ORIGINAL ARTICLE

IJPHY

A STUDY TO ANALYSE THE EFFECTS OF FASCIAL MANIPULATION ON THE LATERAL THIGH REGION IN MECHANICAL LOW BACK PAIN

[*1]G. A. Geetha Hari Priya; M.P.T
[2]Jibu George Varghese; M.P.T, CMP, COMPT, MCTA

ABSTRACT

Background: Low back pain (LBP) is one of the most prevalent musculoskeletal disorders, affecting up to 90% of people at some point in their lifetime. Up to 50% will have more than one episode of back pain. Previous studies have highlighted the benefits of fascial manipulation for chronic low back pain over manual therapy alone. But early detection of densification of specific points in the lateral thigh region in low back pain subjects in an acute phase itself will be of benefit in resolving the back pain as the deep friction on these points aims at restoring the physiological gliding properties of the fascia and lead to immediate pain relief in the low back, increased range of motion and improved functions.

Methods: Sixty individuals were enrolled for the study and were randomly allotted to two groups using a simple random method, were samples were randomly allocated by the primary investigator before baseline assessment. Control group subjects in Group A received conventional exercises, including core stability exercises. Experimental group subjects in Group B received Fascial manipulation to the lateral aspect of the thigh region in the lower limb. Both the groups received interferential therapy for 20 minutes as a part of conventional treatment for low back pain for 15 days. The subjects were assessed for their pain level, using NPRS score, and range of motion (ROM) was assessed to find any restriction in the lumbar region due to fascial densification. The functional activities of daily life were assessed using the ODI scale. The above scores were recorded before and after the interventions for both the groups.

Results: The pre-test and post-test results were analyzed using a Paired and Unpaired t-test. The outcome measures of the Numeric Pain Rating Scale, Modified Schober's test, the Oswestry Disability Index were used for the study. A comparison of post-test values between Group A and Group B using unpaired t-test revealed a significant difference of $p<0.001$ in terms of pain relief, improved Range of motion, and functional ability of subjects in Group B than subjects in Group A.

Conclusion: Fascial manipulation technique on lateral thigh region proved to be effective than conventional exercises as it showed a clinical and significant effect in decreasing pain and disability and improving the range of motion and functional activities of daily living in subjects with mechanical low back pain.

Keywords: Low back pain, Fascial Manipulation, Range of Motion, Core stability, Functional activity.

Received 21st April 2020, accepted 02nd June 2020, published 09th June 2020

www.ijphy.org

10.15621/ijphy/2020/v7i3/702

[2]Professor and Principal, Faculty of Physiotherapy, Meenakshi Academy of Higher Education and Research (MAHER), Chennai, India.

CORRESPONDING AUTHOR

[*1]G. A. Geetha Hari Priya, M.P.T

Assistant Professor, Faculty of Physiotherapy, Meenakshi Academy of Higher Education and Research (MAHER), Chennai, India.
Email: geethaskumar04@gmail.com

INTRODUCTION

Low back pain (LBP) is the most common musculoskeletal disorders, affecting up to 90% of people at some point in their lifetime. Up to 50% will have more than one episode of back pain [1]. Low back pain (LBP) is not a specific disease, and instead, it is a symptom.

As the lumbar spine is constructed to provide mobility of the region, the muscles and ligaments surround the region to support it. The muscular stability is provided by the erector spinae group, multifidus, abdominals, iliopsoas and gluteus medius, and thoracolumbar fascia.

Kumar and Clark, 2002, states mechanical low back pain as a general condition referring to the history of either acute or chronic pain or discomfort near the lumbar region [2]. Several etiological factors contribute to LBP, causing severe pain and functional limitations in daily activities. The most common etiology of LBP is abnormal or bad posture, which causes unusual strain on a disc, and ligaments, causing muscle weakness, fascia tightness, occupation-related risk factors, and all lead to abnormal biomechanics [3]. Mechanical low back pain starts suddenly. It may be associated with occupations that involved heavy weight lifting, bending or twisting forces, heavy physical work, and prolonged static work posture. The pain may be localized to the low back or may radiate to the front, back, or to the lateral aspect of the leg. According to Findley, in 2012, as the tensor fascia lata is a postural muscle, it is prone to tightness in chronic musculoskeletal dysfunctions of the lumbopelvic hip region like low back pain. Fascia tightness occurs during acute inflammation, and hence it loses its flexibility.

Myofascial pain is one of the common causes of backache from irritation of the nociceptive system that is distributed through the muscle mass of the low back, fascial sheath, intramuscular septa, and tendon that attach them to vertebra and pelvis. Myofascial restriction may occur from mechanical overuse or overstrain and also accompany any other type of injury in low back pain [4].

According to a study conducted by Frank Ober on the role of iliotibial (IT) band and fascia lata on low back pain, it was found that a contracted fascia and an IT band exerts pull on pelvic bone resulting from bad posture [5]. Hence pathological changes in the iliotibial band have been considered to have an association with low back pain. In the recent past, there is emerging evidence towards the relation between the densification of specific fascial points of the fascia of the thigh and low back pain.

Fascia is a continuous, three-dimensional web of tissue that extends from head to toe and anterior to the posterior aspect of the body. The lateral aspect of the thigh has a slightly thickened fascia called the iliotibial tract [6].

Any pathological changes of deep fascia could cause alteration along a related sequence resulting in incorrect activation of nerve receptors, uncoordinated movements, and consequent nociceptive afferents. Alternately, tension may proceed along a myofascial sequence, and hence myofascial continuity could be involved. Anatomically, the deep fascia of the thigh, the fascia lata is attached above and behind, to the back of the sacrum and coccyx and provides stability to pelvis [7]. Hence subjects with low back pain and sacroiliac joint pain experience pain in the lateral aspect of the thigh due to densification of the fascia which also contributes to the pelvic instability.

Deep fascial manipulation on the specific points (cc and cf) of the lateral aspect of the thigh aims at restoring tensional balance and relieve low back pain. Fascial densifications develop due to repeated inflammation that provokes an increase in the number of collagen fibers. Manipulation act on densified points for friction against the fascia to produce heat. Manipulation affects the fascia because it is the tissue that is easily accessible and possesses a strong capacity for repairing and regenerating itself [8]. Based on the fact that a stimulus applied to any part of the fascia will naturally affect other parts of the body, only if the stimulus is directed at the appropriate point will it be able to resolve the problem.

Previous studies have highlighted the benefits of fascial manipulation for chronic low back pain over manual therapy alone [10]. Early detection of densification of specific points in the lateral thigh region in low back pain subjects will be of benefit in resolving the back pain at an acute phase itself as the deep friction on these points is aimed at restoring the normal physiological gliding properties of the fascia leading to immediate pain relief, improved range of motion and functions [11,12]. The anatomic correlation also justifies a postural and functional correlation. Hence, an alteration in the status of the fascia can reflect symptoms at other regions that are anatomically connected. Therefore, treatment of the altered fascia at the lateral thigh may be beneficial to subjects with mechanical low back pain.

MATERIALS AND METHODS

Participants

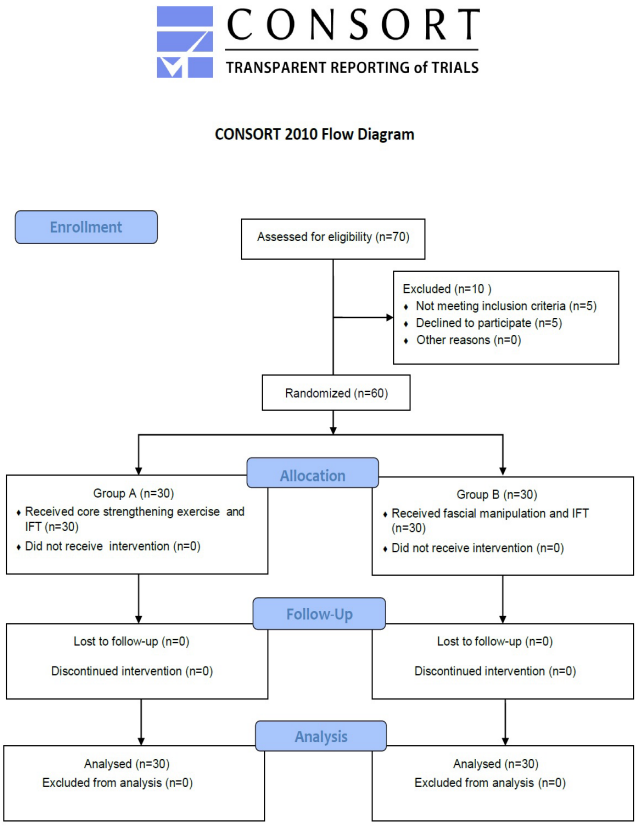
A single-blinded systematic randomized study was conducted at the outpatient unit in the physiotherapy department of Saveetha medical college and hospital. It is an experimental study design. The study was approved by the Institutional Ethical Committee (Ref: 026/08/2016/1EC/SU) of the Saveetha Institute of Medical and Technical Sciences. Seventy subjects with low back pain were evaluated from September 2016 to August 2017. Subjects aged between 25- 60 years and suffering from mechanical low back pain with complaints of lateral thigh pain were included in the study. Both male and female subjects were included in the study. Participants were excluded based on the criteria like severe trauma causing spinal fracture or injury to ligaments, history of spinal surgeries, deformities of the spine and lower limb, subjects with a history of osteoporosis, elderly with history of hip fracture, for example, prior history of cancer infection and subjects using prosthesis in the region of the spine and lower extremity.

The sample size was determined based on the prevalence rate by power analysis of 60% and 2 –tailed. Sixty subjects met the criteria. Written informed consent was obtained from all the subjects, and the procedure was explained to all participants by the principal investigator.

Randomization

Sixty subjects were enrolled for the study based on selection criteria. They were randomly allotted to two groups using a simple random method, where the principal investigator randomly allocated samples before baseline assessment. Before the interventions, the subjects were assessed for their pain level, using NPRS score, and range of motion (ROM) was assessed to find any restriction caused in the ROM of lumbar region due to fascial densification. The functional activities of daily life were assessed using the ODI scale. Control group subjects in Group A received conventional exercises, including core stability exercises. Experimental group subjects in Group B received Fascial manipulation to the lateral aspect of the thigh region in the lower limb. Both the groups received interferential therapy for 20 minutes as a part of conventional treatment for low back pain [13].

Figure 1: Participant flow diagram



Intervention

Participants in group A were taught conventional exercises including core strengthening

exercises to the lumbopelvic-hip complex, which include strengthening of transverse abdominus, hip abductor, and external rotators strengthening in side-lying and hip extensor strengthening in prone. Core strengthening exercises were individualized, focusing on isolated transverse abdominus is a drawing-in manoeuver in supine hook-lying position. (Fig .2)

The subjects were advised to perform the exercises at home (3 sets of 10 repetitions, and hold for 10 counts each), for 15 days was also provided [14].

Figure 2: Core strengthening exercise- transverse abdominus

Participants in Group B received fascial manipulation on the lateral aspect of the thigh region of the leg. Fascial manipulation (Fig 3) is a technique given at the points of densification on the lateral fascia of thigh using elbow or knuckles for a length of three minutes required for initial pain reaction to diminishing. The skin of the therapist's elbow adheres to the skin of the patient, hence the loose subcutaneous tissue moves together with the elbow, and friction is transmitted directly to the fascia. During the treatment, pressure applied by the therapist should be bearable for the patient; an appropriate distribution of the therapist's body weight is used when applying the technique. A change in the consistency of the densification is obtained within a few minutes [15]. Fascial manipulation was given 3 minutes for each densified points, six sessions, for 15 days.

Figure 3: Fascial Manipulation to lateral thigh region of the right leg

Outcome Measures

The outcome measures used were Numeric pain rating scale (NPRS) during baseline measurement as a pre-test and post-test measure to rate pain, Modified Schober's test (MST) was used to measure the flexion and extension Range of motion(ROM) of the lumbar spine during pre and post-treatment period as a measure of lumbar mobility, and Oswestry Disability Index (ODI) was used as a functional outcome measure to assess functional disability.

NPRS used for quantifying pain is an 11-point scale from 0-10, were 0 infers no pain and 10 indicating the most severe pain. Patients verbally select a value that infers their intensity of pain they felt in the last 24 hours [16]. For measurement of lumbar spine mobility using Modified Schober's Test (MST), the participant will stand erect while the lumbosacral junction marked as indicated by the dimples of Venus. The examiner will put a mark 5 cm below and 10 cm above the junction. The participant will be asked to bend forward as far as possible, and the stretched distance of these two points will be measured as the MST value [17]. To evaluate the functional outcome, Oswestry Disability Index (ODI) was used. This questionnaire has been prepared to give information as to how the low back pain or leg pain affects the activities in the daily living of the individual. The Oswestry questionnaire is a 10-items on which each item is scored from 0 to 5, with total scores ranging up to 50; higher values indicate severe pain. The first section is about pain, and the other sections deal with daily activities associated with relevant low back disability. The subjects were asked to choose and circle one number in each section, which closely described their problem. The Oswestry questionnaire was administered at the baseline and the end of the treatment session after 15 days. The Oswestry Disability Index (also known as the Oswestry Low Back Pain Disability Questionnaire) is considered as an essential tool to measure a subject's functional disability. The test is regarded as the 'gold standard' of low back functional outcome tools [18].

Statistical Analysis

The sample size was determined based on the prevalence rate by power analysis of 60% and 2 –tailed test. Data were analyzed using SPSS for window version 24 (SPSS Inc., Chicago, IL, USA).

A paired *t*-test was used to compare the pre-test and post values of NPRS, MST, and ODI within the group. The unpaired *t*-test was used to compare the difference between groups for all the outcome measures of NPRS, MST, and ODI values. The level of significance was $p< 0.05$.

RESULTS

Figure 1 shows the profile of the study. We assessed 70 subjects for inclusion and exclusion criteria. Sixty participants were selected and were grouped under group I as conventional group and group II fascial manipulation group.

The baseline characteristics such as age and gender of the subjects of both the groups are represented in Table 1. There was no significant difference between Groups A and B at the baseline assessment.

Table 1: Demographic characteristics

Demographic characteristics	Group A (30 subjects)	Group B (30 subjects)
Gender	14 Males 16 Females	10 Males 20 Females
Age in years	41.03 ± 8.6	41.03 ± 12.2

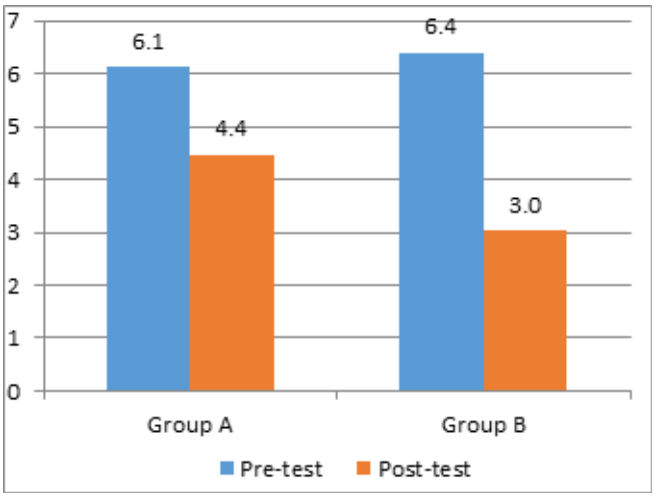
Table 2 shows the post-test values on NPRS, MST, and ODI of both the groups. A statistically significant difference was seen in both the groups in terms of change in pain intensity on NPRS, Range of motion on MST, and functional disability on ODI after corresponding treatment sessions ($p < 0.001$).

Table 2: Comparison of post-test values of NPRS, MST, ODI of Group A & Group B

Parameters	Post-test (Group A)		Post-test (Group B)		't' test value	'p' test value
	Mean	S.D	Mean	S.D		
NPRS	4.47	1.17	3.033	1.13	4.836	<0.001
MST flexion (cms)	4.9	.545	6.5	.812	8.922	<0.001
MST extension (cms)	3.1	.446	4.2	.597	3.305	<0.002
ODI in %	33.46	4.606	20.06	3.38285	12.841	<0.001

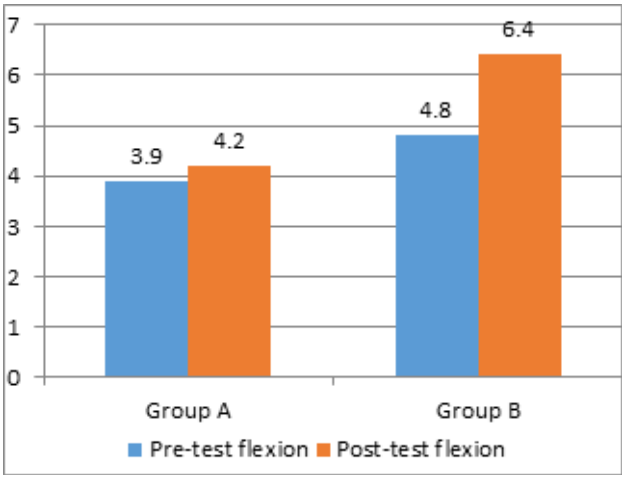
In the experimental group, the post-test values of NPRS and ODI scores are significantly less than that of the control group($p=0.001$). The MST values on ROM show significantly higher value in the experimental group are than the control group in both flexion and extension $p=0.001$. It proves that treatment with fascial manipulation had shown an improvement in the ROM of the lumbar spine, as shown in Table 2.

Graph 1: Comparison of pre-test and post-test NPRS values of Group A and Group B



Graph 1 shows the baseline scores of NPRS values of Group A are 6.1, and Group B is 6.4. The post-test NPRS scores of Group A and Group B are 4.4 and 3, respectively. Therefore, it shows it shows more of pain reduction of pain reduction in Group B Hence Group B that underwent Fascial Manipulation as treatment shows more pain reduction when compared to Group A, which underwent conventional treatment of core stability within the study period.

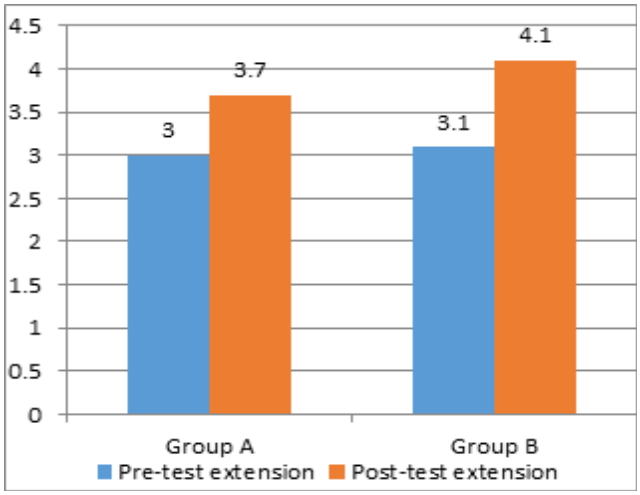
Graph 2: Modified schober's test –flexion range of motion



Comparison of Pre-test and Post-test values of Flexion Range of Motion of Group A and Group B

Graph 2 shows the mean post-test scores of the flexion range of motion of Group A and Group B are 4.8 and 6.4, respectively. The difference from the mean pre-test score is .9 and 2.2, respectively, for Group A and Group B. The difference in Group B is more significant than Group A. Therefore, Group B, which was given fascial manipulation, showed better improvement in flexion Range of motion than Group A, which was given a conventional treatment of exercises and Interferential therapy.

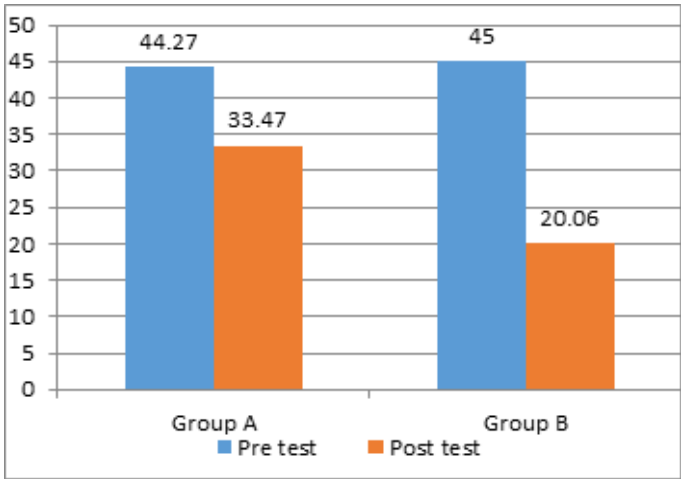
Graph 3: Modified schober's test – extension range of motion



Comparison of Pre-test and post-test values of Extension Range of Motion of Group A and Group B

Graph 3 shows that at baseline, the extension Range of motion of group A and Group B is 3 and 3.1, respectively. So, at baseline, the Modified Schober's test (MST) values of extension ROM is the same in Group A (Control group) and Group B(experimental group). Though improvement in the post test mean extension ROM values were found in both Group A and GROUP B, the post-test mean results of extension ROM of Group B is significantly better at $p<0.001$ compare to group A. Therefore group B which was given fascial manipulation showed significantly better improvement in extension ROM than group A which was given conventional exercises and interferential therapy.

Graph 4: Oswestry disability index



Comparison of pre-test and post-test ODI values of Group A and Group B

The above graph 4 shows the pre-test and post-test values of both groups. The baseline values of group A and group B were 44.27 and 45, respectively. Though improvement in the functional outcome is found in both groups, with a reduction in the post-test values of group A and group B to 33.47and 20.06 respectively, group B shows strong clinical significance in the improvement of functional outcome compared to group A.

Hence, fascial manipulation given to Group B shows statistically significant improvement in functional outcome of $p<0.001$ than conventional exercises, and interferential therapy is given to group A.

DISCUSSION

The objective of the current study is to analyze the effect of fascial manipulation on the lateral aspect of the thigh region in subjects with mechanical low back pain. This study demonstrates that fascial manipulation applied to subjects with low back pain in the experimental group has shown statistical significance and clinical improvement over conventional exercises given to subjects in the control group.

This is the first study to conduct fascial manipulation on subjects with acute low back pain on myofascial units(MFU) of lateral thigh region, which proved relief of densification, improved outcomes on pain, range of movement of the lumbar spine and functional abilities of daily living.

Fascial manipulation aims to restore the gliding property of fascia. In Fascial Manipulation, there are numerous fascial points when treated accurately that will restore the tensional balance. If the MFU is altered or densified, then it results in the non-physiological movement of the joints, causing pain in the joint [18]. Examination revealed reduced lumbar flexion and extension and rotation of the pelvis, which relates to the densification of myofascial units of the pelvis and that of hip la-cx and hence, fascial manipulation at these densified points causes friction and stretch of the densified point. A stretch of the fascia is caused by the insertion of the muscles on it, and its effect is transmitted in both proximal and distal directions.

Myofascial connections both within the myofascial unit (MFU) and between the myofascial unit (MFU) are accorded for immediate pain relief at the region distal to the origin of pain, which do not follow a neurological pathway.

The technique of fascial manipulation acts on the densified cc for a sufficient amount of time for friction against the fascia to produce heat [19]. Heat modifies the consistency of the ground substance and initiates the inflammatory process required for healing, and restores physiological elasticity. The increased temperature produced by the manual pressure modifies the dense fascia to fluid fascia, i.e., from a pathological state to a physiological state, thus enhancing the gliding property of fascia and pain relief. Fascial manipulation is given by the therapist using elbow or knuckle creates friction of the densification of the fascia. The therapist positions one hand on the plinth to regulate the body weight, and pressure is applied over the cc until the consistency of the fascia changes. The immediate relief of pain is also contributed towards the interfascial nerve endings, which slide more freely after the application of this manual pressure.

The fascial system is divided into many myofascial units (MFU), and each MFU consists of all motor units responsible for joint movement and the overlying fascia. The force generated by MFU concentrate at one point, which is the point of vector convergence of muscular forces called the center of coordination (CC), and each CC has an anatomical location. The tensor fascia lata of the thigh is attached above and behind, to the back of the sacrum and coccyx, and provides stability to pelvis. If the densification of CC occurs, then it will not adapt to the muscle spindle stretch. Only some of the muscular fibers within the MFU contract resulting in distorted traction on the sacroiliac joints.

The lateral fascial line is responsible for creating a movement of hip abduction, trunk flexion, and eversion of the foot. The tensor fascia lata is a part of the lateral fascial line. Hence, densification along the fascia lata can cause pain and dysfunction due to a shift in the lateral fascia line. The lateral fascial line is found to contribute towards the stability of the body, preventing excessive lateral shift and rotation.

The pathological manifestation of a dysfunction in a myofascial unit differs from individual to individual. But etiology is the only densification of CC. For densification, it is intended as the incapacity of the fascia to elongate and to accommodate tension that originates from underlying muscle fibers. It develops due to repeated inflammation (overuse) that causes an increase in the number of collagen fibers. Due to pain and abnormal posture, these fibers do not align along the physiological lines, as the thickness of the fascia increases, the gliding property of different layers decreases. The hyaluronic begins to entangle into different layers and thus decreasing the gliding property of fascia.

After treatment, there is an improvement in symptoms and reduction of pain. In this study, patients with sacroiliac joint dysfunction had signs of pain relief after their sixth sitting. Fascia is the only tissue that modifies its consistency when under stress, and that can regain its elasticity when subjected to manipulation [20]. This reason also contributes to immediate pain relief. The restoration of gliding property of the fascia had caused instant pain relief and restoration of improved range of motion.

In this study, subjects were not classified based on the duration of low back pain. We combined fascial manipulation to the lateral aspect of the thigh with Interferential therapy for six sessions. We found an immediate reduction of pain and improvement in ROM and functional abilities.

Possible reaction following fascial manipulation is local soreness formed due to the consequence of the inflammatory phase of the fascia with the arrival of neutrophils followed by macrophages, which is required to nourish and rebuild the loose connective tissue and collagen fibers that make up the fascia. Hence hot water fomentation is given as a precautionary measure to confront soreness.

Also, in this study, during movement assessment, restriction of range of motion of the lumbar spine was found, notably due to limitations in the MFU of lateral motion. Mostly, fascial alterations away from the painful area cause pain and restriction in the joint range. The deep fascia is composed of fibrous connective tissues and hence perfect for transmitting forces at a distance. The coupling between gluteus maximus and contralateral lattismus dorsi conducts the forces to the contralateral leg during gait and tense the tensor fascia lata. Hence, they gain importance during trunk rotation, providing stabilization of lower lumbar spine and sacroiliac joints. Fascial manipulation was given at a distant area, away from the area of symptoms in subjects with low back pain improves the range of motion of the lumbar spine and improves stability. The reason is that fascia is a structure of intricate network found throughout the body, and each area of the body is connected with other areas. Treatment of the symptoms rather than addressing the root cause will only cause the recurrence of the symptoms and further complications.

Hence in this study, subjects with acute low back pain were treated with fascial manipulation at the lateral thigh region without also intervening in the area of pain because the fascial structures in these areas caused abnormal pull on muscles, joints, and nerves causing pain and restricted range of motion. Hence fascial manipulation on these densifications of specific MFU relieved pain at the lumbar region and functional disabilities and improvement in the lumbar range of motion.

Most patients with low back pain were successfully treated with a core stability exercise program [21]. But, in a systemic study conducted by Mahmoud Ahmed, to compare the effect of core strengthening exercises with manual therapy provided low to moderate evidence in its effectiveness in resolving low back pain when compared

to manual therapy and other physical therapy approaches.

Micro Branchini et al., had previously used fascial manipulation technique to chronic low back pain patients versus manual therapy consisting of physiotherapy tailored exercises. The authors had followed the patients for four weeks, but it was unclear about specific regions where fascial manipulation was given [9].

Limitations of the study are that the study was done for a short period of 15 days . Many subjects experienced a significant reduction of pain but not complete pain relief. Hence an extended period of study is required. No follow was done. Future recommendations include extended period of study and a follow up of six months and planning treatment based on findings of thickness of fascia using ultrasound. Large number of subjects can be recommended for future study.

CONCLUSION

The current study shows that fascial manipulation and conventional exercises are beneficial in relieving pain and disability in subjects with mechanical low back pain. However, the fascial manipulation technique on lateral thigh region can be chosen over conventional exercises as it shows clinical and significant effect in decreasing pain and disability and improving the range of motion in subjects with mechanical low back pain.

Conflict of Interest

We declare that there is no conflict of interest.

Acknowledgments

We would like to express our gratitude to Saveetha Institute of Medical and Technical Sciences for extending their immense support for this research.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

REFERENCES

[1] AryaR.K. Low back pain – signs ,symptoms, and management .JIACM 2014;15(1):30-41

[2] Kumar, P.J. and Clark, M. Textbook of Clinical Medicine. 8th ed; 2002.

[3] MohdNazeer ,Surender M Rao, Simmi Soni, Ravinder M, Ramakranhi T,Syamala Bhupathi. Low back pain in South Indians: Causative Factors and preventive measures Sch. J. App. Med. Sci., 2015; 3(1D):234-243.

[4] Darlene Hartling, Randolph M.Kessler .Management of Common Musculoskeletal Disorders Physical therapy principle and method.3rd ed; 1996.

[5] Ober FR: The role of the iliotibial band and fascia lata as a factor in the causation of low- back disabilities and sciatica. J Bone Joint Surg 1936; 18:105-110.

[6] Benjamin M.The fascia of the limbs and back – a review J Anat. 2009 ; 214(1):1-18.

[7] Henry Gray. Anatomy of the Human Body.20th ed; 2000.

[8] Abu-Hijleh MF, Roshier AL, Al-Shboul Q, Dharap AS, Harris PF. The membranous layer of superficial fascia: evidence for its widespread distribution in the body. Surg Radiol Anat.2006;28(6):606-619.

[9] MicroBranchini, Francessca, Lopopolo, Ernesto Andreoli, Ivano Loreli, Aurelie M Marchand, Antonio Steeco. Fascial Manipulation for Chronic low back pain, a single blinded randomized controlled trial. F1000 RESEARCH 2016.4:1208

[10] Roman M, Chaudhry H, Bukiet B, Stecco A, Findley TW. Mathematical analysis of the flow of hyaluronic acid around fascia during manual therapy motions. J Am OsteopathAssoc.2013; 113(8):600-610.

[11] Stecco A, Gesi M, Stecco C, Stern R. Fascial Components of the Myofascial Pain Syndrome. Curr Pain Headache Rep. 2013 Aug; 17(8):352-9.

[12] Stecco C, Tiengo C, Stecco A, Porzionato A, Macchi V, Stern R, De Caro R. Fascia redefined: anatomical features and technical relevance in fascial flap surgery. Surg Radiol Anat. 2013; 35(5):369-76.

[13] OA Olawale, CM Agudzeamegah. The efficacy of interferential therapy and exercise therapy in the treatment of low back pain. Nigerian Journal of Experimental and Clinical Biosciences. 2014; 2(1):10-14.

[14] Allison GT.J Physiother. Abdominal muscle feed forward activation in patients with chronic low back pain is largely unaffected by 8 weeks of core stability training. 2012;58(3):200

[15] Varghese JG, Priya G. Role of fascia in human function. Research J. Pharm. and Tech. 2017; 10(8): 2759-2764.

[16] McCaffery, M., Beebe, A. Pain: Clinical manual for nursing practice, Mosby St. Louis, MO. 1989.

[17] Fairbank JCT, Couper J, Davies JB, O'Brian JP. The Oswestry low back pain disability questionnaire. Physiotherapy 1980; 66:271-3.

[18] Mu-Jung Kao, MD, Ting-I Han, MD, Ta-Shen Kuan, MD, MS, Yueh-Ling Hsieh, PhD, PT, Bai-Horng Su, MD, Chang-Zern Hong, MD. Myofascial Trigger Points in Early Life.2007 Feb; Arch Phys Med Rehabil (88):251-53.

[19] Stecco A, Gesi M, Stecco C, Stern R. Fascial components of the myofascial pain syndrome. Curr Pain Headache Rep. 2013 Aug;17(8):352.

[20] Day JA, Stecco C, Stecco A. Application of Fascial Manipulation technique in chronic shoulder pain--anatomical basis and clinical implications. J Body w Mov Ther. 2009 Apr;13(2):128-35.

[21] Shivalika, Apoorv Narain, Jagmohan Singh, Sabyasachi Bhowmik. To compare the effect of core stability exercises and Muscle Energy techniques on low back pain Patients. IOSR Journal of Sports and Physical Education.2013; 1(2):9-15.