CHAPTER 1
INTRODUCTION

Chapter Overview

This chapter acquaints the reader to the background of the current study and briefly introduces various nomenclatures that would be used often in this study. The chronology of evolution of lumbar facet syndrome is then dealt with to pay the rightful dues to this often neglected but vital component of chronic back pain. Typical as well as atypical symptoms of lumbar facet syndrome are then discussed; followed by scientific methods to diagnose the condition. Various treatment options and the prognosis of this entity is then dealt with. Subsequently a description of various physiotherapy treatment options in chronic low back pain is addressed to with special emphasis on physiotherapy techniques used in lumbar facet joint syndrome. Recent advances and modern invasive current treatment concepts and their prognosis is is discussed in brief.

Thus after highlighting the importance of lumbar facet syndrome in chronic low back pain, this chapter ends on a vital note explaining the need and basic purpose of this research.

1.1 Background to the study

Our human society has been haunted by low back pain since ages. The problem has been so prolific that a mention of this is even found on papyrus the oldest surviving text written about 1500 B.C.\textsuperscript{1} Although various attempts have been made in the past to treat this ailment of mankind, there is poor evidence that low back pain has changed. Two key ideas in the nineteenth century laid the foundations for the modern approach to back pain: 1] Pain originated from the spine; and that 2] It was due to some form of injury. With acceptance of modern innovations and scientific research the diagnosis and management of low back pain has dramatically improved.\textsuperscript{2,3}

Low back pain is a foremost health and socioeconomical problem all over the world and is linked with high costs in care, work absenteeism and disability.\textsuperscript{4,5} A systematic review of prevalence studies, estimated point prevalence of low back pain ranging from 12\% to 33\% with one-year prevalence ranging from 22\% to 65\% and lifetime
prevalence ranging from 11% to 84%.\textsuperscript{6} Linton et al\textsuperscript{7} estimated the prevalence of spinal pain in the general population to be 66%, with 44% of patients reporting pain in the cervical region, 56% in the lumbar region, and 15% in the thoracic region. The prevalence of low back pain in India has been found to range from as low as 6.2% to as high as 92% which depends on the population under study.\textsuperscript{8}

The 2010 global burden of disease study estimated that low back pain is amongst the top 10 diseases and injuries that account for the highest number of disability-adjusted life years (DALYs) worldwide.\textsuperscript{9} Although the economic costs vary among different countries\textsuperscript{10}, it is clear that low back pain represents an important economic burden worldwide. Such is the impact of this malady that even the WHO has named the first decade of the third millennium as the “Decade of campaign against musculoskeletal disorders (as the silent epidemic)”.\textsuperscript{8}

Despite the high prevalence of back pain, based on clinical examination alone; the specific etiology can be diagnosed in only about 15% of patients with certainty.\textsuperscript{11-12} Additionally it has to be remembered well that pain originating from various structures of the spine is a major cause of chronic back pain problems.\textsuperscript{13,14}

Low back pain [LBP] is more common than other types of back pain. There are many structures in the lumbar spine which can individually or in combination serve as major cause of pain. Often, the etiology of low back pain depends on several factors. Structures that can be the likely sources of chronic LBP include the posterior longitudinal ligament, dorsal root ganglia, dura, annular fibers, muscles of the lumbar spine and facet joints.

After being described as a potential pain generator by Joel Goldthwait in 1911,\textsuperscript{15} the facet joint has been increasingly recognized as an important cause of low back pain. The facet joint is also known as the zygophysial joint, a term that was derived from the Greek roots \textit{zygos}, meaning yoke or bridge, and \textit{physis}, meaning outgrowth.

Historically there has been much debate about whether the “the facet syndrome” exists, with numerous papers in support of this clinical entity\textsuperscript{16,17} and others against.\textsuperscript{18} Despite this, many sources agree that the lumbar facet joint certainly has the potential to be the source of a patient’s low back pain.\textsuperscript{19}
In 1927, the Italian surgeon Putti published an article on facet joint degeneration as a cause of low back pain, which supported the results of Goldthwait. Subsequently, in 1933, Ghormley first used the term “facet syndrome”, which he defined as lumbosacral pain with or without sciatic pain, particularly occurring suddenly after a twisting or rotary strain of the lumbosacral region. In 1941, Badgley suggested that facet joints themselves could be a primary source of pain other than the nerve compression component. He also showed that facet joint pathology could cause symptoms, including radiation of pain into the lower extremities. However, it was not until 1963 when Hirsch et al. demonstrated that the low back pain distributed along the sacroiliac and gluteal areas with radiation to the greater trochanter could be induced by injecting hypertonic saline in the region of the facet joints. In 1976 Mooney and Robertson and in 1979 McCall, Marks in 1989 and Fukui et al in 1997 described the distributions of pain patterns and confirmed the findings of previous researchers. Lumbar facet joints have been accepted as potential causes of mechanical spinal pain in the medical literature, as shown by many scientific studies.

Table 1: Historical perspective of facet syndrome

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year</th>
<th>Findings</th>
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<tbody>
<tr>
<td>Goldthwait</td>
<td>1911</td>
<td>Recognition of facet joint as a potential source of back pain</td>
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<tr>
<td>Putti</td>
<td>1927</td>
<td>“Articular facet degeneration” as cause of pain</td>
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<tr>
<td>Ghormley</td>
<td>1933</td>
<td>Used the term facet syndrome</td>
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<tr>
<td>Badgley</td>
<td>1941</td>
<td>Facet joints as a source of pain “without nerve compression”</td>
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<tr>
<td>Hirsh et al</td>
<td>1963</td>
<td>Production of “lumbar pain patterns” with injection of “hypertonic saline”</td>
</tr>
<tr>
<td>Mooney &amp; Robertson</td>
<td>1976</td>
<td>Production of lumbar pain with “hypertonic saline” and relief with local anaesthetic injection</td>
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<tr>
<td>McCall et al</td>
<td>1979</td>
<td>Description of Lumbar pain patterns in volunteers</td>
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<tr>
<td>Marks</td>
<td>1989</td>
<td>Lumbar facet joint pain patterns</td>
</tr>
<tr>
<td>Fukui et al</td>
<td>1997</td>
<td>Lumbar facet joint pain patterns</td>
</tr>
<tr>
<td>Schwarzer et al</td>
<td>1994</td>
<td>USA prevalence of post traumatic lumbar facet joint pain -15 %</td>
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<tr>
<td>Schwarzer et al</td>
<td>1995</td>
<td>Australian prevalence of lumbar facet joint pain 40%</td>
</tr>
<tr>
<td>Manchikanti</td>
<td>1999-01</td>
<td>US prevalence of lumbar facet joint pain 28-52%</td>
</tr>
<tr>
<td>Thipse et al²⁸</td>
<td>2014</td>
<td>Prevalence of facet-joint involvement 66.88% in Rural population</td>
</tr>
</tbody>
</table>

Lumbar facet joints have been implicated as one of the cause²⁹,³⁰ and described as source of chronic pain in 15% to 45% of patients with chronic low back pain (CLBP).²⁷,₁⁸ The reported prevalence rate varies widely in different studies from less than 5% to as high as 90%, being heavily dependent on diagnostic criteria and selection methods.³¹,³² Since arthritis is a prominent cause of facetogenic pain, the prevalence rate increases with age.³³,³⁴ Using single local anesthetic (LA) blocks, the prevalence of lumbar facet joint pain has been reported to range from 8% to 94%.¹⁸,³²

Panjabi³⁵ hypothesised that trauma or a repetitive micro-trauma may cause injuries of the spinal ligaments, disc annulus and the facet capsules, so affecting the embedded mechanoreceptors. The injured mechanoreceptors may then generate altered transducer signals, leading to altered muscle response pattern produced by the neuromuscular control unit. It results in abnormal loading forces due to changed motor behaviour and thus excessive loading of, and strain on, the facet joints. Higher stresses, strains and injuries may develop in the spinal ligaments, and mechanoreceptors present in the joint. When the facet joints are overloaded, the spinal muscles fatigue or get injured. Over time, these injurious stresses and strains can initiate inflammation of neural tissues³⁶ and accelerate disc³⁷ and facet joint³⁸ degeneration. Thus, a vicious cycle is set up, leading to chronic dysfunction of the entire spinal system, resulting in chronic low back pain.

Bogduk³⁰,³⁹ identified four factors that are necessary for any structure to be deemed as a cause of back pain: a nerve supply to the structure; the ability of the structure to cause pain similar to that seen clinically in normal volunteers; the structure's susceptibility to painful diseases or injuries; and demonstration that the structure can be a source of pain in patients using diagnostic techniques of known reliability and validity.

The facet joints of the lumbar spine are well innervated by the medial branches of the dorsal rami.⁴⁰ Neuroanatomic, neurophysiologic, and biomechanical studies have
demonstrated free and encapsulated nerve endings in facet joints, as well as nerves containing substance P calcitonin gene-related peptide.\textsuperscript{40} Facet joint capsules also contain low-threshold mechanoreceptors, mechanically sensitive nociceptors and silent nociceptors.\textsuperscript{40} The presence of nociceptive nerve fibers in the various structures of facet joints and substance P, suggest that these structures may cause pain under increased or abnormal loads.

In rare cases, facet joint pain can result from a specific traumatic event (i.e. high-energy trauma associated with a combination of hyperflexion, extension, and distraction).\textsuperscript{41} More commonly, it is a result of repetitive stress and/or cumulative low-level trauma. This leads to inflammatory changes, which can lead to the facet joint accumulated with fluid and swelling, which in turn causes stretching of the joint capsule and subsequent pain generation.\textsuperscript{42}

1.2 Statement of the problem

Pain originating from lumbar facet joint is defined as “lumbar facet joint syndrome.” The diagnosis of facet joint syndrome can consequently be made clinically by assessment and by excluding any other causes of LBP.\textsuperscript{43}

A unambigious history of symptoms is required which may help to indicate the facet joint as the primary source of symptoms in low back pain. In addition to causing localized pain, facet joints may refer pain to adjacent structures. The typical symptoms and signs are localized “pseudo radicular” lumbar pain that may radiate unilaterally or bilaterally to the buttock, the hip, the groin, and the thighs, typically ending above the knee without neurological deficits.\textsuperscript{44} If pain radiates below the knee joint, it suggests an increased likelihood of radiculopathy rather than pain emanating from the facet joint. It can be further confirmed if there is associated true numbness or weakness is present.\textsuperscript{11,45} Adding to this pain increases with stress, exercise, lumbar spine extension, rotary motions, and in standing or sitting. Lying and flexion at the lumbar spine leads to pain relief.\textsuperscript{44} Patients usually report increased complaints in the morning and during periods of inactivity.\textsuperscript{46} It is widely acknowledged that lumbar paravertebral tenderness is indicative of facetogenic pain, which is a claim supported by clinical trials.\textsuperscript{47} It has been postulated that lumbar spine extension with lateral flexion and rotation to the same side, load the facet joint provocatively and has been
used to help in diagnosis of facet joint pain. In this position, maximal pressure is on the facet joints as they act to assist the disc in resisting compressive forces.

Low back pain is multifaceted and it involves structural, biomechanical, biochemical, medical, and psychosocial influences that result in dilemmas of such complexity that treatment is often difficult or ineffective.

Chronic low back pain of facet joint origin may be managed by intraarticular injections, facet joint nerve blocks and neurolysis of facet joint nerves. Conflicting results have been reported regarding the effectiveness of these different invasive treatment modalities in systematic reviews. Datta et al, in a systematic review of therapeutic facet joint interventions, presented moderate evidence for therapeutic lumbar facet joint nerve blocks and radiofrequency thermo neurolysis. Geurts et al determined that there was moderate evidence that radiofrequency lumbar facet denervation was more effective for chronic low back pain than placebo. Manchikanti et al in their review assessed medial branch neurotomy for managing chronic spinal pain, including randomized and observational reports. They concluded that there was strong evidence for short-term relief but moderate evidence for long-term relief of facet joint pain.

European guidelines for the management of chronic nonspecific low back pain, utilizing the evidence available from January 1995 to November 2002, concluded that intraarticular facet joint injections were ineffective in managing chronic low back pain. In that literature review, they showed no significant effectiveness of medial branch blocks. The European guidelines concluded that there was conflicting evidence, that radiofrequency denervation of the facet joints is more successful than placebo in pain or functional disability in mechanical chronic low back pain. They also indicated that there was limited evidence for intraarticular denervation of facet joints.

Percutaneous radiofrequency denervation of facet joints (RF-facet), a symptomatic treatment of chronic pain attributed that these joints, have become a common practice over the last decades in many Western countries but the long term effect of treatment modality is not described.

The exact mechanism of the therapeutic effect of lumbar facet joint nerve blocks is not known, whereas radiofrequency neurotomy causes denaturing of the nerves.
Subsequently, with radiofrequency treatment the pain reappears when the axons regenerate which requires repetition of the radiofrequency procedure.

There are multiple treatment approaches in physiotherapy for low back pain of any origin. A conservative approach which is generally recommended for chronic non-specific low back pain includes; patient education, traction, lower-quarter nerve mobilization. Manual therapy and treatments based on exercises holds the stronger evidence.\(^57,58\) Exercise therapy, is a combination of trunk strengthening, stretching, coordination, and endurance exercises, are the most widespread conservative approaches used in clinical practice and is recommended by most of the guidelines for acute or chronic low back pain.\(^4,59\) Exercise therapy decreases pain and improves physical function in adults with chronic low back pain, particularly in health care population.\(^58\) In most cases, treatment methods include bed rest, wearing of assistive devices, traction therapy, thermotherapy, electrical stimulation therapy, exercise therapy, drug treatment, spinal decompression therapy and manual therapy.\(^60\)

The first evidence of the use of spinal manual therapy dates back to around 400 BCE, when manipulative therapy was described by Hippocrates in 460–385 BCE.\(^61\) Manual therapy treatment is commonly used in primary care by physiotherapist, in combination with specific and functional exercises. Manual therapy techniques comprise of a variety of techniques such as mobilization, manipulations, massage and stretching. The effectiveness of mobilization and manipulations are often summarized in reviews. Reviews present moderate / strong evidence that mobilization therapy can be effective for relief of pain and improvement of function.\(^62\) Manual therapy (manipulation or mobilization or both) has been advocated as a primary treatment for the patient suffering from back dysfunction.\(^63,64\) Manual therapy techniques including joint mobilization technique, is thought to affect the neurophysiological and mechanical aspects of pain, pain arc, or muscle spasm, and they are effectively used in treating joints with hypomobility.\(^65\)

Historically, lumbar facet joint has been targeted with manual therapy based on the assumption that the joint may present with a ‘manipulable lesion’.\(^66\) It has been assumed that in a lumbar facet joint, demonstrating some interruption of normal movement, or biomechanical dysfunction, the application of manual therapy involving the direction of specific forces to the joint can correct the dysfunction and restore normal movement.\(^67\) Because facet syndrome generally involves pain and joint
dysfunction, it seems logical to apply treatment that not only relieves pain but also helps in correcting the underlying dysfunction. Posterior joint dysfunction appears to have specific intra articular origin and is simply not a product of segmental muscle spasm. This has been demonstrated by performing manipulations under anesthesia when muscles are relaxed yet the intrinsic joint dysfunction is still quite evident.

Novel growing concepts in the field of manual therapy and clinical practice which remain sparsely studied in cases of facet syndrome are Mulligan’s mobilization and Maitland’s mobilization technique. The popularity and use of manual therapy for the management of LBP, is supported by inclusion of manual therapy in various practice guidelines.\textsuperscript{68,4}

Mobilization with movement (MWM) originally developed by Mulligan, is a manual therapy treatment technique in which a manual force, usually in the form of a joint glide, is applied to a motion segment and sustained while a previously impaired action called as comparable sign (e.g. painful & reduced ROM, painful resisted isometric muscle contraction) is performed. The technique is indicated if, on its application the technique permits the impaired joint to move freely deprived of pain or impediment.\textsuperscript{69} The direction of the applied force (translation or rotation) is typically perpendicular to the plane of movement or impaired action and in some instances it is parallel to the treatment plane.\textsuperscript{69,70}

Mulligan's mobilization-with movement (MWM) treatment techniques are gaining increasing popularity for it’s use in musculoskeletal conditions, not only for low back pain (LBP) but also other disorders.\textsuperscript{71-73} One of the most important MWM technique is described as the SNAG, pioneered by Brian Mulligan.\textsuperscript{74}

SNAG is an acronym for "Sustained Natural Apophyseal Glide" technique involves the application of an accessory passive glide to the lumbar vertebrae while the patient simultaneously performs a restricted or painful active movements of the spine.\textsuperscript{74,75} The direction of the glide is along the plane of the facet joint and the technique is performed in a weight-bearing position (i.e. sitting, standing). Among other principles, basic and important principle of the SNAG's is an immediate reduction of pain and an increase in range of motion (ROM).\textsuperscript{74-76} This technique especially targets the facet joints which was also demonstrated in a single case study.
According to Mulligan, the effect of MWMs is based on the presumption that pain is associated with 'positional fault(s)' in joints with resultant subtle "biomechanical" changes such as joint restriction and stiffness. Combining this joint glide with a physiological spinal movement, is thought to overcome the joint problems that may be the cause of symptoms.

Spinal manual therapy includes both manipulation and mobilization. Maitland’s mobilization uses low-grade velocity, small-or large-amplitude passive movement techniques within the patient’s joint range of motion and control that does not involve a thrust. One of the most frequently used mobilization techniques for patients with low back pain is the central postero anterior (PA) glide. During the application of this technique, a therapist manually applies a force to the skin over lying a patient’s spinous process while the patient lies prone. A number of randomized controlled trials conducted on subjects with LBP have demonstrated the efficacy of spinal manual therapy in reducing pain and increasing range of motion and improving disability.

Joint mobilization techniques are thought to benefit patients with lumbar mechanical dysfunction through the stimulation of joint mechanoreceptors. These receptors are supposed to alter the pain-spasm cycle through the presynaptic inhibition of nociceptive fibers in associated structures and the inhibition of hypertonic muscles, which eventually improves functional abilities.

Non-pharmacological methods including a variety of physical agents are the cornerstone for the management of chronic LBP. Therapeutic ultrasound (US) is amongst the commonly used physical modalities for treating soft tissue injuries in physiotherapy practice. Effectiveness of ultrasound is already proved in various types of musculoskeletal pain. Effect of high frequency currents on deep seated pain and resolution of inflammation by pro inflammatory effect is already been documented. In the last decade use of ultrasound has changed significantly. In the past, it was mainly used for its thermal effect, and is now it is more and more used for nonthermal effects, especially for pain relief, wound healing and the healing of bone fractures. Thermal effects are attributed to the continuous ultrasound and nonthermal effects to the pulsed ultrasound of small intensity. The greatest analgesic effect is attributed to the thermal effect of ultrasound because it leads to increased metabolic
activity in the tissue, improving circulation and relaxation of rigid structures of the soft tissues, especially in degenerative musculoskeletal system.\textsuperscript{85}

A systematic review of studies included in the Cochrane database from 2010, highlights the therapeutic efficacy of ultrasound in the treatment of the pain in degenerative condition of the knee and improving the functionality of the patients. Results of the survey conducted in Australia in the year 2007 showed that therapeutic ultrasound remains the most popular physical agent that is used in physiotherapy practice.\textsuperscript{86} In addition to the mechanical and biological effects, the rise in temperature as a result of absorption and transformation of US energy in tissues is thought to play a significant role in the effectiveness of therapeutic US.\textsuperscript{87} It has been suggested that pain threshold can be elevated by the increasing the tissue temperature.\textsuperscript{88} There is a dearth of evidence for the clinical use of therapeutic US in patients with LBP.\textsuperscript{89} Studies on the efficacy of continuous US in chronic LBP are lacking\textsuperscript{90} and there is little evidence of its effectiveness in physiotherapy practice.\textsuperscript{4,90} However, lack of evidence is not evidence of lack of effect.

Exercise is possibly the most advocated treatment option for chronic low back pain.\textsuperscript{4,6} This is not a surprise, given the fact, that there is a good biological rationale\textsuperscript{91} for the use of exercise for patients with chronic nonspecific low back pain (i.e. exercise has the potential to improve spinal ROM, muscle strength, endurance and spinal stabilisation). Moreover, the costs for exercise therapy are reasonably less and exercise providers are readily available.\textsuperscript{92}

Some authorities\textsuperscript{92} suggest that muscle is a potential source of low back pain. They argued that failure of muscles to protect passive structures (i.e. facet joint, intervertebral discs) from excessive loading may result in damage to these pain-sensitive structures and produce pain.\textsuperscript{93} Enhancing muscle endurance, therefore, may help to reduce low back pain.

Endurance is mechanically defined as either the point of isometric fatigue, where the contraction can no longer be maintained at a certain level or as a point of dynamic fatigue, where repetitive work can no longer be sustained at a certain force level. Fatigue may decrease the muscular support of the spine and may lead to an increase possibility of strain on passive structures, eventually leading to low back pain.
Evidence suggests that muscle endurance is lesser for people with low back pain than for without low back pain individuals.⁹⁴

Fatigue can affect the ability of people with low back pain to respond to the demands of an unexpected load.⁹⁵ Fatigue which follows repetitive loading, also leads to a loss of control and precision, which may predispose an individual to developing low back pain.⁹⁶ Therefore, back muscle endurance training exercises has been suggested to increase fatigue threshold and improve performance, thus dipping disability level.⁹⁷

The main aspect in endurance training is to increase muscle endurance along with strength for reducing the risk of recurrence injury of intervertebral discs, facet joints and surrounding structures to minimum, by continuing the musculo ligamentous control.⁹⁸

There is evidence to suggest that endurance training of the low back extensors can be effective in relieving low back pain.⁹⁹

It has also been opined that pain and inactivity make trunk muscles fatigue in normal situations, thereby hindering them from being constantly active during the course of the day. Reduced endurance of trunk muscles has been specifically identified as a contributing factor to LBP of facet origin.⁹⁹ Motor control is also an important factor in spinal stability, and motor control errors due to improper muscle forces are known to increase with fatigue and reduced endurance.¹⁰⁰ A number of investigators have cited evidence that supports the use of stabilization exercises for enhancing spinal stability.¹⁰¹-¹⁰² The local muscles are said to be crucial in this mechanism.¹⁰²,¹⁰³ This may be because of their contribution to maintaining the position of the spine and their ability to improve trunk endurance.

Enhancing the endurance of trunk muscles may help in reducing LBP. Hence, training of trunk muscle endurance has been recommended as a means of increasing fatigue threshold and improving performance and subsequently reducing disability.¹⁰⁴

1.3 Need for the present study

Physical therapy treatment has been, for many decades, the most standard conservative treatment for chronic LBP. Yet, lack of scientific evidence for physiotherapy interventions, and shortage of cost-effectiveness data for treatment of LBP, has led to argument and dilemma within the medical and health allied
Therefore, despite being identified as a serious health concern, effective means of managing chronic LBP still remains controversial.

Although numerous studies have examined the role of physiotherapy treatment for chronic low back pain, published controlled trials of physiotherapy management specifically targeted to facet joint pain are lacking. To date, the management of this disabling condition has neither been widely studied nor published.

Manual therapy treatment provided by physiotherapists is a common conservative treatment option for LBP mentioned in research, but evidence of its effectiveness remains limited in lumbar facet syndrome patients. It has been suggested that this may be the result of previous trials providing a “one size fits all” approach to treatment, where all the patients complaining of low back pain receive the same generic treatment intervention, rather than an intervention targeted to the particular subgroup of low back pain with which they present. Rather than all patients receiving the same intervention, treatments could be targeted towards specific subgroups of patients (i.e. facet syndrome) with low back pain more likely to respond to these interventions, thus applying a subgroup specific treatment approach.

None of the previous trials in physiotherapy included a subgroup of low back pain considered to be of lumbar facet joint origin. This was a surprising omission given that this subgroup is widely purported to exist. The absence of this subgroup in trials applying subgroup specific manual therapy was also surprising given the theoretical mechanisms by which manual therapy is considered to provide therapeutic effects at the lumbar spine. Manual therapy is thought to restore normal movement at the lumbar spine through the application of specific forces; these are thought likely to have the greatest effect on the lumbar facet joints because of their role in controlling and guiding movement of the lumbar spine. For this reasons, in chronic low back pain, lumbar facet pain, was thought to be a suitable group in current study upon which to determine the effectiveness of a physiotherapy program with specific manual therapy technique.

1.4 Purpose of the study

To fill up the gap between knowledge and practice, this randomized controlled trial was conducted with the purpose to find out the effectiveness of sustained natural apophyseal glides and Maitland’s spinal mobilization as compared to conventional
physiotherapy in treating lumbar facet joint syndrome. To investigate the effectiveness of a physiotherapy program with specific manual therapy in a group of patients with chronic low back pain diagnosed on MRI imaging and clinical assessment to be of lumbar facet joint origin; a detailed treatment protocol was developed. To develop a physiotherapy program with specific manual therapy, an appropriate manual therapy approach first needed to be selected. It was essential that this approach should be well established and reflective of clinical practice based on evidence. For this reason the Maitland spinal mobilization approach and Mulligan’s sustained natural apophyseal glides were chosen. To improve endurance and strength of back muscles to maintain stability and prevent recurrence of problem, manual therapy techniques were supported with back endurance exercises. This approaches to the treatment has been well documented and developed over many years. These manual therapy approaches used in research are integral part of the syllabus in many undergraduate physiotherapy training programs and has previously been shown to be one of the most frequently attended postgraduate training courses. Large-scale surveys of physiotherapists have also suggested that these are the most commonly used treatment approaches in the management of spinal pain.

Given the potential impact that the treatment variation may have on estimates of treatment effects, it was important that the protocol in this scientific research was developed with sufficient details to minimize this impact. To do this, the recommendations of the extended CONSORT statement regarding the reporting of non-pharmacological interventions were applied.

Recommendations for the reporting of interventions in randomized controlled trials of non-pharmacological interventions: Item 4

**Standard CONSORT statement**

**Item 4** Researchers must report the details of the interventions for both the treatment and control group including how and when they were administered

**Extended CONSORT statement for non-pharmacological treatment**
Researchers must describe different components of the interventions and, when applicable; describe how the intervention was tailored to individual patients.

Researchers must provide detail of how the interventions were standardised.

Researchers must describe how the adherence of care providers with the treatment protocol was assessed or enhanced.

Though the techniques are well practiced by physiotherapists all over the world; but their effectiveness on lumbar facet joint syndrome has not yet been specifically and scientifically established. Therefore a treatment protocol for lumbar facet joint with specific manual therapy techniques along with endurance exercises that was sufficiently detailed and adequately standardized so that it could be replicated consistently in a randomized controlled trial and in clinical practice was developed. The findings of the trial are expected to bridge the gap between knowledge and practice and thereby help the physiotherapists to understand the facetal cause of LBP and treat it suitably with the most appropriate physiotherapy techniques. Hence this trial was undertaken with the purpose of to study the effectiveness of passive accessory intervertebral movement (PAIVM) such Maitland’s mobilization and passive sustained accessory mobilization, such as Mulligan’s technique (SNAGs) along with conventional physiotherapy intervention as compared to conventional physiotherapy in facet joint syndrome.

1.5 Aim and objectives

Aim of the Study:

The overall aim of this thesis was to study the effectiveness of Sustained natural apophyseal glides, Maitland’s mobilization and conventional physiotherapy over conventional physiotherapy in treatment of lumbar facet joint syndrome.

Specific Objectives:

1. To evaluate effectiveness of new structured physiotherapy protocol involving Mulligans sustained Natural apophyseal glides and conventional physiotherapy in lumbar facet joint syndrome.
2. To evaluate effectiveness of new structured physiotherapy protocol involving Maitland’s mobilization and conventional physiotherapy in lumbar facet joint syndrome.

3. To evaluate effectiveness conventional physiotherapy in lumbar facet joint syndrome.

4. To compare the effectiveness of Sustained natural apophyseal glides, Maitland’s mobilization and conventional physiotherapy in treatment of lumbar facet joint syndrome.

1.6 Hypothesis

**Null Hypothesis (H₀):** There is no difference in participants of lumbar facet joint syndrome treated with Sustained natural apophyseal glides and Maitland’s mobilization as compared to conventional physiotherapy in terms of pain intensity, disability, back muscle endurance, pressure pain threshold (PPT) and spinal range of motion.

**Alternative Hypothesis (H₁):** There is significant difference in participants of facet joint syndrome treated with Sustained natural apophyseal glides and Maitland’s mobilization as compared to conventional physiotherapy in terms of pain intensity, disability, back muscle endurance, pressure pain threshold (PPT) and spinal range of motion.