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Effectiveness of MCKenzie technique and Neural Mobilization technique in chronic lumbar radiculopathy- a randomized clinical trial

[1] Dr. Lopa Das PT, [2] Dr. Anand Hegganavar,
Associate Professor (HOD), NEPNI group of Institutions, Guwahati, India
Email: anusree1984@gmail.com
Associate Professor, J N Medical College, KLE University, Belgaum, Karnataka, India
Email: anandhegganavar@klekipt.edu.in

Abstract: ***Background and Objectives*** *Low Back Pain is characterized by a range of symptoms which include pain, muscle tension or stiffness, and is localised between the shoulder blades and the folds of the buttocks, with or without spreading to the legs . Manual therapy is a concept of musculoskeletal evaluation and treatment in physical therapy that applies the principles of kinesiology, histology, neurophysiology and pathophysiology. The McKenzie method is popular amongst physiotherapists as a management approach for spinal pain. A key aspect of the McKenzie approach is that the patients receive individualized treatment based upon their clinical presentation. Neural mobilization is a treatment modality used in relation to pathologies of the nervous system. It has been suggested that neural mobilization is an effective treatment modality. The objectives of the present study were to compare the effectiveness of McKenzie Technique and Neural Mobilization Technique in chronic low back pain with radiculopathy.*
Materials and Methods *60 participants diagnosed with chronic low back pain with radiculopathy were recruited from Department of Physiotherapy, KLES Dr. Prabhakar Kore Hospital and MRC and KLES Ayurved Hospital and Research Center, Belgaum. An ethical clearance was obtained and written informed consent was obtained from study subject. Participants were randomly assigned into three groups of 20 each. Physical therapy treatment protocol which included TENS, traction therapy, McKenzie Technique and Neural Mobilization Technique. The outcome measures recorded pre and post intervention using VAS, MODQ and Schober's method.*
Results: *The results in this study showed that pain relief, improved lumbar extension range of motion and reduced disability was statistically significant in all the three groups, but mean improvement in group A (receiving McKenzie Technique) was more significant ($p<0.0001$) as compared to group B (receiving Neural Mobilization) and group C (receiving McKenzie Technique and Neural Mobilization Technique).*
Conclusion and Interpretation *The randomized clinical trial provided evidence to support the use of McKenzie Technique in relieving pain, improving lumbar range of motion and improving functional well being. In addition Neural Mobilization is of great value which can be useful in improving lumbar extension range of motion .*

Key Words: *Spine; LowBack Pain; McKenzie Technique; Neural Mobilization Technique; Radiculopathy.*

1. INTRODUCTION:

Low back pain is neither a disease nor a diagnostic entity of any sort.[1] Low back pain is one of the most common medical problems and causes a significant amount of disability and incapacity in different countries. [2]It is very common in developed countries especially in adults of working age. The costs of back pain in society is huge.[3]Chronic LBP is persistent and recurrent in nature ,with major consequences for individuals and society. It represents a particularly costly sociomedical problem due to the expenditure associated with repeated treatments, longterm absence from work and need for social support.[4] After 3 months of low back pain , only 5-10% of patients have persisting symptoms , but these patients account for 85% of the costs in terms of compensation and loss of work related to low back pain.[5]It is thought to be as a result of disc degeneration , musculoskeletal sprain or strain ,or with disorders associated with movement or position of spine.[6] The intervertebral disc is the common cause of back pain and the most common cause of radiculopathy.[7]It has been proved that the disc is innervated. Although this may be partial or variable between the individuals, it is potential source of pain in its own right.[8] Traumatic or degenerative conditions of the spine are the most common causes of chronic low back pain. Although disc potrusion and herniation have been popularized as causes of LBP and radiculopathy. Radiculopathy also known as nerve root pain which arise from disc herniation or spinal stenosis or post operative scarring, it radiates down the leg in a dermatomal pattern, the unilateral leg pain is often described by the patient as worse than the back pain.[6] In approximately 90% of the cases of radiculopathy is caused by herniated disc with associated nerve root compression but lumbar stenosis and less frequently tumors are the possible causes.[9] Chronic low back pain with radiculopathy occurs in approximately 3-5% of the population, and men and women are affected equally , although men are most commonly affected in their 40s and women are affected commonly between ages 50-60, of those who have this condition , 10-25% develop symptoms that persists for more than 6 weeks. It has been estimated that this involves less than 5% of all those who have back pain,

some studies give higher estimates.[10] The incidence of LBP peaks in middle age and declines in old age, when degenerative changes of the spine are universal.[16]Radiculopathy usually occurs in patients during the fourth and fifth decades of life; the average age of patients who undergo lumbar discectomy is 42 years.[11]

Chronic LBP associated with radiculopathy are often referred to physiotherapist. There are various interventions available for this which includes Transcutaneous Electrical nerve stimulation, Traction, Therapeutic ultrasound, Thermotherapy, EMG Biofeedback, Spinal manipulations, Neural mobilizations, Exercises and various other manual therapy techniques. McKenzie technique and neural mobilization are one of the manual therapy techniques used in spine care programs in an effort to decrease pain and to improve range of motion and activities of daily living.

There are three approaches in NMT, one of the important approach is via direct mobilization of the nervous system, usually by tension tests and their derivatives and also by palpation techniques.[19]

Transcutaneous Electrical Nerve Stimulation (TENS) is a simple, non-invasiveanalgesic technique that is used extensively in health-care settings by physiotherapists. By definition, it is a stimulating device which delivers electrical currents across the intact surface of the skin. The most common use of TENS is in management of low back pain. Various studies have show effectiveness of TENS in reduction of pain and improvement of range of motion in patients suffering from chronic low back pain.[12] TENS modulates pain by applying electrical impulses to the skin. There are two basic types: high frequency , low intensity TENS and low frequency, high intensity TENS. Conventional TENS works due to the "gate theory" of pain. Presented simply, this involves incoming cutaneous sensory and proprioceptive impulses carried through larger myelinated fibers , which inhibits the pain impulses carried more slowly by unmyelinated fibers at the level of the dorsal column of the spinal cord. The faster impulses arrive at the dorsal first and " close the gate" forestalling propagation of the slower pain impulses.[13]The advantage of TENS is that it is non-invasive. Several different electrodes and stimulator settings should be utilized before discontinuing it for failing to relieve pain. There is a variation in individual response to TENS therapy. There are a few contraindications to TENS. Theoretically , it may cause malnutrition of cardiac pacemakers. Hypersensitivity to the electrodes (skin irritation) occasionally necessisates discontinuation , but can be minimized if different electrodes are used.14

Lumbar traction can be mechanical or electrical attempting to produce continuous or intermittent stretching of the vertebral ligaments to achieve a small separation between them.[14] Traction has been used since ancient times in the treatment of painful spinal conditions, but the literature on traction and its clinical effectiveness is limited. Traction can be defined as a drawing tension applied to a body segment. Traction encourages movement of the spine both overall and between the each individual spinal segment. Changes in overall length and the amount of separation or space the each vertebrae have been shown in studies of both lumbar and cervical spine.[15]

An increasingly popular conceptual system is that of Robin McKenzie of New Zealand , who believes that the principal cause of back pain is disc disease manifested by abnormal mechanics resulting from the consequences of migration of the intact nucleus within the disc ,not frank herniation.[16]McKenzie technique is a method of diagnosis and treatment based on movement patterns of the spine.[17] McKenzie classifies LBP based on spinal movement patterns, positions and pain responses and describes a postural syndrome, dysfunction syndrome and derangement syndrome. McKenzie describes a postural syndrome characterized by mechanical deformation of the soft tissues as a result of prolonged postural stress that can lead to pain and a dysfunction syndromethat features pathologically involved muscles, ligaments, fascia, facet joints,and the intervertebral disc. The major factor is adaptive soft tissue shortening of the motion segment, causing chronic mechanical deformation and loss of joint play. The precipitating causes are usually by products of disc migration (derangement syndrome), spondylosis, or poor posture (postural syndrome). McKenzie advocates position and movement patterns, flexion or extension at best relieve the patient's symptoms. McKenzie describes the phenomenon called "centralisation" of pain whereby distal symptoms moves proximally, towards the midline of the spine, and are abolished by certain movements.[38] The McKenzie technique is a more passive form of spinal manipulation in which patient produces the motion , position and forces that improve the condition.[18]

Butler recommends that Neural mobilization technique(NMT) is another from of manual therapy similar to joint mobilization.[19] As with all manual therapy procedures, goals remains the same that is to restore maximum pain free movement within postural balance. In this regard, the treatment of signs and symptoms is based on the, irritability and the nature of the impairment.[20] One of the most outstanding features of the nervous system's biomechanics , relevent to manual therapy ,is the mobility of the nervous system .

Low back pain with radiculopathy or sciatica is a common clinical problem that mainly involves L5 and S1 nerve roots. In the field of physiotherapy there is a growing interest towards developing an evidence based practice of common procedures used in the physiotherapy treatment programs. McKenzie technique utilizes back extension exercise for the management of lumbosacral radiculopathy. Neural mobilization is another

effective technique in management of low back pain with radiculopathy. But very little has been published in the literature. Hence this study is to determine the effectiveness of two forms of manual therapy interventions that is McKenzie technique an Neural mobilization technique (NMT) in participants with chronic low back pain with radiculopathy on pain, movements and functional ability.

2. METHODOLOGY:

It was proposed to study the **"**Effectiveness of McKenzie Technique and Neural Mobilization Technique In Chronic Low Back Pain with Radiculopathy":- Randomized clinical trial.

Source of Data: Data was collected from physiotherapy OPD of KLES Dr. Prabhakar Kore Hospital and MRC, and KLES Ayurved Hospital and Research center, Belgaum during the study period of April 2009 to January 2010.

Method of Data Collection: The method of data collection used for this study was a primary method.

Study Design: The study design used for this research was randomized clinical trial. For this R.C.T, ethical clearance was obtained from the institutional ethical committee, JNMC, Belgaum before commencement of the study .

Sample size: The sample size used for this research study was 60. Sample selected was heterogenous. It was calculated on the basis of record of number of participants that attended physiotherapy department in the last three years.

Study sample: The study sample consisted of both male and female participants referred to the physiotherapy outpatient department with clinical diagnosis of chronic low back pain with radiculopathy.

Sampling design: Sampling design used for this research was Random sampling (Envelope method) with allocation to 3 study groups.

Participants: There were 60 participants with clinical diagnosis of chronic low back pain with radiculopathy.

Inclusion Criteria:

- LBP and symptoms extending distal to the gluteal region on lower extremity.
- Patients age between 25-60 years.
- The centralisation phenomenon, determined by using active movements testing has to be present.
- Symptoms more than 3 months.
- Subjects who were willing to participate in the study was be recruited.

Exclusion Criteria:

- Patients with inflammatory, infections, metabolic diseases of spine and malignancy.
- Patients with history of vertebral fracture.
- Pregnancy.
- History of spinal surgery.
- Patients with neurological defects such as altered sensation, muscle weakness, altered deep tendon reflexes.
- Cardiovascular disorders and psychological pain.

3. Apparatus and Equipment's:

3.1. Measuring Tape:

A measuring tape of total length of 60 inches/152 centimeters was used to measure the height of each patient. The participant was made to stand against a wall, head and heel touching the wall and a mark was made on wall at the vertex of head. The distance between the floor and the mark was measured in centimeters and considered as of the participant.

3.2. Weighing machine:

A standard weighing machine with 1kg increment was used to measure the weight of each participant in kilograms weight.

3.3. Transcutaneous electrical nerve stimulation:

TENS is applied to the patient using Microstim Genius TENS unit .

3.4.Traction :

Lumbar traction is applied using weights which is 1/3 of the body weight of the patient by Autotrac Traction unit manufactured by Electrocare systems private limited, Chennai.

4. Main Outcome Measures:

4.1. Visual analogue Scale:

A horizontal visual analogue scale was used. A 10 cm line was drawn on a paper and participants were asked to mark a point on the line that best defined the present pain level, where 0 indicated no pain and 10 indicated severe pain. Visual analogue scale was taken pre-interventionally and immediately post-interventional.

4.2. Range of motion (ROM):

Active ROM of lumbar spine was measured by Schober's method by using measuring tape. In this method, a point was marked midway between the two PSISs, which is at the level of S2,then points 5cm(2 inches) below and 10 cm above (4 inches) are marked. The distance between the three points were measured, the patient was asked to flex forward ,and the distance was remeasured .The difference between the two measurements indicates the amount of flexion occurring in the lumbar spine. After completion of the flexion movement , the patient was asked to extend the spine ,and the distance between the marks was noted .[20]

4.3. Modified Oswestry Disability Index:

Disability score was measured b using Modified Oswestry Disability Questionnaire which consisted of 10 items , each consist of 6 questions. MODQ is a disease specific disability measure which is used to establish a level of disability, stage a patient's acuity status and monitor change over time.[21]

5. Procedure:

Participants who reported to KLES Dr. Prabhakar Kore Hospital and MRC, KLES Ayurved Hospital and Research center, Belgaum were included for the study. The purpose of the study was explained, subjects were screened based on the inclusion and exclusion criteria and a written informed consent was obtained from all the participants after their inclusion. All participants were assessed using a specific proforma. Pain intensity was measured by using visual analogue scale, functional ability by Modified Oswestry Disability Questionnaire and range of motion by Schobers method were taken. All subjects were randomly allocated into 3 groups, group A , B and C by using envelope method. All these outcomes were measured pre-treatment.

- Group A participants received treatment of TENS for 30 minutes and traction for 20 minutes followed by McKenzie technique.
- Group B participants received treatment of TENS for 30 minutes and traction for 20 minutes followed by Neural mobilization technique.
- Group C participants received treatment TENS for 30 minutes and traction for 20 minutes followed by McKenzie technique and Neural mobilization technique.

  All the participants received the selected treatment for 8 sessions. After 8 sessions of intervention , post treatment outcome measures was recorded and data thus obtained was used for statistical analysis.

5.1. McKenzie technique:

Following TENS and traction therapy McKenzie technique was performed in following way. The participant lie on abdomen on the treatment couch. The goal was to produce centralisation of symptoms. The activity was a sagittal extension forces rapidly progressing through to patient overpressure to gain full range. Extension exercises was progressed as tolerated starting with static prone positioning , if anysymptoms were recorded. Next stage was lying prone in extension (prone on elbows). The next progression is extension in lying (prone on hands with elbow extension). Last step was extension in lying with patient overpressure. In this stage the patient sags her hips and breaths out fully to gain maximal extension to complete the reductive process. A subject who tolerated the complete exercise programme performed 3 sets of 10 repetitions of repeated end range extension in prone position.

5.2. Neural Mobilization Technique:

Following TENS and traction therapy, neural mobilization technique was performed in following way. The participant in supine lying and the leg was lifted upward as a solid lever, while maintaining the knee extension. The leg was raised past 35degrees in order to take up the slack in the nerve. Sciatic nerve is completely stretched at 70 degrees. For additional sensitization hip adduction was added to straight leg raising. The intervention consist of gentle short duration (1 second) and large amplitude passive movements were performed at 'feather edge' of patients neural symptoms in on/off fashion. A mild degree of discomfort was permitted during 'on' phase which must be completely abate when the tension was withdrawn (off phase). 30 seconds of on/off mobilization of 3 repetitions was performed.

6. DISCUSSION:

The present clinical trial was conducted to compare the effectiveness of McKenzie technique and Neural Mobilization technique with a common treatment of TENS and traction therapy to all the three groups. In the present study Group A received TENS, traction therapy and McKenzie technique, Group B received TENS, traction therapy and Neural Mobilization technique and Group C received TENS, traction therapy, McKenzie technique and Neural Mobilization technique in combination. All three groups had equal number of participants and had shown no significant difference with respect to their gender distribution, which could have altered the results of the study.

A combination of pain assessment by visual analogue scale (VAS), range of motion assessment quantified by Schober's method and disability score by Modified Oswestry Disability Questionnaire(MODQ) outcome measures was used to assess the effectiveness of manual therapy techniques in subjects with chronic low back pain with radiculopathy. All of which was easy to administer in a standardized manner. TENS is a form of electrical stimulation with surface electrodes to modulate pain perception. TENS is an electrotherapy modality which helps to reduce pain perception. There are 4 theories which explains physiological effects of TENS regarding reduction in pain perception. These are gate control theory, opiate- mediated control theory, local vasodilatation of blood vessels in ischemic tissues and stimulation of acupuncture points causing sensory analgesia effects. According to gate control theory when an electrical current is applied to a painful area, transmission of the perception of pain via small diameter fibers to the brain is inhibited by the activity of the large diameter, fast-conducting highly myelinated, proprioceptive sensory nerve fibers closing the gate to the pain perception to the brain. Transcutaneous electrical nerve stimulation (TENS) was introduced more than 30 years ago as an alternative therapy to pharmacological treatments for chronic pain. However, despite its widespread use, the effectiveness of TENS is still controversial.[22]

Traction is commonly used for the treatment of low back pain (LBP), predominately with nerve root involvement; however its benefits remain to be established.[22] Traction has been shown to separate the vertebrae and it appears that large forces are not required. Vertebral separation could provide relief from radicular symptoms by removing direct pressure or contact forces from sensitized neural tissue.[23] Notwithstanding the controversies regarding the beneficial effects of traction, it continues to be used as a popular modality in the management of low back pain. Recent preliminary studies suggest a there exists a subgroup of patients with LBP that is likely to benefit from traction. A systematic review including 17 RCTs found inconclusive evidence that traction is an effective therapy for back and neck pain.[24]

In present study age distribution and anthropometric variables (Height, Weight, BMI) showed no statistical difference in the groups which represents the homogeneity of participants. In the resent study age group of participants was between 25-60 years. It has been reported that back pain is the most common expensive ailment in the 30-60 year old age group.[5] Low back pain with radiculopathy most commonly affect men at their 40s and female between age of 50-60.

Reduction of pain intensity was significant in all the three groups. For this purpose VAS was used. The VAS consisted of a 10cm horizontal line labelled as "no pain" at its left end and as " worst possible pain" at it right end. This measure is commonly used to assess changes in pain over time and has been recommended as an outcome measure in studies of spinal disorders such as low back pain. It has been shown that data derived from such written scales among patients with chronic low back pain are normally distributed even when the scales are used without verbal instruction.

Analysis of pain relief was done by subjective VAS by statistical mean. When the intra group mean values of VAS was analyzed it was found statistically significant in all the three groups pre to post-intervention ; but when comparison was done inter group, group A had shown statistical significance over group B and group C in relieving pain . In the present study reduction in pain level, as quantified by the VAS, is consistent with the findings of previous studies that McKenzie approach decreases pain intensity to a considerable level.

Most of the results from individual studies and the pooled results reveal that McKenzie therapy was statistically significantly more effective than other treatments in reducing pain and disability at short term follow-up. The long term effects of McKenzie therapy on pain outcomes in patients with low back pain are uncertain because no study provided data beyond three months.[25]Another characteristic of the McKenzie approach is that patients receive individualized treatment. There is some evidence provided recently that this approach to treatment is more effective than a generic treatment (Fritz et al 2003,Long and Donelson 2003).[26]

Reviews of treatments for low back pain suggest that some treatments appear more effective for acute low back pain than for chronic low back pain. For example manipulative therapy is more effective in the acute phase (Ferreria et al 2002, Ferreira et al 2003) while exercise is more effective for chronic symptoms (van Tulder et al 2001).[27] The McKenzie protocol, which has been commonly utilized in low back conditions such as postural syndrome, dysfunction syndrome and derangement syndrome as classified by Robin McKenzie. Centralization of pain is a phenomenon initially observed by Robin McKenzie in 1956. He noted this phenomenon to be quite helpful in evaluating and treating patients with radicular symptom[19].The McKenzie method utilizes a loading strategy that incorporates the centralizing phenomenon; this is defined as a rapid change in the location of pain from a distal or peripheral location to a more proximal or central position to the spine. This has been shown to be an accurate predictor of successful conservative treatment outcome in the low back.[28] McKenzie back extension exercises were reported to be effective in reducing acute and chronic radicular pain. McKenzie back extension is a progression to lying prone. Lying prone is believed to encourage the nucleus pulposus to move interiorly away from the compromised nerve root as a result of

gravity effect and to improve the alignment of the lumbar spine at L5-S1. Moreover, back extension from prone lying is assumed to have a greater effect in moving the disc content anteriorly away from spinal nerves pathway. This movements is believed to reduce radicular symptoms of patient with derangement.[29] Active flexion and extension range of lumbar spine was measured using Schober's method by an measuring inch tape, the result showed statistically significant increase in the values of lumbar spine range of all three groups post-interventonally when it was compared within the groups whereas when comparison was done between the groups, there was a highly statistical significant improvement found in extension range of motion in group B (Neural Mobilization technique) versus group A. In the present study Schobers method was used to evaluate the lumbar extension range of motion. It is valid and reliable method as many studies have been done in which Schobers method was used for evaluation of range of motion. A study done on The Significance of High Lumbar Mobility and Low Lumbar Strength for Current and Future Low Back Pain In Adolescents used Schobers method to evaluate lumbar extension range of motion.[30] The concept of neural mobilization includes links between mechanics and physiology of the nervous system in which interactions occur both ways and can be capitalized on therapeutically.[31] Neural mobilization is a method of conservative treatment of disorders of neural tissue. The rationale for using neural mobilization in the treatment of musculoskeletal conditions is based on in vivo and in vitro studies which point to a high efficacy of neural mobilization procedures.[32] As per theory behind neural mobilization musculoskeletal system interfaces mechanically with nervous system. The concept of neurodynamics has given this form of treatment, which is defined as the interactions between the nervous system mechanical and physiological mechanisms. A neurodynamic test is deemed positive with the reproduction of symptoms and/or the presence of antagonistic muscle activity to prevent further nerve bed elongation.[33]

Neural mobilization techniques are movement based and attempt to take the nerve throughout the available range of motion, potentially affecting the nerve both mechanically and physiologically. Neural mobilization may improve the actual excursionor movement of the nerve, decreasing adhesions and reducing mechanosensitivity, there by reducing the symptoms and allow the nerve to move freely. The technique may also improve intraneural blood flow; help to oxygenate the nerve.[34]This may be one reason in reduction of pain in neural mobilization group. Since nerves are viscoelastic structures they may respond to mobilization procedures and techniques similar to those for the musculoskeletal system, with purpose to correct such abnormal neural tensions and re-establish the proper movement of the neural tissue. This will result in a pain free state with subsequent improvement in the patient's functional ability level which is most of times the final goal.[35]In the present study, the group B treated with Neural Mobilization technique showed statistically significant improvement in active range of motion. Neural mobilization is a part of manual therapy that has been reported to be an effective intervention for certain conditions, including cervical radiculopathy, carpal tunnel syndrome, upper quadrant neurogenic pain and low back pain.[36] The improvement in functional ability has been found to be significant in all the subjects. All 3 groups were found to be effective in improving the functional ability , using MODQ. A study done on a comparison of a Modified Oswestry Low Back pain Disability Questionnaire and the Quebec Back Pain Disability Scale by Fritz and Irrang Concluded that the MODQ demonstrated superior measurement properities compared to the Quebec Back Pain Disability Scale (QUE).[34]

7. STATISTICAL ANALYSIS:

Statistical analysis for the present study was done manually as well as using the statistics software SPSS 13 version so as to verify the results obtained. For this purpose data was entered into an excel spread sheet, tabulated and subjected to statistical analysis. Various statistical measures such as mean, standard deviation and tests of significance such as Paired 't' test, one-way Analysis of Variance (ANOVA) and pairwise comparison using TUKEY's POST HOC test were utilized for this purpose for all the available scores in all the participants. Nominal data from patient's demographic data i.e. age, height ,weight were analyzed using 'F' test or ANOVA. Intra group comparison of the pre interventional and post interventional outcome measures was done by using student paired 't' test whereas one way ANOVA and pairwise comparision Tukey's Post Hoc test was used to measure the inter group difference. Probability values less than 0.05 were considered statistically significant and probability values less than 0.0001 were considered highly significant.

8. DEMOGRAPHIC PROFILE:

Age Distribution

The average age of the participants in group A subjects was 50.70± 8.37 years, group B subjects was 49.10± 8.48 years and group C subjects mean age was 49.60± 7.47 years. There was no significant difference between the mean ages of the participants in all the three groups. (F= 0.20,p= 0.8167) (Figure: 1)

9. ANTHROPOMETRIC MEASUREMENTS :

Body Weight

Group A subjects were having mean weight of 64.25± 4.73 kgs, group B subjects were having mean weight of 64.35± 4.61 kgs and group C subjects mean weight was 64.70± 4.64 kgs. There was no significant difference between the mean weight of the participants in the groups. (F=0.05, p= 0.9499)

Body Height

Mean height of group A was 168.40± 5.40 centimeters, group B mean height was 167.80 ±4.88 centimeters, and group C mean height was 168.20 ± 5.09 centimeters. There was no significant difference between the mean height of the participants in the groups. (F= 0.07, p= 0.9316)

Body Mass Index

Mean BMI of group A was 27.32 ± 3.44, group B mean BMI was 29.21 ± 3.33, and group C mean BMI was 27.37 ± 2.17. There was no significant difference between the mean ages of the participants in the groups. (F= 0.09, p= 0.9086).(Figure:1.1)

10, OUTCOME MEASUREMENTS:

i) Visual Analogue Scale (VAS) Score:

In the present study pre-interventional mean VAS was 6.53 ± 1.75, 7.31 ± 1.54, and 6.85 ± 1.72 in group A, B, and C respectively whereas post-interventional mean VAS was 1.72 ± 0.59, 2.61 ± 0.92, and 2.27± 0.97 in group A, B, and C respectively. Intra group changes in the visual analogue scores revealed statistically significant reduction in pain post interventionally for all the three groups. This was done using paired 't' test. The inter group analysis for VAS showed statistically significant difference between group A versus group B ($p<0.0001$) and group A versus group C ($p<0.0001$), whereas group B versus group C showed no significant difference ($p=0.04$). This was done by using one way ANOVA and pairwise comparison by Tukey's Post Hoc test.

ii) Modified Oswestry Disability Questionnaire (MODQ)

In the present study the pre-interventional values of mean MODQ was 0.29±0.07, 0.37 ± 0.13, and 0.31 ± 0.12 in group A, group B and group C respectively whereas post-interventional values of mean MODQ index was 0.10 ± 0.04, 0.16 ± 0.07, and 0.15 ± 0.07 in group A, group B, and group C respectively. On comparing pre-interventional versus post-interventional values; there was statistically significant difference shown in all the three groups i.e. group A, group B, and group C ($p<0.0001$). The inter group analysis for MODQ showed statistically significant difference between group A versus group B ($p<0.0001$), and group A versus group C ($p<0.0001$), whereas group B versus group C ($p=0.014$) showed no statistical significant difference. This was done by using one way ANOVA and pairwise comparision by Tukey's Post Hoc test.

iii) Range of Motion

Flexion ROM

In the present study pre-interventional mean active lumbar flexion range of motion in group A was 1.67 ± 0.42 centimeters, group B was 1.67 ± 0.40 centimeters, and group C was 1.65 ± 0.44 centimeters, whereas post-interventional mean active lumbar flexion range in group A was 2.52 ± 0.48 centimeters, group B was 2.27 ± 0.46 centimeters, and group C was 2.38 ± 0.51centimeters. On comparing pre-interventional versus post-interventional values; there was no statistical significant difference ($p=0.72$) in active lumbar flexion range of motion. Inter group analysis showed no significant difference in active lumbar flexion range of motion.

Extension ROM

In the present study pre-interventional mean active lumbar extension range of motion measurement was 3.54 ± 0.55 centimeters, 3.64 ± 0.45 centimeters, and 3.59 ± 0.56 centimeters in group A, group B, and group C respectively, whereas post-interventional mean active lumbar extension range was 4.64± 0.38 centimeters, 4.28 ± 0.40 centimeters, and 4.49 ± 0.43 centimeters in group A, group B, and group C respectively. Intra group comparison had shown statistically significant difference in all the three groups i.e. group A, group B, and group C ($p<0.0001$) in improving active lumbar extension range of motion.

The inter group analysis for active lumbar extension ROM using one way ANOVA and pairwise comparison using Tukey's Post Hoc test showed statistically significant difference between group A versus group B ($p=0.005$) and between group A and group C($p=0.005$).

11. RESULTS:

The results of this study were analyzed in terms of pain relief indicated by decrease in VAS score, improvement in lumbar range of motion (ROM) which was measured using Schobers method and improvement in physical function by decreased score in the Modified Oswestry Disability Questionnaire (MODQ). Intra and inter group differences were compared so as to evaluate the effectiveness of three treatment protocols under consideration in the present study.

12. RECOMMENDATIONS:

Further studies can be conducted on larger sample size and considering other signs and symptoms related to chronic LBP with or without radiculopathy. Also studies can be carried out by using various other manual therapy techniques.

FIGURES:

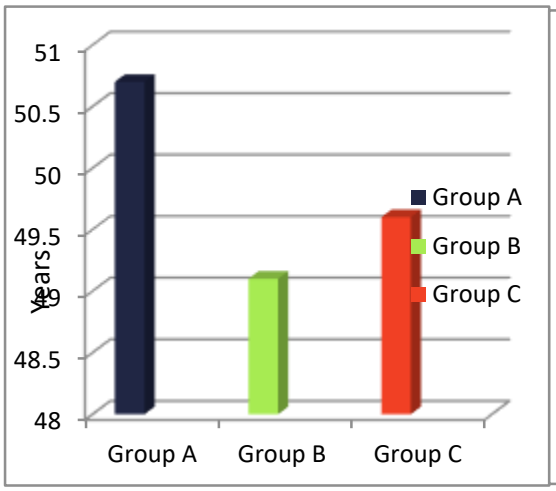

FIGURE :1

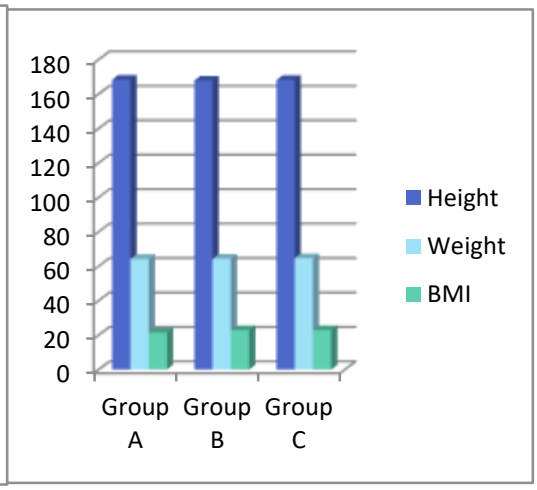

FIGURE: 1.1

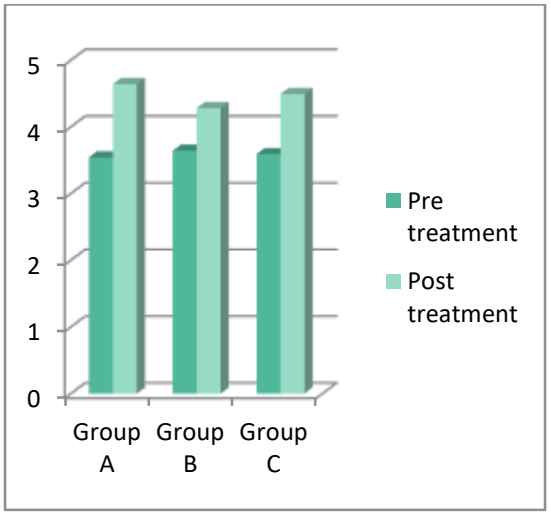

Figure:2

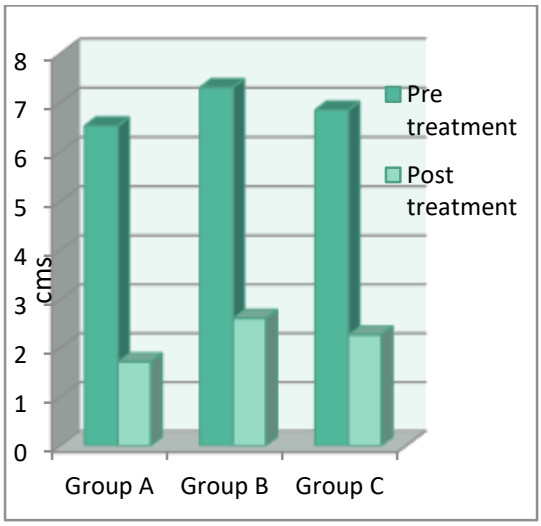

Figure: 3

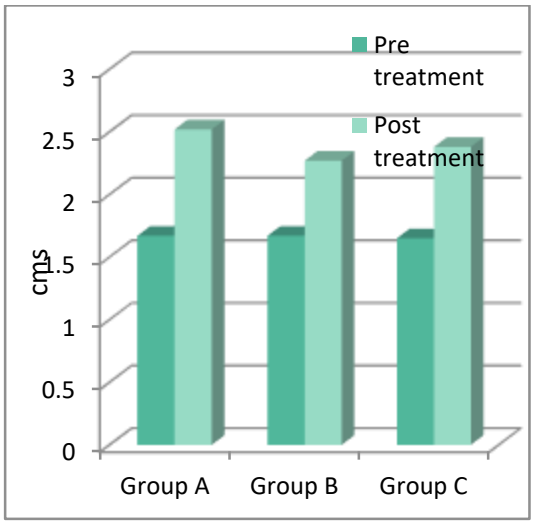

Figure:3.1

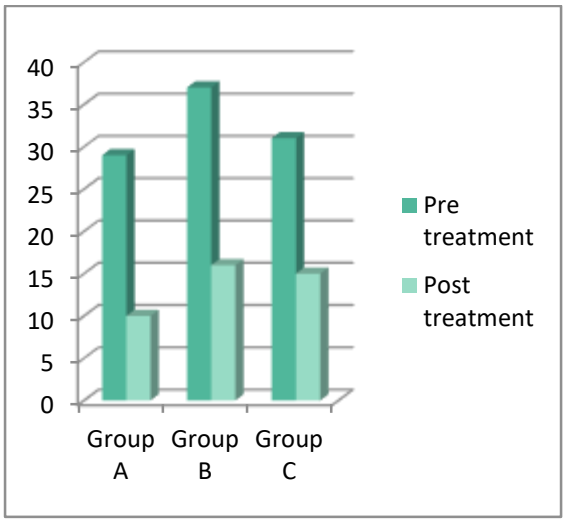

FIGURE : 4

13. CONCLUSION:

In conclusion, this randomized clinical trial which was performed on 60 participants consisting of males and females with a diagnosis of chronic low back pain with radiculopathy with interventions in the form of TENS + traction therapy + McKenzie technique, TENS + traction therapy + Neural Mobilization technique and TENS + traction therapy + McKenzie technique + Neural Mobilization technique showed that, both the physical therapy regimen can be useful in alleviating the chronic low back pain with radiculopathy. McKenzie technique can be useful in reduction of pain and improvement in functional ability in terms of pain and MODQ respectively. Neural Mobilization technique can be helpful in improvement in range of motion .Hence, it can be concluded that both the interventions are effective therapeutic options in the treatment of chronic low back pain with radiculopathy.

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