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EFFICACY OF LUMBAR BRACING STRATEGIES AND HOLLOWING EXERCISE FOR LUMBAR DEGENERATIVE DISEASE

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ABSTRACT

Introduction and Aim: This study was aimed to evaluate the efficacy of hollowing and bracing strategies in lumbar degenerative disease. The objective of this study was to find the effect of lumbar bracing strategies and hollowing exercise on pain and quality of life for lumbar degenerative disease.

Materials and Methods: Sample size: 40 subjects based on inclusion and exclusion criteria, Study design: Experimental study, Sampling method: convenient sampling. Outcome measures: VAS and Modified Oswestry Disability Index. Intervention was given for 2 weeks, 5days/week. A baseline analysis VAS and Modified Oswestry Disability Index was done before the intervention began. 2nd weeks of intervention was given to the subjects following which a post-test was conducted and done to analyze the sustained effects of the intervention.

Results: From the statistical analysis made with the quantitative data revealed a statistically significant difference between the groups.

Conclusion: Therefore, it was concluded that hollowing lumbar stabilization exercise (HLSE) and bracing lumbarstabilization exercise (BLSE) combined with Interferential therapy (IFT) is effective in improving was found to bemore effective than conventional therapy in decreasing pain leading to faster recovery in subjects with lumbar degenerative disease.

Keywords: Hollowing lumbar stabilization exercise, Bracing lumbar stabilization exercise, Interferential therapy, Lumbar degenerative disease, VAS and Modified Oswestry Disability Index.

I. INTRODUCTION

Low back pain is a major public health problem all over the world. Most people suffer incapacitating back pain at some stages in their lives. Low back pain is a leading cause of disability, which interfere with qualities of life and work performance. The lumbar spine structures involved in the development of low back pain are intervertebral disk cartilages, intervertebral joints, tendons, and muscles. In general, the clinical course of an episode of acute low back pain seems favorable, and most pain and related disability will resolve within a couple of weeks [1]. This is also illustrated by the finding that about 90% of patients with low back pain in primary care will have stopped consulting their doctor within three months [2]. Croft suggests that in many patients low back pain symptoms fluctuate over time [3].

Most patients with back pain have experienced a previous episode, and acute attacks often occur as exacerbations of chronic low back pain. So, recurrences are common. Pengel et al estimated the cumulative risk of at least one recurrence within a 12month period to be 73% (95% confidence interval 59% to 88%). The severity of these recurrences, however, is usually less and does not always lead to a new visit to the general practitioner [4]. Only a

small proportion (5%) of people with an acute episode of low back pain develops chronic low back pain and related disability. Lumbar disc degenerative disease is the most common cause of Low back pain throughout the world. In the industrialized part of the world low back pain is extremely common. It is the single most common cause of disability at age above 45 years and second most common reason for primary care physician visit [5-8]. Despite the high prevalence of low back pain in both developed and developing nations, it is still enigmatic in terms of cause, diagnosis and treatment1. Intervertebral disc is the largest avascular tissue in the body [9], and consists of inner nucleus pulposus, outer annulus fibrosus and cartilage located superiorly and inferiorly.

Intervertebral disc resists compression because of the osmotic properties of the proteoglycans. The ability of the disc to resist anterior and lateral shears along with compression and flexion makes the intervertebral disc the most important load bearing component of the spine, beside the facets [10-12]. Due to loading there is a deformation of the endplate which results in reduced intradiscal pressure, loss of height and adding stress to the surrounding annulus and facet joints. Signs of degeneration includes one or all of the following: diminished disc height, narrowing of facet, spondylophytes and sclerosis of upper and lower endplates, stenosis of spinal canal, narrowing of lateral recess, real or apparent desiccation, fibrosis, diffuse bulging of the annulus beyond the disc space, extensive fissuring (i.e., numerous annular tears), mucinous degeneration of the annulus, defects and sclerosis of the endplates, and osteophytes at the vertebral apophyses [13]. Lumbar degeneration can occur at any level but mainly it occurs on L3-L4 and L4-S1 vertebrae. Lumbar disc degenerative disease may present as disc herniation, lumbar spinal stenosis, facet joint arthropathy or their combination. Herniation occurs when nuclear materials protrude or extrude into the perineural space through radial tears of the annulus [14].

Lumbar spinal stenosis is defined as any type of narrowing of spinal canal, nerve root canal or intervertebral foramina. With disc degeneration and loss of disc space height, there are increased stresses on the facet joints with craniocaudal subluxation resulting in arthrosis and osteophytosis, and this condition is termed facet joint arthropathy [15-17]. The most common symptom associated with lumbar disc degeneration is low back pain and it is due to the presence of neural tissue around the intervertebral disc. The main symptom of disc degeneration after low back pain is sciatica. Features suggestive of sciatica are unilateral or bilateral leg pain radiating to the feet and toes, numbness in dermatomes distribution and positive straight leg raising test. Sciatic pain aggravates on standing, walking, bending, straining and coughing [18]. Other symptoms of lumbar disc degeneration are sensory disturbances in legs, claudication, relief of pain when bending forward and weakness. Risk factors for causing lumbar disc degenerative disease include advancing age, socioeconomic status, torsional stress, smoking, obesity, heavy lifting, vibration, trauma, immobilization, psychosocial factors, gender, height, hereditary, genetic factors, occupations like machine drivers, carpenters and office workers [19]. Main diagnostic tool and imaging technique for the evaluation of disc degeneration is magnetic resonance imaging (MRI). Exercise can improve back extension strength, mobility, endurance, and functional disability. Various exercises, such as lumbar stabilization exercise, motor control exercise, core exercise, lumbar flexion exercise, walking exercise, and bracing exercise, have been proposed to mitigate chronic LBP.

These exercises focus on lumbar stabilization and core strengthening. However, to date, no one particular exercise has been shown to be superior. Lumbar Stabilization exercise is primarily aimed at improving neuromuscular control, strength, and endurance of the muscles, which are considered to be central to the maintenance of dynamic spinal and trunk stability. It is considered as a safe exercise with the advantages of having multiple stages, as well as cost- effectiveness [20]. Each individual has different lumbar muscular strengths, and therefore, lumbar SE programs should be individualized, comprising of various postures with varying intensities to maximize therapeutic benefit to a particular individual [21]. To improve compliance, the intensity level of each exercise can be modified according to each patient's capacity, with changes in the postures of the upper and lower extremities or neck as well as changes in the duration of exercise time. Therefore, individualized graded lumbar SE (IGLSE) will allow for a customized exercise program that caters to the needs of a specific patient.

The ability to strengthen the lumbar musculature without flexion or extension, but it also has the potential to offer high compliance owing to the graded protocol with modifiable intensity. Lumbar stabilization exercises have become increasingly popular as a treatment for low back pain. The exercise protocols to improve lumbar stabilization vary from training of multifidus and transversus abdominis (TrA) with isometric contraction to using weight machines designed to strengthen the prime movers of the spine. Some notable lumbar stabilization exercises include the side plank, bridge, 4-kneeling, prone plank, and prone back extension exercises. Lumbar stabilization exercises are commonly used to improve lumbar stability and increase trunk muscle strength [22].

Although previous studies have revealed the therapeutic effectiveness of lumbar stabilization exercises, these exercises focus on contraction of rectus abdominis, external oblique, and erector spinae muscles but considered less preferential contraction of the TrA or co-contraction of anterolateral muscles, which are effective to relieve pain and low back disability [23,24].

Hollowing strategy preferentially contracts the TrA while minimizing global muscles, including the RA muscle. Bracing strategy simultaneously contracts anterolateral abdominal muscles, including TrA, internal oblique, EO and RA [13, 15]. The hollowing strategy has been reported to relieve pain and improve low back disability in persons with NSLBP. Hollowing strategy is effective for muscle activation mainly focused on RA, EO, IO, and TrA, which contribute to the partial stability of the spine. The bracing strategy is also beneficial in inducing higher activation in deep abdominal muscles. However, because the therapeutic effects of hollowing and bracing strategies in previous reports were based on experimental studies, itis difficult to apply the therapeutic effects to the community setting. Hollowing and bracing strategies with lumbar stabilization exercises could be expected to provide the preferred neutral lumbar spine position with contraction of the IO, EO, and TrA muscles, which all contribute to spinal stability [25].

Therefore, the purpose of the present study was to explore the therapeutic effectiveness of HLSE and BLSE for older adult women with NSLBP to be applied in a community setting. We hypothesized that HLSE and BLSE are effective in enhancing trunk strength and static balance and improving low back disability. The evidence that non-steroidal anti-inflammatory drugs relieve pain better than placebo is strong. Advice to stay active speeds up recovery and reduces chronic disability. Muscle relaxants relieve pain more than placebo, strong evidence also shows, but side effects such as drowsiness may occur. Conversely, strong evidence shows that bed rest and specific back exercises (strengthening, flexibility, and stretching, flexion, and extension exercises) are not effective.

Material and methods:

Study design: Experimental study, Study setting: The Saveetha Medical college and Hospital, Physiotherapy OPD, SIMATS, Sampling method: Convenient sampling Sample size: 40 subjects

Inclusion criteria: 1. Participants with lumbar degenerative disease more than 3 months like lumbar spondylosis, lumbar spondylitis, degenerative disc disease, disc herniation, facet joint degeneration, spinal stenosis, lumbar spondylolisthesis (grade 1) 2.Both Gender 3. Patients age 30 to 50 years. Exclusion criteria: 1. Neurological problems 2. History of spinal surgery 3. Spinal conditions such as Infection,Tumors,Osteoporosis and Spinal fracture

Outcome Measure: Visual Analogue Scale (VAS) and Modified Oswestry Disability Index

Procedure: 40 individual were selected according to inclusion and exclusion criteria. The consent was obtained from the participants. Participants were explained about the risk factors, safety and procedure of the study. All the participants were selected according to convenient sampling technique. All Subjects are allocated into the Control group :(n=20) and Experimental group :(n=20) the control group received only Interferential Therapy (IFT), for 15 minutes. The experimental group received both Hollowing & Bracing Exercises are Side Plank, Bridge Exercise, Four point -Kneeling Exercise, Prone Back Extension, Cat Stretch Exercise, Abdominal Bracing Exercise, Quadruped arm / Leg raises. Prior to initiation of the treatment session, VAS and Modified Oswestry Disability Index is done as a pre-test outcome. Patient was asked to be seated for few minutes and they were explained about the procedure after which therapist demonstrated the exercises to the patient and the outcomes were measured with the same protocol of VAS and Modified Oswestry Disability Index of pretest is repeated in post-test measures following the 2 weeks of treatment procedure. Treatment Session: Sessions: 1session/day Frequency: 5days/weekDuration: 2 week

Statistical analysis:

The collected data was tabulated and analyzed using inferential statistics to assess all the parameters. To find out significant changes within the group of pre and post-test by paired t- test was used. And between groups unpaired t test was used.

Table: 1 Comparison of pre and posttest values of group A

Group A		Mean	Standard deviation	p value
Visual Analogue Scale (VAS)	Pre test	4.2	0.85	<0.0001
	Post test	2.10	1.05	
Oswestry Disability Index (ODI)	Pre test	26.1	2.38	<0.0001
	Post test	13.2	1.37	

Table: 2 Comparison of pre and posttest values of group B

Group B		Mean	Standard deviation	p value
Visual Analogue Scale (VAS)	Pre test	4.3	0.83	<0.0001
	Post test	1.10	1.01	
Oswestry Disability Index (ODI)	Pre test	26.0	2.37	<0.0001
	Post test	11.2	1.05	

Result:

The collected data has been tabulated, analyzed using descriptive and interferential statistics. Hence, to the parameters mean and standard deviation where it was used for paired t-test to analyze significant changes between pretest and posttest measurement. From statistical analysis made with the quantitative data revealed statistically significant difference between Group A and Group B. The post-test mean value of VAS for Group A was 2.10 and post-test mean value of Group B was 1.10. Hence from the above statistical data the post-test value is found to be more significant in group B than the post- test value of group A. In this study the parameters used to measure the pain is by Visual Analogue scale and functional disability measured by Oswestry Disability Index Scale. In group A pre intervention mean of VAS was 4.2 and group B was 4.3 In group A pre intervention mean of Oswestry Disability Index Scale was 26.1 and for group B was 26.0, which shows statistical significant difference within the group. After two weeks of the treatment all the above parameters showed significant improvement in both Experimental and Control group, with a more marked improvement in Experimental group.

II. DISCUSSION:

Degenerative lumbar disc disease and resulting low back pain impart a large socioeconomic impact on the health care system. Disc degeneration is a multifactorial occurrence with a strong genetic component. Age and environmental factors contribute to the degenerative process. Novel treatment strategies for lumbar disc degeneration require further evaluation in preclinical and clinical trials. Stabilization exercises, which aim to protect the spinal joints from microtrauma and degenerative changes, can normalize functional and morphological trunk changes. Stabilization exercises consisting of hollowing and bracing exercises, which are the opposite of each other, have shown different results in previous studies on exercise. For instance, Grenier and McGill et al. claimed that a bracing exercise showed better results than a hollowing exercise, whereas Richardson et al. claimed that a hollowing exercise supported better stability. Therefore, this study attempted to compare and analyse the effects of hollowing and bracing exercises on the cross-sectional areas of abdominis muscles.

Allison et al. found a significant difference in transverse abdominis muscle activity between hollowing and bracing groups. In their study of muscle activity in the abdomen, Bjerkefors et al. showed that stabilization exercises including a hollowing exercise resulted in higher EMG activity in the transverse abdominis. In their study on transverse abdominis activity, Urquhart et al. also reported that hollowing exercises resulted in more significant improvements than bracing exercises. That is, during a hollowing exercise, abdominis muscles such as

the rectus abdominis, internal obliques, and external obliques showed no difference in muscle activity, but the transverse abdominis showed significant improvements in activation independently [25]. The present study also showed that after applying the two exercises, the cross-sectional muscle area of the right transverse abdominis showed a significant difference between the two groups, and significant changes in the left and right transverse abdominis were shown within the group after the hollowing exercise. This finding proves that hollowing exercisescan selectively and independently contract the transverse abdominis, which is a deep abdominal muscle.

With regard to rectus abdominis activity, Allison et al. found no difference between the two groups. In theirstudy on abdominal muscle activity, Bjerkeforset al. also reported that a hollowing exercise caused single contractions of the transverse abdominis because it did not act on the rectus abdominis. Our group has conducted research relevant to physiotherapeutic intervention on various neurological and musculoskeletal ailments [26-33], and warrants further experimental research by our group in signifying the results. However, the cross-sectional area of the left rectus abdominis showed a significant within-group difference in both groups, indicating that the hollowing exercise was also related to contraction of the rectus abdominis, and the bracing exercise (a plank exercise) caused co-contraction of the entire trunk muscle [34].

III. CONCLUSION

From the result, it has been concluded that hollowing and bracing exercises with IFT is found to be more effective than the regular low back strengthening exercise with IFT in reducing pain and improving functions among subjects with lumbar degenerative disease. Our findings indicates that the lumbar stabilization exercise (HLSE) and bracing lumbar stabilization exercise (BLSE) and Interferential therapy (IFT) described here could be considered in individuals who require VAS and Modified Oswestry Disability Index. Hence it was recommended to implement this treatment in clinical practice.

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Conflict of interest:

The authors declare no conflict of interest.

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