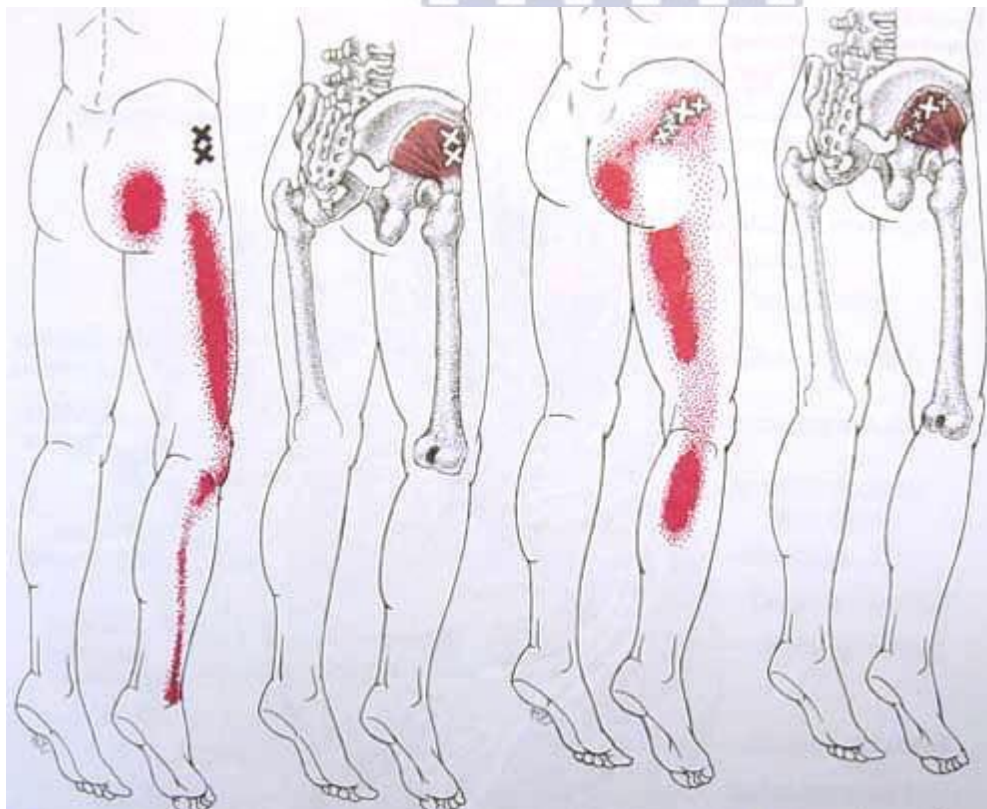
Gluteus Medius muscle trigger point referral patterns. www.triggerpoint.net

Trigger points may refer to the sacroiliac joint, gluteal and lumbosacral regions, and along the iliotibial tract, gluteal region, posterior thigh and posterior lower leg (Simons et al., 1999).

The patient is positioned in prone or side lying (Simons et al., 1999). The muscle is needled with flat palpation perpendicular to the muscle along the contour of the iliac crest (Simons et

al., 1999). Strong depression of the subcutaneous tissue is required to reduce the distance from the skin to the muscle. Needle contact at the periosteum is common (Simons et al., 1999). Precaution is to be taken not to needle the sciatic nerve. There are also deep branches of the superior gluteal vessels and nerve between the medius and minimus which should not be needled. Depth of penetration is dependent on the amount of adipose tissue (Simons et al., 1999).

5.4 The gluteus minimus muscle originates from the external surface of the ilium, between the anterior and inferior gluteal lines and margin of the greater sciatic notch (Kendall et al., 2005). Points of insertion for this muscle are the anterior border of the greater trochanter of the femur and hip joint capsule (Kendall et al., 2005). The gluteus minimus muscle abducts, medially rotates and may assist in flexion of the hip joint (Kendall et al., 2005).



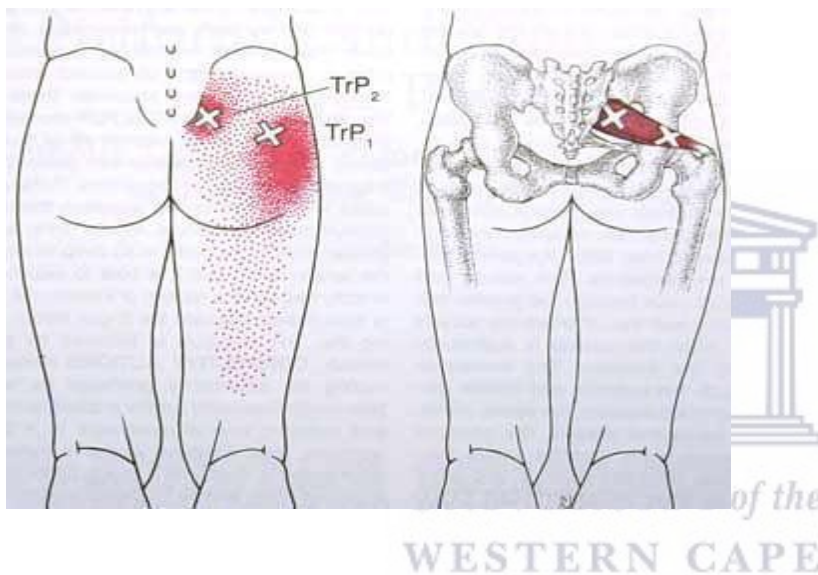
Gluteus Minimus muscle www.triggerpoint.net

Referred pain from the gluteus minimus muscle is into the iliotibial tract, gluteal region, posterior thigh, and posterior one third of the lower leg (Simons et al., 1999). It is not possible to separate referred pain patterns from the gluteus medius muscle in the area where the two muscles overlap (Simons et al., 1999).

The patient is positioned in prone or side lying (Simons et al., 1999). The muscle is needled in flat palpation perpendicular to the muscle along the contour of the iliac crest (Simons et al., 1999). Strong depression of the subcutaneous tissue is required to reduce the distance from the skin to the muscle. Needle contact at the periosteum is common (Simons et al., 1999). Precautions need to be taken as there are deep branches of the superior gluteal vessels and nerve between gluteus medius and minimus which should not be needled (Simons et al., 1999).



5.5 The piriformis muscle originates from the pelvic surface of the sacrum between (and lateral to) the first through fourth pelvic sacral foramina, margin of the greater sciatic foramen and pelvic surface of the sacrotuberous ligament (Kendall et al., 2005). Point of insertion for this muscle is on the superior border of the greater trochanter of the femur (Kendall et al., 2005). The piriformis muscle laterally rotates the hip joint (Kendall et al., 2005).



Piriformis muscle www.triggerpoint.net

Patients suffering from trigger points in the piriformis muscle may report pain radiating into gluteal area, low back, groin, perineum, hip, posterior thigh, calf, foot and intense pain while sitting or squatting (Jankovic, Peng and Van Zundert, 2013).

Needling technique requires for the patient to be placed in Sims position (Jankovic et al., 2013). The piriformis line overlies the superior border of the piriformis muscle and extends from immediately above the greater trochanter to the cephalic border of the greater sciatic foramen at the sacrum (Jankovic et al., 2013). The line is divided in to three equal thirds

(Jankovic et al., 2013). The point of maximum trigger point tenderness is usually found just lateral to the junction of the middle and last thirds of the line (Jankovic et al., 2013).



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UNIVERSITY of the
WESTERN CAPE

**OFFICE OF THE DEAN
DEPARTMENT OF RESEARCH DEVELOPMENT**

5 December 2013

To Whom It May Concern

I hereby certify that the Senate Research Committee of the University of the Western Cape approved the methodology and ethics of the following research project by:
Mrs GL Bruinders (Physiotherapy)

Research Project: The effectiveness of dry needling as an
intervention for acute myofascial low back
pain

Registration no: 13/10/33

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

The Committee must be informed of any serious adverse event and/or termination of the study.

*Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape*

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Eastern Cape Department of Health

Enquiries: Zonwabele Merile

Tel No: 040 608 0830

Date: 05th January 2015

Fax No: 043 642 1409

e-mail address: zonwabele.merile@mpilo.ecprov.gov.za

Dear Mrs GL Bruinders

Re: The effectiveness of dry needling as an intervention for acute myofascial low back pain

The Department of Health would like to inform you that your application for conducting a research on the abovementioned topic has been approved based on the following conditions:

1. During your study, you will follow the submitted protocol with ethical approval and can only deviate from it after having a written approval from the Department of Health in writing.
2. You are advised to ensure, observe and respect the rights and culture of your research participants and maintain confidentiality of their identities and shall remove or not collect any information which can be used to link the participants.
3. The Department of Health expects you to provide a progress on your study every 3 months (from date you received this letter) in writing.
4. At the end of your study, you will be expected to send a full written report with your findings and implementable recommendations to the Epidemiological Research & Surveillance Management. You may be invited to the department to come and present your research findings with your implementable recommendations.
5. Your results on the Eastern Cape will not be presented anywhere unless you have shared them with the Department of Health as indicated above.

Your compliance in this regard will be highly appreciated.

SECRETARIAT: EASTERN CAPE HEALTH RESEARCH COMMITTEE



Ikamva eliqaqambileyo!



UNIVERSITY OF THE WESTERN CAPE

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E-mail:

CONSENT FORM

Title of Research Project: The effectiveness of dry needling as an intervention for acute myofascial low back pain

The study has been described to me in language that I understand and I freely and voluntarily agree to participate. My questions about the study have been answered. I understand that my identity will not be disclosed and that I may withdraw from the study without giving a reason at any time and this will not negatively affect me in any way.

Participant's name.....

Participant's signature.....

Witness.....

Date.....

Should you have any questions regarding this study or wish to report any problems you have experienced related to the study, please contact the study coordinator:

Study Coordinator's Name: Professor Anthea Rhoda

Telephone: (021) 959 2542

Email: arhoda@uwc.ac.za

Student's Name: Glynis Liezl Bruinders

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