Proprioceptive Neuromuscular Facilitation versus Muscle Energy Techniques: A Comparative Study on Pain Reduction and Functional Improvement in Sciatica

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ABSTRACT

Background and Purpose: Sciatica, characterized by radiating pain in the lower back and legs, is a major cause of disability worldwide. Physical rehabilitation techniques such as Proprioceptive Neuromuscular Facilitation (PNF) and Muscle Energy Technique (MET) are widely used for pain relief and functional improvement. This study aimed to compare the effectiveness of PNF and MET in reducing pain and disability among patients with chronic low back pain associated with sciatica.

Methodology and Procedure: An experimental study was conducted on 30 patients divided equally into two groups. Group A received PNF exercises, and Group B received MET for 45 minutes daily, four days per week for six weeks. Pain intensity and disability were assessed using the Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI).

Results: Both groups showed significant improvement in pain and functional ability ($p<0.0001$). However, Group A (PNF) demonstrated greater reduction in VAS and ODI scores compared to Group B (MET).

Conclusion: Proprioceptive Neuromuscular Facilitation is more effective than Muscle Energy Technique in reducing pain and disability and improving flexibility in patients with sciatica.

Keywords: Sciatica, Chronic Low Back Pain, Proprioceptive Neuromuscular Facilitation, Muscle Energy Technique, Physiotherapy, Rehabilitation.

Introduction

Sciatica is usually defined as pain, aching or discomfort radiating in area between costal margin and gluteal folds and upto lowerlimbs[1]. Chronic low back pain is one of the most common and important problems of industrial societies and a major cause of disability[2]. Low back pain affects work capacity of individuals and leads to loss of reproductive forces[3].

Low back pain is an extremely common symptom in the general population affecting up to 85% and is the most common disability in those under the age of 45 and the most expensive health problem in those between the age of 20-50[4]. It is tiredness, discomfort , or pain in the low back region, with or without radiating symptoms to the leg or legs and categorized as acute, sub-acute and chronic low back pain[5].

Frequently the cause of low back pain is not known[6] and our understanding of the problem is very limited. In 9 out of 10 instances low back pain is transient, it is related to some posture or strain, and recovery can take place in a short time[7] .In spite of numerous efforts, dating the determination of significant causes of LBP is very difficult[8]. A definite diagnosis of the cause of LBP is only possible in 15% of patients. In most cases, LBP is non-specific[9] .

Exercise is the most current modalities for rehabilitation of subjects with chronic low back pain[10]. The primary goal of physical exercises in the treatment of chronic low back pain is to increase muscle strength, flexibility, and endurance, to release of injured tissues, and as well to gain ability to perform normal activities of life[11].

There are various exercise programs for treating chronic low back pain according to the duration, frequency, intensity and type of exercise[12]. However, the effects of specific types of exercises, their efficacy and superiority of certain components of exercise on function should be determined[13]. Neurophysiologic studies have linked pain development in the lumbar spine region of the vertebral column with disturbances in the mechanoreceptors and probably with impairment of the superior proprioception centers[14]. Therefore, exercise programs that enhance proprioception may be beneficial for managing chronic low back pain[15].

The patterns of PNF exercises have a spiral, diagonal direction, and the performance of these patterns is in line with topographic arrangement of the muscles being used[16]. The performance of

movements in PNF patterns may permit muscles to act in ways that are close to the actions and movements found in various sports. These synergistic muscle combinations form the PNF patterns of facilitation.[17]

The primary goal of treatment is to help patients achieve their highest level of function. PNF involves stretching, resisted movement, traction and approximation to ameliorate muscle decline, disharmony, atrophy and joint movement limitations[18].

Another common treatment for acute low back pain is the use of muscle energy technique (MET). MET is an active technique in the patient, instead of the care provider, supplies the corrective force[19].

MET is a "manual medicine treatment procedure that involves the voluntary contraction of patient muscle in a precisely controlled direction, at varying levels of intensity, against a distinctly executed counterforce applied by the operator. It has been hypothesized that MET can be used to lengthen and strengthen muscles, to increase fluid mechanics and decrease local edema, and to mobilize a restricted articulation[20].

The purpose of this study is to compare the effect of proprioceptive neuromuscular facilitation program with muscle energy techniques for decreasing pain, improving flexibility and functional ability of the patients with Sciatica.

The primary aim of this study is to identify an effective method for treating sciatica. The objectives of the study are to evaluate the effects of the Proprioceptive Neuromuscular Facilitation (PNF) program and the Muscle Energy Technique (MET) in reducing pain, enhancing flexibility, and improving functional performance in patients with sciatica. Furthermore, the study seeks to compare the effectiveness of the PNF technique with the Muscle Energy Technique to determine which method provides superior results in reducing pain and disability among individuals suffering from sciatica.

Methodology & Procedure

Throughout the study, all ethical considerations were strictly followed with utmost care and respect for the patients' health and well-being. Informed consent was obtained from all participants prior to inclusion in the study. Each patient was clearly informed about the purpose of the study, as well

as the potential benefits and risks of the treatment procedures. Participants were also informed of their right to withdraw from the study at any time without any consequences.

This study was conducted at the outpatient department of Physiotherapy, SunRise University, Alwar, and followed an experimental design using a convenience random sampling technique. A total of 30 subjects diagnosed with chronic low back pain associated with sciatica were selected and divided equally into two groups—Group A and Group B, each comprising 15 subjects. The duration of the study was 12 weeks. Only participants who signed the approved consent form were included in the study.

The inclusion criteria were patients aged between 20 and 50 years of either gender, experiencing chronic low back pain for more than three months, and willing to participate in the study. The exclusion criteria included patients with spinal pathology, a history of spinal surgery, spondylosis, spondylolisthesis, vertebral fractures, or systemic disorders such as spinal tuberculosis or rheumatoid arthritis.

The parameters used for assessment were the Visual Analogue Scale (VAS) for measuring pain and the Oswestry Low Back Pain Disability Questionnaire (ODI) for assessing disability. The materials used in the study included a treatment couch, pillow, paper, scale, patient record form, and the Modified Oswestry Low Back Pain Disability Questionnaire scoring sheet.

A total of 30 well-defined patients were randomly allocated to two groups. Group A received Proprioceptive Neuromuscular Facilitation (PNF) techniques, which included rhythmic stabilization training and combination isotonic exercises for the trunk. Each session lasted 45 minutes per day, four days a week for six weeks, with three sets of 15 repetitions per set and a two-minute rest interval between sets. The number of repetitions was progressively increased over the course of treatment.

In the PNF training, rhythmic stabilization was performed with the patient seated and facing the therapist. The therapist placed both hands on the upper thoracic region below the shoulder level, providing resistance as the patient flexed the trunk. Resistance was gradually increased and alternated to facilitate antagonist muscle action, allowing the patient to extend the trunk against resistance. In the combination isotonic exercise, patients sat upright while the therapist applied resistance to trunk flexion and extension movements. Each position was held for five seconds,

repeated for three sets of 15 repetitions, with 30 seconds of rest between repetitions and 60 seconds between sets, totaling approximately 30–35 minutes of training per session.

Group B received the Muscle Energy Technique (MET) for the low back region, administered for 45 minutes per day, four days per week for six weeks, with a two-minute rest between repetitions. In Technique 1, the subject was positioned side-lying in the fetal position with a pillow between the knees and hips flexed at 90°. The therapist placed one hand on the anterior thigh and the other on the lower back while instructing the patient to resist hip extension for five seconds. This was repeated five times for three sessions a week. The therapist ensured that the lumbar spine remained stable throughout the technique. In Technique 2, the subject lay on the edge of the couch, with one leg supported over the therapist's shoulder and the other leg held below the couch. The subject was instructed to press the leg against the therapist's resistance for five seconds while simultaneously flexing the opposite hip against resistance. This procedure was repeated five times per session, three times per week.

Data Analysis & Results

All data collected during the study were analyzed using appropriate statistical methods. The results were expressed as mean ± standard deviation (SD). The comparison of pre- and post-intervention values within each group was performed using a paired *t*-test to assess the significance of change after treatment. The comparison of post-treatment outcomes between the two groups was carried out using an unpaired *t*-test. A *p*-value of less than 0.05 was considered statistically significant, and values less than 0.001 were considered highly significant.

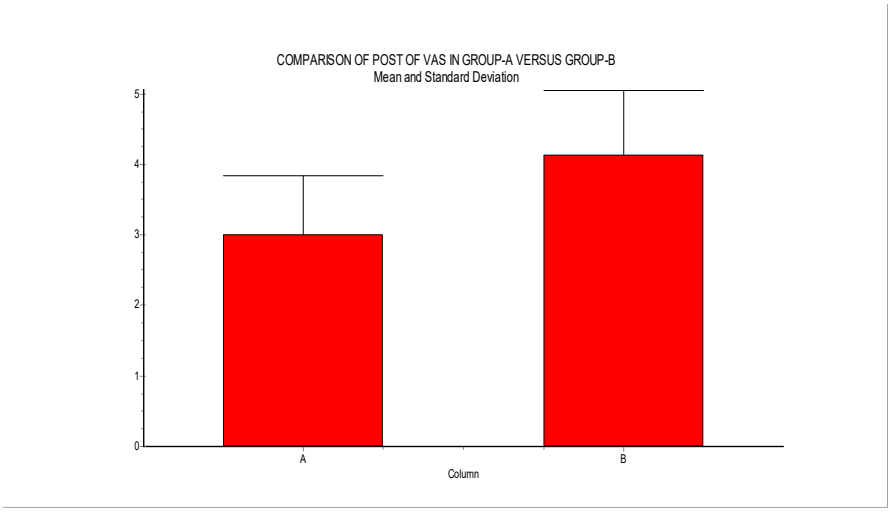
In Group A, the mean pre-treatment VAS score was 8.06 ± 0.7988, and the mean post-treatment score was 3.00 ± 0.8452. The reduction in pain intensity was found to be highly significant ($t = 16.874$, $p < 0.0001$).

In Group B, the mean pre-treatment VAS score was 8.00 ± 0.7559, and the mean post-treatment score was 4.13 ± 0.9155. This decrease was also statistically significant ($t = 12.614$, $p < 0.0001$).

When comparing post-treatment VAS scores between Group A and Group B, a statistically significant difference was observed ($t = 3.523$, $p = 0.0015$), indicating that Group A experienced greater pain reduction than Group B.

	MEAN	STANDARD DEVIATION	P-VALUE	T-VALUE
POST VAS OF A	3	0.845	<0.0015	3.523
POST VAS OF B	4.13	0.9155		

Table- I: Statistical analysis of POST VAS IN GROUP-A VERSUS GROUP-B



Graph -I: COMPARISON OF POST VAS IN GROUP-A VERSUS GROUP-B

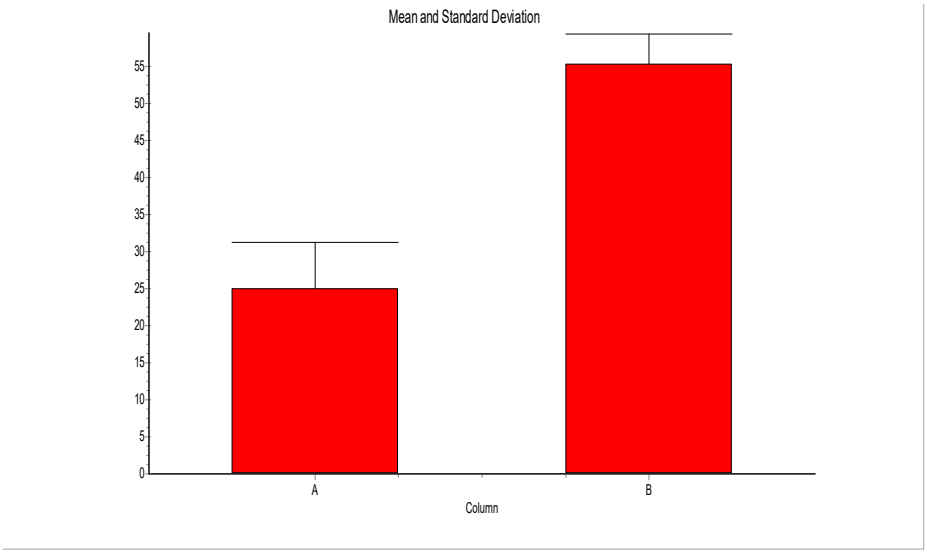
In Group A, the mean pre-treatment ODI was 65.6 ± 25.06, which decreased to 25.06 ± 6.181 post-treatment. The improvement in functional disability was extremely significant (t = 11.626, p < 0.0001).

In Group B, the mean pre-treatment ODI was 67.8 ± 9.674, which reduced to 55.3 ± 4.030 after treatment, showing a significant improvement (t = 4.818, p < 0.0001).

The comparison of post-treatment ODI scores between Group A and Group B revealed a highly significant difference (t = 15.886, p < 0.0001), suggesting that Group A achieved superior functional recovery compared to Group B.

	MEAN	STANDARD DEVIATION	P-VALUE	T-VALUE
POST OF GROUP-A	25.06	6.181	<0.0001	15.886
POST OF GROUP-B	55.33	4.030		

Table- II: Statistical analysis of POST ODI IN GROUP-A VERSUS GROUP-B



Graph – II: COMPARISON OF POST ODI IN GROUP A VERSUS GROUP B

The statistical analysis demonstrates that both interventions led to significant improvement in pain (VAS) and functional disability (ODI) from pre- to post-treatment values. However, when comparing the two groups, Group A showed significantly greater improvement in both pain reduction and functional recovery compared to Group B.

DISCUSSION

This study was designed to investigate and compare the effectiveness of PNF and muscle energy technique in reducing pain and disability in patients with chronic low back pain. The purpose of this study was to find out which of these exercise programs will be more effective in reducing the level of pain and disability in chronic low back pain patients.

Based on the results above it is seen that subjects in both the groups GROUP-A and GROUP-B showed reduction in pain and disability and there is a significant difference between the improvements after treatment in GROUP-A than in GROUP-B. In the present study, the PNF group shows highly significant improvement in all the outcomes measures.

Mari Namura et al (2008) had stated that PNF is a normalized, facilitated training method for muscles that involves stretching, resisted movement, traction (separation the joint surface), and

approximate to ameliorate muscle decline, disharmony, atrophy and joint movement limitations[35]. The patterns of PNF exercises have a spiral, diagonal direction, and the performance of these patterns is in line with topographic arrangement of the muscles being used (Areeudomwong P and Buttagat V 2018).

PNF exercises are designed to enhance the response of neuromuscular mechanisms by stimulating proprioceptors. PNF techniques often have been used to improve the range of motion of a joint and endurance as well performance in a vertical jump[36]. PNF group showed an improvement in functional ability (Tab.3) could be seen as a direct result of flexibility and endurance improvements, thereby providing further support for the effectiveness of PNF exercises for chronic low back pain. The improvements in muscle mobility and functional ability, the visual analog scale showed similar improvements in this group.

Muscle energy technique uses the voluntary contraction of the patient's muscle in precisely controlled direction against a distinctly executed counter – force, which is applied by the operator. MET can be used to lengthen a shortened muscle, mobilise an articulation with restricted mobility; strengthen a physiologically weakened muscle; reduce localized oedema and passive congestion[37]. This might have been the reason for the reduction in pain and disability in Group- B. MET has undergone considerable modification. The classical concept focuses on an osteo-kinematic diagnosis and sees the tightened muscle in the context of a joint dysfunction[38], while newer concepts ignore the arthro-kinematic emphasis and see the primary application of MET in muscle tightness, spasms and myofascial trigger points, with joint mobilization as a consequence of muscle relaxation[39].

MET is a form of manual or "hands on" therapy used by osteopathic. In this type of therapy, a patient contracts muscles by pushing against resistance provided by the therapist. The therapist then assists the patient in stretching, strengthening and relaxing those muscles. The goal is to help restore normal muscle & joint mobility. This study also found that the mean number of muscle energy technique procedures required for subjects in the experimental group.

In conclusion, group – A shows more improvements in reducing the pain and disability than in group-B in patients with chronic low.

Conclusion

The results of this study show that both treatment groups — the proprioceptive neuromuscular facilitation (PNF) technique and the muscle energy technique (MET) — were effective in reducing pain and disability among patients with chronic low back pain. However, when comparing the two approaches, the proprioceptive neuromuscular facilitation technique demonstrated greater effectiveness in alleviating pain intensity and improving functional ability than the muscle energy technique. This indicates that while both interventions are beneficial, PNF provides superior outcomes in the management of chronic low back pain.

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