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RESEARCH ARTICLE

IMMEDIATE IMPACT OF MATRIX RHYTHM THERAPY ON HAMSTRING FLEXIBILITY IN FEMALE: A PILOT STUDY

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ABSTRACT

Purpose: Hamstring extensibility is of functional significance in prevention of locomotion related injuries. stretching is a typical component of its rehabilitation programs. Recently evolved, matrix therapy promotes extracellular matrix clearance on a cellular level thereby normalizing tension of the musculature. Hence, this study was done to compare the immediate impact of stretching compare with matrix rhythm therapy on hamstring flexibility in normal healthy females. In this experimental study 40 female subjects aged between 18-25 were recruited. After their prior consent, selection criteria included screening and assessment of hamstring tightness by active knee extension test($p>0.05$).Subjects fitting the study design were divided into 2 groups of 20 each who received either matrix therapy (Group A) or self stretching(Group B) for 3 times each within 3 weeks. On each leg matrix was given for 30 minutes whereas self stretching was repeated 6 times each with 30 secs hold. Pre and Post interventional ranges of both knee extension were measured after each session. Paired 't' test was used to analyze within group difference while independent 't' test was used for between group differences. ***Results:*** Significant improvement in hamstring flexibility was found post intervention compared to pre intervention in both the groups ($p<0.001$).However greater improvement in flexibility was seen in group A (Matrix rhythm) when compared to group B (self stretching). **Conclusion:** Based on the results, matrix therapy had an upper hand in improving hamstring flexibility than self stretching. matrix rhythm therapy can be used in the early rehabilitation of individuals with hamstring tightness.

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INTRODUCTION

Flexibility training is an integral component in the prevention and rehabilitation of injuries as well as a method of improving performance in daily activities and sports.[1] Evidence suggests that hamstring and fascia tightness is common in asymptomatic healthy individuals. The incidence of hamstring tightness is reported to be 27.50% in males and 45% in females. [2]Hamstring is one of the most common muscles prone to tightness especially in females. It is "the inability to extend the knee to less than 20 degrees of knee flexion with the femur held at 90 degree of hip flexion while the person is positioned in supine".[3]Various causes have been established for hamstring tightness. Some studies say that development of hamstring tightness can be due to genetic predisposition, injury to muscle or adaptive shortening due to some chronic condition. Pathological reasons leading to muscle tightness can be neural tension (tautness of the sciatic nerve supplying the muscle),faulty posture or overuse syndromes and hamstring trigger points.

Most commonly modern sedentary style of living is one of the main reason for postural abnormalities evident in society. The prolonged sitting hours required in most of the jobs and educational setups can affect flexibility of soft tissues, especially two joint muscles.[4] According to isometric length-tension relationship, when a muscle fiber is lengthened or shortened beyond optimal length, its ability to generate amount of active tension reduces.[3]Due to attachment of back extensor muscles on the pelvis, the posterior pelvic tilt puts these muscles into a lengthened position and makes them work harder. Constant pulling of the pelvis by the shortened hamstrings for a prolonged time, weakens the muscles in the low back causing sooner fatigue. Back extensor muscles with reduced endurance may over load the soft tissue and passive structures of spine leading to LBP. Tight hamstrings increase knee flexion, which induces prolonged forefoot loading and engages the windlass mechanism which in turn produces greater stress over the plantar fascia causing its inflammation[5].

When hamstring tightness surpasses borderline values, ankle dorsiflexion and lumbar lordosis decreases leading to postural deformities, there is a bending- forward deficit, discomfort when sitting (especially cross sitting), and a shambling gait.In older adults tight hamstrings can lead to reduced stride length and walking speed, which in turn can cause problems with dynamic balance.[6]Many treatment techniques are available for muscle tightness. To name a few are relaxation training, pilates, stretching, sub occipital inhibition and other medical interventions. A new dimension in the management of pain and restricted mobility is matrix rhythm therapy. Studies have shown that it has an effective role in significant reduction of shoulder pain and ROM in non-traumatic restricted movements of the shoulder. On the other hand, commonly used stretching techniques have also known to be effective in improving muscle length. However, very few studies have explored the effects of matrix rhythm therapy as a new clinical modality on flexibility. To see the response of tight musculature to matrix therapy is a current need. Therefore, to fulfill this demand the present study aimed to compare the effect of matrix rhythm therapy versus passive stretching on hamstring flexibility.

MATERIALS AND METHOD

This study was conducted among females aged between 18 to 25 years with a sample size of 40. Prior to participation, all participants were explained about the study and an informed consent was received from them. Participants were screened based on the inclusion and exclusion criteria. Inclusion criteria were: Normal healthy female individuals aged between 18 to 25 years, knee extension loss of more than 20 degrees due to hamstring tightness in bi lateral extremities, healthy female individuals with good quadriceps strength(MMT grade 4 or 5). Exclusion criteria were: Any previous trauma within the last 6 months, any surgery around the hip or knee, any history of LBP since the last 2 months, professional sport players. Included participants were screened using a validated self-designed questionnaire. Eligible participants were then randomized by lottery method.

METHOD

Pre and post measurements were taken by active knee extension test after each session of treatment and under the same testing procedures and environmental conditions. Both the groups received an intervention within a duration of 3 weeks. In each week 3 sessions of matrix therapy or self stretching were given in the respective groups on alternate days. Before each maneuver in both the groups, moist heat was given for 10 minutes over the hamstrings to relax the area. In group A matrix therapy was given for a total of nine sessions. Each session of matrix therapy was given for a duration of 30 minutes on alternate days.[7]Here the patient was in a prone position and any dry substance like powder which reduces friction was applied to the area before treatment. The head of the machine was moved in all directions rhythmically from proximal to distal covering the main areas of tightness or spasm with the vibrations directed from the tail towards the base of the head. Scooping action of the head from the tail towards the base was maintained with every stroke. Pressure was applied according to patient's tolerance, it also depended upon the amount of fat present. Similarly, in group B self stretching was given for total nine sessions.

Here the patient was in a supine position Bend one knee and bring it towards chest while keeping the other leg extended on the floor. Hands Grab the back of the thigh of the bent leg with both hands, just above the knee, and slowly extend the leg upwards toward the ceiling. The extremity to be stretched was supported on the therapist's arm or shoulder. The opposite extremity was extended and stabilized at the distal aspect of the thigh. With hip-knee flexion at 90 degrees, the knee was passively extended as far as possible. The terminal position of knee extension was defined as the point at which the subject complained of a feeling of discomfort or tightness in the hamstring muscles or the therapist perceived resistance to stretch. This was done with a duration of 30 second hold. For every session two sets of three repetitions (total 6) was given in each leg.[3]

STATISTICAL ANALYSIS

Data was analyzed using WINPEPI software for windows version 4: 2001. Shapiro Wilk test was used to analyze normality of baseline values. (Normality value for Group A was 0.36 and for Group B was 0.32). Pre values of both the groups was analyzed by Independent T-test which showed that groups were comparable i.e. there was no significant statistical difference. P value for right extremity of Group A & B was 0.067 and p value for left extremity of Group A & B was 0.875.Paired t-test was used to analyze within group difference (Pre & Post) whereas the independent t-test was used to analyze between group difference (Group A & Group B).The level of significance was set at $P<0.05$(- level at power of 80%).

RESULTS

Results showed an increase in the post mean in all the subjects for bi lateral extremities within Group A and this difference was found to be statistically significant ($p<0.001$) (refer table 3). Increase in the post mean was also seen within Group B in all the subjects for bi lateral extremities and this difference was also found to be statistically significant ($p<0.001$) (refer table 4). Post- interventional mean values between Group A (matrix) and Group B (passive stretching) showed significant improvement in ROM, which was more in the matrix group as compared to the stretching group.($p<0.001$) (refer tables 1 and 2). The Mean age for Group A was 21.8 yrs and for Group B was 22.8 yrs.

DISCUSSION

This study was conducted with an aim to compare the effect of matrix rhythm therapy versus self stretching on hamstring flexibility in normal healthy female individuals. 40 females were recruited in the study who received either matrix rhythm therapy or passive stretching over nine sessions for a period of three weeks. Group A showed significant result in improving hamstring flexibility. Post intervention analysis showed a mean difference of 21.73 and 22.46 degrees on the right and left extremities respectively($p<0.001$). Physiologically stating, these changes can be attributed to the re-synchronization of cells into their normal oscillatory rhythm.[7]According to the Principle of Matrix, a healthy musculature always synchronizes itself between a frequency of 8-12 Hz which has been found with the help of piezo electric sensors.

Table 1. Between Group A and B comparison of knee extension ranges for right extremity pre and post intervention (Independent t-test)

	Group A		Group B		N	Std Dev	t value/p value
Right Extremity (ROM in degrees)	Pre Mean	Post Mean	Pre Mean	Post Mean	15	6.681(Group A)	t = 3.209
	36.46°	58.2°	31.06°	46.4°		3 (Group B)	p = 0.003

Table 2. Between Group A and B comparison for left extremity pre and post intervention (Independent t-test)

	Group A		Group B		N	Std Dev	t value/p value
Left Extremity (ROM in degrees)	Pre Mean	Post Mean	Pre Mean	Post Mean	15	8.518(Group A)	t= 4.032
	35.73°	58.4°	36.13°	49.66°		3.739(Group B)	p<0.001

Table 3. Mean difference of pre to post active knee extension ranges of right and left extremities within Group A (Paired t test)

	Right (Degree)	Left (Degree)	N	Std Dev		t value/p value	
Group A				RIGHT	LEFT	RIGHT	LEFT
(Mean difference of pre to post)	21.73°	22.46°	15	6.681	8.958	t = -12.361 p <0.001	t =-9.204 p <0.001

Table 4. Mean difference of pre to post active knee extension ranges of right and left extremities within Group B (Paired t test)

	Right (Degree)	Left (Degree)	N	Std Dev		t value/p value	
Group B				RIGHT	LEFT	RIGHT	LEFT
(Mean difference of pre to post)	15°	13.53°	15	3.266	5.11	t =-21.349 p <0.001	t = -12.386 p <0.001

This internal rhythm of cells concerns the partial pressure of oxygen in cell medium which is decisive for ATP regeneration and energy balance of the cell. It is important to achieve a correct acid- base ratio for the proper functioning of cells which depends upon the metabolism of the cell(supply of oxygen) and upon the ion gradients of the semi permeable membrane.[7] Degradation of cell logistics causes the ECM fluid to become more acidic leading to deficiency of ATP causing difficulty in muscle re-polarization which is the actual energy consuming process. Thereby, hindering ability of the muscle to stretch. A study by Dhamane P et al showed significant improvements in pain and ROM in degenerative post traumatic conditions of the knee. In the same context, Dr. Randoll, the inventor of matrix has stated that the model of energy crisis is the most plausible physiological explanation for myofascial and myotendinous pain syndromes.[8] Mechanically,the Matrix Mobil is a rod with a spiral shaped vibration head and an oscillating electromagnetic field induced by permanent magnets mounted in it. Therapeutic application of matrix generates a rhythmic micro stretching of the tissues along the propagation of waves in the cells. This has an effect on the acceleration or stretch sensitive muscle spindle apparatus and pressure sensitive Golgi tendon apparatus self stretching on the other hand also showed a significant improvement on hamstring flexibility. In the analysis, mean difference showed an improvement of 15 and 13.3 degree on the right and left extremities respectively($p<0.001$).[9]Here the muscle's response to tensile force is rate and time dependent.[3]The changes due to stretching can be attributed to this viscoelastic property that occurs with creep in the elastic region. stretch exerts both longitudinal and lateral force transduction,wherein there is tissue re-modelling and plastic deformation of the fibres allowing the filaments to slide apart and the sarcomeres to relax and lengthen. If a muscle is held in a lengthened position for a long period of time,it adapts by increasing the number of sarcomeres in series causing greater functional overlap of actin and myosin leading to a permanent /plastic form of the muscle provided newly gained length is maintained on a regular basis.[3] Proske and Morgan studied viscoelastic properties of muscles and said that the gain in ROM may also be due to a decrease in inter-filament spacing and increased myofilament calcium sensitivity leading to the formation of newer and stronger cross-bridges.[10] Holding stretches for 20 to 30 seconds is a good standard because most of the stress relaxation in a passive stretch occurs in the first 20 seconds.[11] The stretch reflex is more likely to be activated during a quick stretch to the muscle.[3] Knudson D studied the biomechanical effects of stretching and stated that according to sensory theory ROM improvements may also be due to an increase in stretch and pain tolerance found with static stretching rather than actual mechanical increase in the muscle length[11]. However, Duong et al stated that viscous deformation is only transient and dissipates shortly after the removal of the stretch[12].So self stretching is one of the techniques to maintain flexibility and length of the muscle tissue. Within group comparison showed that both the treatment methods were significant in improving hamstring flexibility but matrix therapy showed highly appreciable results both statistically and clinically. To explain the same, elasticity and plasticity of muscle are directly connected with oscillations of the individual cell. Energy transmission at 8-12 Hz allows ECM clearance. Release of cross links between myosin and actin depends on the physiochemical quality of ECM.

Matrix therapy releases tightness by normalization of tension of the musculature and target relaxation of the local muscular spasm.[7] Similarly, this experimental study showed better results with matrix therapy on hamstring flexibility when compared with self stretching. This electrotherapeutic modality will help in early rehabilitation of athletes and in individuals having hamstring tightness stating that it can be efficiently addressed in our treatment protocols. Passive stretching being a manual technique requires good amount of stabilization and external force, it thus demands more therapist effort and may

not be able to serve the purpose of improving flexibility in cases like LBP or lower extremity injuries/trauma where stretching may aggravate the acute condition[13].Matrix on the other hand is therapist friendly and requires less manual effort which adds more to its benefit. Matrix therapy has negligible contraindications, whereas self stretching has many limitations when it comes to certain medical conditions. Stretching works on muscle tendon unit and reflex zones to obtain flexibility of the muscle fibers, whereas matrix rhythm therapy works on the entire belly of the muscle across its whole cross sectional area. Hence, to obtain credible effects it is clearly essential to exploit the natural vibrations of the body which can be done by Matrix Rhythm Therapy. However long term effect is a matter of concern and needs to be evaluated. Small sample size and follow up is crucial and needs to be considered.

LIMITATION

There was no follow up done for this study. Hence the long term effects of ROM gains with matrix rhythm therapy or self stretching is not clear. Future double blinded studies can be conducted with a larger computer generated sample size.

CONCLUSION

The present study accepts the alternate hypothesis. Matrix rhythm therapy has an upper hand in improving hamstring flexibility when compared to self stretching.

Clinical Significance: This study is therefore useful for the faster rehabilitation of muscle tightness and musculoskeletal imbalances.

Conflict of Interest: There is no conflict of interest.

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