IMMEDIATE EFFECT OF APPLICATION OF BILATERAL SELF MYO-FASCIAL RELEASE ON THE PLANTAR SURFACE OF THE FOOT ON HAMSTRING AND LUMBAR SPINE FLEXIBILITY: A QUASI EXPERIMENTAL STUDY

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ABSTRACT

Background: Flexibility is the ability to move a single or series of joints smoothly and easily through an unrestricted, pain-free range of motion. Decreased hamstring flexibility is considered to be a predisposing factor for lower back pain and injury. The purpose of the study was to see the immediate effect of a single session of self-myofascial release on plantar aspect of foot, on hamstring and lumbar spine flexibility.

Methodology: A Quasi experimental study was conducted on 30 subjects who were randomly allocated into 2 groups. Group A-self-myofascial release was given. Group B was a control group (no therapy).Baseline and post flexibility was assessed by sit-and-reach test (SRT) and Active Knee Extension (AKE) test.

Results: Within group analysis in group A showed significant difference in both AKE (right and left) scores and sit and reach scores ($p<0.05$).Within group analysis for group B also showed significant difference in AKE (right and left) scores and sit and reach scores($p<0.05$). Between group analysis for AKE (right and left) score showed significant difference ($p<0.05$).But there was no significant difference in between group analysis for sit and reach score ($p>0.05$).

Conclusion: A single session of SMR on bilateral plantar aspect of foot is effective in increasing hamstrings length, but there was no change seen in lumbar spine flexibility in young asymptomatic individuals.

Keywords: Self myofascial release; Anatomy trains; hamstring flexibility ,lumbar spine flexibility

INTRODUCTION

Flexibility is vital for all movements and changes in flexibility may cause abnormal loading of the musculoskeletal system which could lead to injury.[1]Maintaining hamstring and low back flexibility may prevent acute and chronic musculoskeletal injuries, low back problems, postural deviations, gait limitations and risk of fall.[2]

Flexibility may be hindered for a number of reasons, one of which is fascial restrictions. Fascia is connective tissue that surrounds muscles, nerves, blood vessels and connects structures of the body. Fascia can become restricted due to injury, disease, inactivity, or inflammation. These restrictions can decrease flexibility, strength, endurance, motor coordination and lead to high amounts of physical pain.[3]

A "schematic map" of the body's fascia connections, namely "anatomy trains" has been suggested and proposed that any tension at a particular part of an "anatomy train" may have detrimental effects resulting in global decreased flexibility. For example, issues related to the plantar fascia may be associated with tight hamstrings and lumbar lordosis. Anatomy trains concept joins individual muscles into functional complexes within fascial planes each with a defined anatomy and 'meaning' inhuman movement.The "anatomy train" suggested to be most related to lumbar spine and hamstrings is the superficial back line (SBL) through which muscles are connected by one neural system which passes through duramater. The SBL contains the plantar fascia and short toe flexors, muscle group triceps surae, hamstrings, sacrotuberous ligament, fascia of the sacrolumbar area, erector spinae, &epicranialfascia which extends and attaches to the supra orbital ridge on the anterior surface of the cranium.[4]

Myofascial therapies cover a numerous and varied spectrum of techniques, including osteopathic soft-tissue techniques, structural integration (Rolfing), massage including connective tissue massage (CTM), instrument assisted fascial release, myofascial trigger point therapy, strain-counter strain and muscle energy technique (MET).[5] Myofascial release (MFR) has been described as an umbrella term for a wide variety of manual therapy techniques in which pressure is applied to muscle and fascia.[6]

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Self myo-fascial release (SMR), works under the same principles as myofascial release and has been adapted to allow regular and frequent applications, without a therapist's intervention. The difference between the two techniques relates to the individual using their own body mass to exert pressure on the soft tissue as they roll over a tennis ball on the plantar aspect of the foot.[3,7]

There is a correlation between hamstring and lumbar spine flexibility, indicating some degree of connectivity.[8]The aim of the present study was to see the immediate effect of one session of bilateral self myo-fascial release on plantar aspect of foot of hamstring and lumbar spine flexibility.

MATERIALS AND METHODOLOGY

A quasi experimental study was conducted at the College of Physiotherapy, Ahmedabad for 4 weeks. Subjects, both males and females aged 18 to 25 years, lacking at least 25 degrees of active knee extension with the hip flexed to 90 degrees in both limbs, [9] were included in the study. Subjects having complaints of recent (within 3 months) soft tissue, bony, spinal or lower limb injuries, fibromyalgia or taken any manual therapy in the last 3 months and/or contraindications to myofascial release,or exhibited, hyper mobility as judged by the Beightonscore[10] were excluded from the study. Beighton score consists of a series of nine tests, with each test allocated a score of one point for successful completion. A score of four or more out of nine was used as a hyper mobility exclusion.[11]All subjects were asked to carry out the nine tasks, namely; place hands flat on the floor knees straight (1 point); extend or bend left and right elbows backwards (2 points); extend or bend left and right knee backwards (2 points); flex or bend your left and right thumb on to the front of the forearm (2 points) and extend or bend the left and right little finger at 90 degrees, towards the back of the hand (2 points).

A sit-and-reach box (SRB) was used in measuring for the sit-and-reach test (SRT), which has been recommended for use in measuring lumbar spine and hamstring flexibility. It was selected for use in the current study due to the unique ability to incorporate lumbar spine and hamstring flexibility simultaneously whilst tensioning the SBL. Three SRT measurements, held for 2 s each, were recorded and the average calculated as recommended by the American College of Sports Medicine.[12,13,14,15]

The Active Knee Extension (AKE) test can be used as an accurate tool for the assessment of Hamstrings muscle length. The subject lay in supine position with hips flexed 90^{o} and knee flexed. The testing was done on the right lower extremity and subsequently the left lower extremity and the pelvis were strapped down to the table for stabilization and control on accessory movements. Landmarks used to measure hip and knee range of motion were greater trochanter, lateral condyle of femur and the lateral malleolus which were marked by a skin permanent marker. The fulcrum of the goniometer was centred over the lateral condyle of femur with the proximal arm secured along the femur using greater trochanter as a reference. The distal arm was aligned with the lower leg. The hip and knee of the extremity being tested was placed into 90^{o} flexion. The subject was then asked to extend the testing lower extremity as far as possible until a stretch sensation was felt. A goniometer was used to measure the angle of knee flexion. Three readings were performed and an average of three was taken as the final reading. [9,16,17]

Using convenience sampling and random table method, 30 subjects were randomly divided in to two groups, group A (self myo-fascial release group) (n=15) and group B (control group) (n=15). The subjects were explained about the study. Informed consent was taken from all the subjects.

Self myo-fascial release (SMR) group: Participants were instructed to roll a tennis ball on the sole of each foot from behind the metatarsal heads to the heel concentrating on the medial arch for 4 min (2 min per foot), with as much pressure as they could, pushing into discomfort but not pain.[18]

Control group: In control group, participants were kept in the waiting period, they remained seated on an identical chair that was used for the intervention with supervision for 4 min in the same position as the SMR intervention group with both feet flat on the floor.

Post readings of control group were taken, after that they were given same session as SMR group. Pre and post intervention Sit and Reach Test [19] and Active Knee Extension Test [9] scores

Table 1 : Demographic data of subjects

Sample size	Mean age(years)	SD	M:F
30	21.70	1.118	3:27

Table 2: Comparison of sit and reach test scores within SMR and CONTROL groups

Groups	Mean ± SD (PRE)cm	Mean ± SD (POST)cm	Z Value	P Value
SMR	27.06±9.43	33.66± 9.46	3.432	0.001
Control	28.06± 6.97	28.66± 6.68	2.714	0.007

Table 3: Comparison of Active knee extension ROM within SMR and CONTROL groups

Groups	Mean ± SD PRE(degrees)	Mean ± SD POST(degrees)	Z Value	P Value
SMR	33.20 ± 7.45	20.46 ± 8.82	3.411	0.001
(Right/Left)	32.40 ± 7.56	21.80 ± 8.19	3.413	0.001
Control	29.26 ± 5.76	27.46 ± 6.57	3.088	0.002
(Right/Left)	28.66 ± 4.62	27.40 ± 4.83	3.272	0.001

Table 4: Comparison of Active knee extension and sit and reach scores between the groups

Outcome measures	Mean ±SD of SMR group	Mean± SD of control group	U value	P value
AKE (right)	20.46 ± 8.82	27.46 ±6.57	65.00	0.050
(left)	21.80 ±8.19	27.40 ±4.83	60.50	0.029
Sit and reach	33.66 ±9.46	28.66 ±6.68	79.50	0.17

were documented.

STATISTICAL ANALYSIS

Level of significance was kept at 5% .Within group analysis was done using Wilcoxon test and between group analysis was done using Mann Whitney U test.

RESULTS

Table 1 shows the demographic data of subjects. Table 2 shows comparison of sit and reach test scores within SMR and control groups which is shows significant difference.Table 3 shows comparison of Active knee extension ROM within SMR and control groups also shows significant difference .Table 4 shows comparison of Active knee extension and sit and reach scores between the groups, shows significant difference in AKE but not in sit and reach scores.

DISCUSSION

Within group analysis in group A showed significant difference in both AKE (right and left) scores and sit and reach scores ($p<0.05$). Within group analysis for group B also showed significant difference in AKE (right and left) scores and sit and reach scores ($p<0.05$). Between group analysis for AKE (right and left) scores showed significant difference ($p<0.05$). But there was no significant difference in between group analysis for sit and reach score ($p>0.05$). This are similar to findings by Sullivan K [3], Grieve R,[20], Roylance D.[26]

Grieve et al (2014), who investigated the effects of rolling a tennis ball underfoot found an increase in flexibility in hamstrings and lumbar spine despite using an unconventional tool.[20] Haeley K et al (2014) concluded that an FR(foam roller) is often advocated in clinical practice and by fitness professionals in fields such as yoga and sports.[21]

Ajimsha et al(2014) found that therapist initiated myofascial release (MFR), has been identified in increasing quadriceps and hamstrings ROM chronic lower back pain and plantar heel pain.[22,23,24]Grieve R et al (2013)studied the effect of self MTrP (myofascial trigger point) release in patients with triceps surae (calf) dysfunction focussing on MTrPs in the gastrocnemius and soleus using an FR in combination with a course of MTrP therapy [25].They concluded that a brief course of multimodal MTrP therapy would be helpful for some patients with sub-acute or chronic calf pain.

Roylance et al, 2013 did study on acute changes in joint range of motion using self-myofascial release (SMR), postural alignment exercises, and static stretches concluded that there was beneficial effects seen when SMR was combined with either postural alignment exercises or static stretching on hamstring and lumbarspine

flexibility. [26]The findings of this study do support the use of SMR in increasing hamstring ROM or flexibility using SRT(Sit and reach test) as an outcome measure [3,26] similar to present study.

An RCT, by Hyong and Kang in 2013 showed the positive effects of passive hamstring stretching exercises along the SBL on cervical spine range of motion and balance.[27] Kuruma H et al 2013 studied effects of myofascial release and stretching technique on range of motion and reaction time, concluded that Myofascial release (MFR), has been identified in increasing quadriceps and hamstrings ROM. [28]

The dose-response of the acute effects of SMFR on flexibility is also still unclear. Sullivan et al (2013) compared the effects of four different volumes of SMFR with a roller-massager (either 5-second or 10-second duration and either 1 or 2 sets) on sit-and-reach performance. There was a significant increase in all conditions but no significant difference between groups, which is consistent with the present study. [3]

It is hypothesized that during the rolling, direct and sweeping pressure is exerted on the soft tissue causing the fascia to stretch and increase ROM. Friction is also created during the rolling movement and this friction causes the fascia to increase in temperature and possibly change to a more fluid like state. This change in state allows for the breaking apart of fibrous adhesions between the different layers of the fascia and restores the soft tissue extensibility. [3]

In a systemic review (2015) by Chris B and Skarabot J found that SMFR does lead to increased joint ROM. This may make SMFR a viable alternative to static stretching prior to exercise, training or competition that requires increased flexibility. In addition, it has been reported that the time-course of effects appears to be limited to around 10 minutes. While the dose-response of effects on flexibility is unclear, most studies have found meaningful improvements with around 1 – 2 minutes of treatment. Precisely where it is applied may affect the resulting acute changes in flexibility but such effects may not always be predictable and the reasons for this are unknown.

The various potential mechanisms of massage, SMFR or MFR, reviewers have grouped fascia-specific mechanisms in different ways. Weerapong et al (2005) categorized possible effects of massage into four types: biomechanical, physiological, neurological and psychological. [29] Other reviewers have differentiated between two types: mechanical and neurophysiological. Mechanical mechanisms of SMFR include thixtrophy, piezoelectricity, fascial adhesions, cellular responses, fluid flow, fascial inflammation, and myofascial trigger points.[30]

Because of continuation of one neural system (i.e superficial back line), one needs to see whether additional effect is seen in hamstrings alone or in lumbar spine, hence two outcome measures were taken, for hamstring AKE and SRT for hamstring and lumbar spine both. No change was seen in sit and reach score in between group analysis. The SRT test position is comparable to a neurological tension test (slump test), which may place the SBL on stretch. The slump test can provoke neural pain of which tight muscle and fascia adhesions are often a causative factor, therefore participants SRT score may have been limited by lack of normal neural glide causing pain prior to reaching potential active ROM. [31]Also, as effect was seen only at end of one session, there may be not that much increase in flexibility of lumbar spine seen compared to hamstrings.

The significant increase in control group is seen, may be as the average of three readings were taken for the measurement. So because of the viscoelastic property of muscles “creep” can result in changes in muscles length after extended periods of strain. The majority of creep may occur within the first 15-20 s of stretch, with a high percentage in the first 0-10 s. Three measurement was taken, in SRT, which was held for 2 s and for AKE till stretch felt. Hence, after the multiple SRT and AKE measurements, this may be one explanation for increase in control group. [32]

Limitations of the study were that other myofascial therapy (technique) was not compared. No quantification of the pressure applied on the tennis ball was attempted and study was not be performed over a long time.

CONCLUSION

A single session of SMR on bilateral plantar aspect of foot is effective in increasing hamstrings length, but there was no change seen in lumbar spine flexibility in young asymptomatic individuals.

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