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The Effect of Spinal Exercises on H-Reflex in Subjects with Lumbosacral Radiculopathy

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Abstract:-

Title: Effect of Spinal Exercises on H-reflex in subjects with Lumbosacral radiculopathy (L_5-S_1) Methodology: Single group pre and post design study aimed to recruit 40 subjects with L5-S1 lumbar radiculopathy confirmed by clinical and MRI findings. Subjects underwent H reflex testing, NPRS scoring, sit to stand test at the base line and after three weeks of exercise sessions. Control values were obtained from volunteers with no symptoms. Inter-side comparisons were made in patients with unilateral symptoms. Result: 40 patients have been recruited with unilateral Radiculopathy symptoms and have completed three weeks post exercise testing. Among them none of them had abnormal H reflex at baseline. NPRS score improved significantly in baseline versus post exercise comparison (P<0.05) [Mean score 6.92Versus 2.3], Sit to stand time [Mean 29.75Versus 19.9sec] and H reflex parameters [Mean H latency 30.40Versus 30.05ms; Mean H Amplitude 2.9Versus 3.4mV] did not reach the statistical significance (P>0.05). Conclusion: H reflex did not change with multiple sessions of McKenzie repeated spinal exercises in subjects with lumbosacral radiculopathies, But Improvement in with respect to reduction in Numerical pain score and improvement in capability of sit to Stand performance in this study.

Keywords:- *Mckenzie Exercise, H-Reflex, Sit To Stand, NPRS-Numerating Pain Rating Scale, Back Pain.*

I. INTRODUCTION

Low back pain is the commonest musculoskeletal disorder and one of the leading causes of activity limitation in working adults which originates from many potential anatomic sources such as nerve roots, muscles, facial structures, bones, joints, inter-vertebral discs and organs within the abdominal cavity [1]. It has been identified as one of the most exorbitant disorders with a prevalence of (60-80) % of general working population suffers from LBP at some time during their lives [2, 3]. Various risk factors such as gender, height, weight and physical inactivity, nature of occupation, poor posture and socio-economic status have been attributed to the occurrence of back pain [4].

Previous studies have reported that lack of spinal motion which is elicited by prolonged standing (85%) or sitting (73%) and activities like walking (23%) and cycling (15%) can also lead to Low back pain.

Radiculopathy is one of the most common causes for referral to the electromyography (EMG) laboratory. Symptoms originating from the nerve roots arise when there is significant reduction in space within the bony canal either by herniated disc or altered bony components resulting in nerve root irritation or compression[5, 6].

It affects 4-6% of the population at some point in their lives among which L4-5 and L5-S1 are the most common level affected in lumbosacral radiculopathy[7].

Conventional treatment of back pain includes pain medications, physical therapy and surgery. In physical therapy there are several mechanical methods and physical agents therapists use to relieve pain, such as ice/heat pack, ultrasound and electrical stimulation. In addition to the exercise which stretch the sore muscle and increase their flexibility, McKenzie approach and dynamic lumbar stabilization exercise are also commonly used.

The McKenzie method consists of 3 steps: evaluation, treatment and prevention. The evaluation is received using repeated movements and sustained positions.

The choice of exercises in the McKenzie method is based upon the direction of movement (flexion, extension or lateral shift of the spine). The aims of the therapy are: reducing pain, centralization of symptoms (symptoms migrating into the middle line of the body) and the complete recovery of pain. The prevention step consists of educating and encouraging the patient to exercise regularly and self-care[8, 9]. A single direction of repeated movements or sustained postures leads to sequential and lasting abolition of all distal referred symptoms and subsequent abolition of any remaining spinal pain[10]. This approach is focused on sustained postures or repeated

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movements. Although McKenzie exercises could improve pain intensity in acute low back pain, sub-acute low back pain and chronic low back pain. McKenzie method of exercises is a widely followed for exercises regime in back pain patients. McKenzie method prescribes repeated exercises in a specific direction combined with educational approach to treat patients with mechanical back pain. McKenzie method evaluates the cause and effect relationship between the abnormal positions that patient usually assume while sitting, standing or moving and the generation of pain as a result of those positions or activities. This therapeutic approach requires a patient to move through a series of activities and test movements to gauge the patient's pain response. Based on the information gathered during assessment an exercise protocol is designed to centralize or alleviate the pain[11].

Various Neurophysiological methods are available to check the recovery of subjects with radiculopathy, among those H reflex have been used to diagnose and understand prognosis in lumbosacral radiculopathies[12]. It involves conduction to and from the spinal cord, reflects motor neuron activation and occur at interface between the peripheral and central nervous system. H reflex can be recorded in calf muscles following submaximal stimulation of the posterior Tibial nerve at the popliteal fossa, It has a latency comparable with the Achilles tendon reflex The reflex arc of the H reflex includes input from large, fast conducting Ia-fibres and output via the motor axons[13].

H reflex is regularly found only in calf muscles, primarily soleus, and homologous forearm flexors (Flexor carpi radials) [14, 15]. H reflex parameters can be affected by various factors such as age, gender, body mass index, skin temperature and height[12]. Although there is considerable variability in H/M ratios, the H/M ration for calf H reflexes is normally less than 0.7[16, 17]. The upper limit of H reflex latency for calf H reflexes is 35ms. Upper limits of normal side-to-side latency differences are 1.5ms for calf H reflexes[18, 19]. Side-to-side H reflex amplitude difference in healthy controls can be calculated by smaller amplitude/ larger amplitude. Mean values of which varies between 0.74-0.83 (SD 0.11-0.17)[12].

It has been found to be a clinically useful method in the diagnosis of radiculopathies and assessing of the McKenzie neck retraction exercise and traction in patients with cervical radiculopathy. It is used to assess the effects of prone position and interferential therapy on the compromised nerve root of patients with lumbosacral radiculopathy[20, 21, 22].The previous studies shows that Ultrasound therapy is significantly effective on patients with low back pain and sacroiliac joint manipulation on healthy and patients with low back pain[23, 24]. Even though the diagnostic value of H reflex in lumbosacral radiculopathies is well established, it has been less frequently used to study the changes following physical therapy treatment interventions.

II. MATERIALS AND METHOD

Study design: Single group pre and post design
Source of data: The oxford college of physiotherapy (OPD), Clinics in and around Bangalore (South region).
Method of collection of data:
Population: Subjects with lumbosacral radiculopathy
Sampling: Convenient sampling
Sample size: 40
Duration of study: 6 months

Inclusion criteria:

- Subjects with L5-S1 disc herniation confirmed by MRI and clinical findings.
- Subjects with age group between 25-50 years.
- Both male and female.

Exclusion criteria:

- Subjects with any previous low back surgeries
- Subjects with any bony abnormality
- Subjects with scoliosis
- Metabolic system disorder
- Subjects with history of upper and lower motor neuron lesion

Materials required:

- Pen
- Paper
- Stopwatch
- Chair
- Couch
- RMS Salus 2 channel EMG unit

III. RESULT AND DISSCUSSION

Table-1: Range, mean and SD of outcome measures.

Outcome measure	Group				Paired t test	P value
	Pre test		Post test			
	Range	Mean ± SD	Range	Mean ± SD		
NPRS	4-10	6.92±1.93	0-5	2.3±1.32	t=15.26	p<0.0001*
Sit to Stand	15-32	27.54±8.42	5-14	19.90±4.81	t=8.04	p<0.0001*

Note: * denotes – Significant (p<0.05). t - Paired t-test 3

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Table-2: Comparison of pretest and posttest on affected and unaffected side

Outcome Measures	Pre Test		Post test	
	Affected side	Unaffected side	Affected side	Unaffected side
	Mean± SD	Mean± SD	Mean± SD	Mean± SD
H-reflex latency	28.88±2.66	28.75±2.19	28.87±2.47	28.73±2.18
H-reflex amplitude	4.69±2.68	4.35±2.47	4.35±2.35	3.93±2.06
comparison between affected and unaffected side paired t-test	H-reflex latency: t=0.44, p= 0.662366 NS H-reflex amplitude: t=1.65, p=0.11 NS		H-reflex latency: t=0.49, p=0.626879 NS H-reflex amplitude: t=1.41 p=0.166465 NS	

S-denotes significant ($p<0.05$); NS – not significant ($p>0.05$)

Data obtained from the study was analyzed and paired t test were used as a statistical tool for detecting the significant difference within the group and the results suggests that spinal exercises have significant effect on reduction in numerical pain scoring and sit to stand performance at ($p<0.0001$). It was also found that there is no significant effect on h-reflex in subjects with lumbosacral-radiculopathy at ($p<0.05$).

The present study was carried out to find the effect of spinal exercises on h-reflex in subjects with lumbosacral radiculopathy.

Total 40 subjects were recruited for this study depending upon selection criteria. Selected subjects were allotted in single group for McKenzie exercises, Outcome of this study was measured using NPRS, sit to stand performance and H-reflex (Latency and Amplitude).

This study showed that spinal exercises had no positive effect on the H-reflex of the compromised S1 spinal root despite pain intensity or sit-to-stand performance of patients with Lumbosacral Radiculopathy. This could indicate that the compromised large fibers of the spinal root either have not been sufficiently decompressed after three weeks of Spinal exercises or have been severely demyelinated and/or degenerated to a degree unable to recover within short period of time. The H-reflex latency and amplitude recorded from the non-involved leg before Spinal exercise were within the published normal range[25, 26] and were significantly shorter and bigger respectively, than what were recorded from the involved leg. Such differences are consistent with previous studies[27, 28]. A side-to-side latency difference of more than 1msec is the minimum for a definite sign of radiculopathy[26, 29]. In addition, two-to-fourfold amplitude side-to-side difference has been considered abnormal[30, 31]. The value of using side-to-side latency/amplitude difference in the diagnosis of unilateral S1 radiculopathy is well documented[32,33,34]. These differences indicate the presence of true pathological nerve root compression, demyelination or both, in the involved leg. It has been documented that both spinal root compression and demyelination interrupt the passage of impulses, prevent saltatery conduction, increases H-reflex latency and decreases amplitude[35, 36]. In the present study, muscle weakness and diminished tendon reflex of the patient's further confirmed extensive damage in the compromised nerve root. The H-reflex latency and amplitude after spinal exercises did not significantly change. This could be attributed to the fact that re-myelination or axonal regeneration in patients with lumbosacral radiculopathy is impossible to take place in three week session of spinal exercises. It is suggested that recovery from the neurological deficit as a result of radiculopathy ranges from 3 weeks up to one year or not fully recoverable at all[34,37].

Spinal exercises from prone is believed to encourage the nucleus pulpous to move anteriorly away from the compromised nerve root as a result of gravity effect and to improve the alignment of the lumbar spine at L5-S1[37, 38]. This movement is believed to reduce radicular symptoms of patient with Lumbosacral radiculopathy. The result of our study did not support such belief; as the H-reflex did not show any significant change after the spinal exercises but pain and sit to stand show significant change. This controversy may be attributed to the pathological differences among patients groups, affecting the movement of the nucleus pulpous. According to Schnabel patients with chronic radicular symptoms (herniation) are expected to have some degree of disc degeneration. Movement of nuclear material in degenerated disc reported to be less predictable[39].

Patients in our study had disc pathology. Nuclear materials either did not move during spinal exercises or slightly moved but insufficient to decompress the compromised spinal root, or moved into a direction not decompressing the spinal root. It was reported that 59% of disc protrusions postero-lateral and 28% is central[37]. This may lead us to assume that spinal exercises that is purely one single axis movement would not be efficient in reducing a postero-lateral disc prolapses. Besides, McKenzie believed that patients with chronic constant symptoms of Lumbosacral radiculopathy need a long time and frequent repetition of exercise to achieve centralization or reduction in pain intensity. The results of the present study may support such belief. The symptoms of Lumbosacral radiculopathy with no signs of improvement could show that the cause is a large irreducible disc herniation, and both bulging annulus displaced disc material is in a state of fixation and unable of move by fibrous repair[37]. In conclusion, repeated McKenzie back extension exercise from prone position seems to have no neurophysiological effect on the H-reflex of the compromised S1 nerve root but pain intensity and sit-to-stand

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performance have positive effect in Subjects with lumbosacral radiculopathy.

IV. CONCLUSION

The study was intended to examine the effect of spinal exercises on h-reflex in subjects with lumbosacral radiculopathy. This study shows that H-reflex (Amplitude and Latency) did not change significantly following three weeks of McKenzie spinal exercises in subjects with lumbosacral radiculopathy despite improvement in numerical pain scoring and sit to stand performance is conquered.

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