Effect of Hand-Held Percussion Massage vs Instrument Assisted Soft Tissue Mobilization on Hamstring Muscle Flexibility in Young Adults -Randomised Clinical Trial

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Abstract: Background: Flexibility is regarded as a necessary component of normal biomechanical function. Tight hamstrings put an individual into risk of recurrent injury. The prevalence of hamstring tightness is very high in college going students among the age group of 18-25years. Hamstring tightness is not only a cause of limited range of motion, but it can also lead to a variety of other musculoskeletal issues. One of the most common complaints associated with hamstring tightness is hamstring strain. **Objectives**: To compare the effect of hand-held percussive massage versus instrument assisted soft tissue mobilization(IASTM) on hamstring muscle flexibility in young adults. **Methods and Materials**: The study was conducted on 100 subjects aged between 19-29 years of all genders, in which the subjects were divided in two groups namely, group-A and group-B which received treatment with hand-held percussive massage and IASTM respectively. The outcome measures i.e., Sit and reach test, active knee extension test and passive knee extension test were performed prior and post 1st session and post 6 sessions of intervention. **Results**: This study resulted that both the groups showed improvement, but active knee extension was found to be significant in parameters of outcome measures in accordance with the group-B who received treatment with IASTM compared to another group. **Conclusion**: The present study concludes that the interventions given to group A and B using hand-held percussive massage and IASTM respectively, both were found equally effective. Whereas, group-B was more effective than group-A in term of active knee extension test and passive knee extension test.

Keywords: Hand-held percussive massage, Instrument assisted soft tissue mobilization (IASTM), Hamstring flexibility.

Introduction:

The hamstring muscles are a group of hip extensors located at the posterior aspect of the thigh. With hip extensor as a secondary action, its principal movement is knee flexion. This muscle group is essential for everyday tasks including sprinting, jumping, climbing stairs, and maintaining proper posture. Hip and knee movement is impacted or hindered when these muscles shorten or tighten. When the hip is flexed to 90 degrees and there is pain and discomfort, the tightness is evident when the knee cannot fully extend[1].

Hamstring tightness is characterized by the muscle's impaired capacity to deform. Asymptomatic hamstring tightness is typical and does not cause any conditions, thus it frequently goes untreated. Symptomatic hamstring tightness can lead to structural issues like flat back, low back pain, patella femoral discomfort, and plantar fasciitis [2,3].

Younger generations are more likely to have tight hamstring muscles due to a sedentary lifestyle. Due to a lack of daily stretching activity, healthy young individuals have a higher risk of developing tight hamstrings [4].

Massage involves rhythmically pressing and stroking the body's tissues. It is believed that massage is effective. Increased blood flow, neurological stimulation, less muscle tension, and improved wellbeing are all results of massage [5,6]. The IASTM technique focuses on ailments associated with musculoskeletal disease and its function in regenerating soft tissues. When IASTM equipment is used to deliver stimulus to soft tissue, connective tissue remodelling is stimulated. This results in the resorption of fibroblasts and scar tissues, the breakdown of adhesions and fascial limitations, and the restoration of normal function surrounding the structures. Various tools, such as the M2T Blade, Edge Tool, Jade Stone, Graston Tool, GuaSha, Hawk Grips, Rock Grips, Rock Tapes, etc., are used during IASTM [7,6]

In addition to vibration therapy, hand-held percussion devices (Hypervolt, TheragunHyperice) provides conventional massage [1]. Vibration therapy has been shown to be useful in boosting muscle power, range of motion, performance, blood flow, and balance [1]. From a few Hz to 53 Hz, this gadget offers various attachment heads depending on the bone tissue or soft tissue[8]. Hand-held percussive massage gun provides back and forth oscillation movements. The current study intended to compare the effect of hand-held percussive massage versus IASTM on hamstring flexibility in young adult using sit and reach test , active knee extension test (AKE) and passive knee extension test.

Materials and Methods:

Procedure

For this interventional study ethical clearance was obtained from Institutional Ethical Committee. The purpose and procedure of the study was well explained and written informed consent was taken from 100 subjects included in the study, which were divided further into 2 equal groups. The subjects with any recent lower limb or spine fractures, neurological disorders, history of back pain or cardiac pacemaker and pregnant women were excluded from the study.

Outcome Measures:

Hamstring tightness in each subject was measured using sit and reach test with measuring tape , active knee extension test and passive knee extension test by universal goniometer.

Intervention:

In Group-A: The participants were in prone lying position with their posterior part of the thigh exposed for the intervention. The intervention was then given using the hand-held percussive device for 5 minutes on each leg. The vibration were given deeper to the muscle as per the tolerance of the participant by moving the device longitudinally, covering the hamstring muscle.

In Group-B: in this group intervention was given using (IASTM) technique for 5 minutes on each leg. The M²T blade was held in direction of (push/pull) with 45°of angle maintained throughout the procedure and the strokes were given using electrophoresis gel as a medium.

Results : The interventions for both group-A and group-B were given for alternate 6 days i.e., 6sessions. The ranges were measured pre and post 1st session to observe the immediate effect and also post 6 sessions to observe the effect of post 6 sessions.

Statistical Analysis:
The statistical analysis was done by using Statistical Package of Social Sciences (SPSS) of 23 version, so as to verify the results. This is the reason for which 100 participants having diagnosed with hamstring tightness were selected and included in the study by randomized chit method and were divided equally in 2 groups accordingly. The protocol was provided to participants which was of alternate 6 sessions. Different statistical measures, such as mean standard deviation and the test for significance such as paired sample 't-test' were used. Data was procured using the outcome measures among the Group-A and Group-B (Table-1), were analysed using

Kolmogorov- Smirnov test. Further comparison of pre-post Intervention outcome measures within the groups were done for all the outcome measures. It was found that sit and reach test for group A and B[Fig-1], active knee extension test for group A and B table passive knee extension test [Fig-2] done for both right and left leg was significant for both groups. But group B was found to be much better than group - A .

Normality Test [Table 1]

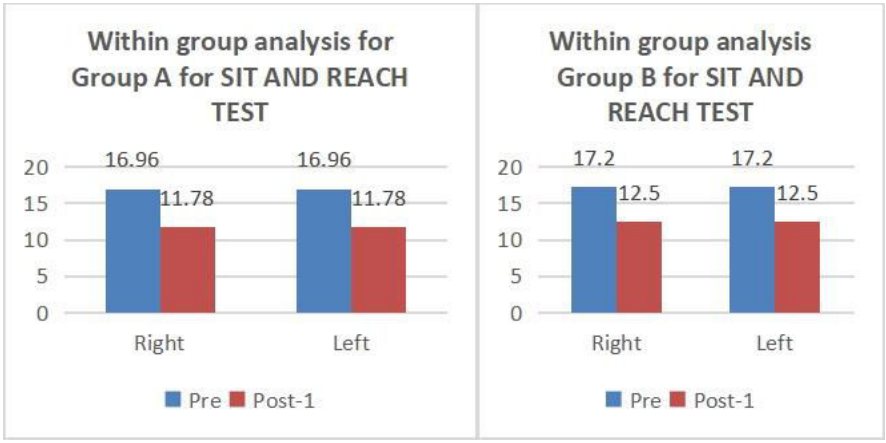
Variable	Time frame	Side	Group A		Group B	
			z-value	p-value	z-value	p-value
Sit And Reach Test	Pre	Right	0.074	0.200	0.111	0.165
	Immediately		0.117	0.086	0.093	0.200
	Post		0.127	0.060	0.129	0.051
	Pre	Left	0.074	0.200	0.111	0.165
	Immediately		0.117	0.086	0.093	0.200
	Post		0.127	0.060	0.129	0.051
Active Knee Extension Test	Pre	Right	0.115	0.096	0.139	0.050
	Immediately		0.105	0.200	0.135	0.054
	Post		0.118	0.079	0.161	0.002
	Pre	Left	0.096	0.200	0.132	0.050
	Immediately		0.090	0.200	0.132	0.052
	Post		0.134	0.051	0.124	0.054
Passive Knee Extension Test	Pre	Right	0.136	0.054	0.125	0.056
	Immediately		0.084	0.200	0.125	0.052
	Post		0.133	0.052	0.124	0.051
	Pre	Left	0.113	0.151	0.126	0.054
	Immediately		0.091	0.200	0.124	0.057
	Post		0.133	0.051	0.125	0.053

Since the data set in respective groups are normally distributed as per the Kolmogorov-Smirnova test outcome so the researcher shall apply parametric test for data analysis purpose.

Fig- 1 -Within group analysis for Group A for Sit and Reach Test pre (1st session) and post (6th session)

Post 1st Session

1. 2.



Post 6 Sessions

3. 4.

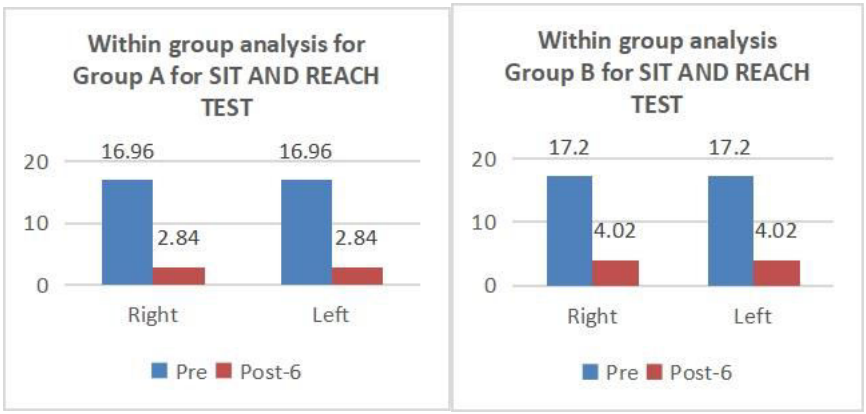
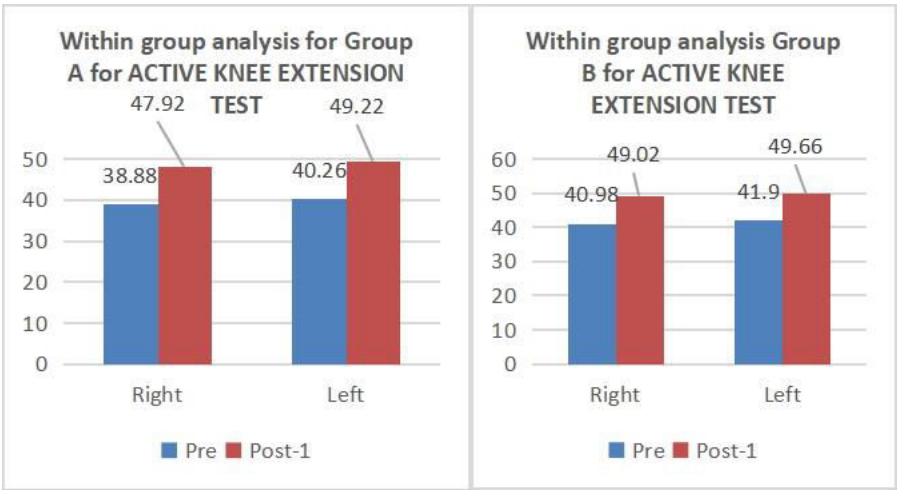


Fig- 2 - Within group analysis for Group A for Active Knee Extension test pre (1st session) and post (6th session)

Post 1st Session

5. 6.



Post 6 Sessions

7. 8.

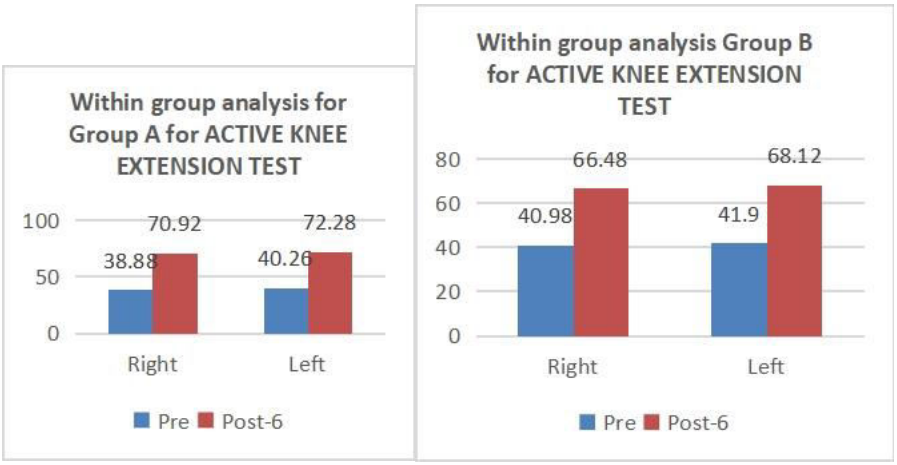
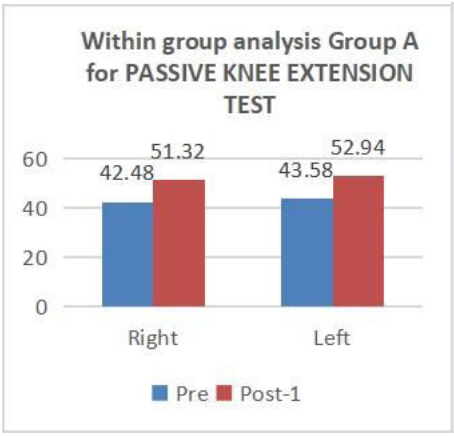


Fig-3- Within group analysis for Group A for Passive Knee Extension Test pre (1st session) and post (6th session)

Post 1st Session

9.



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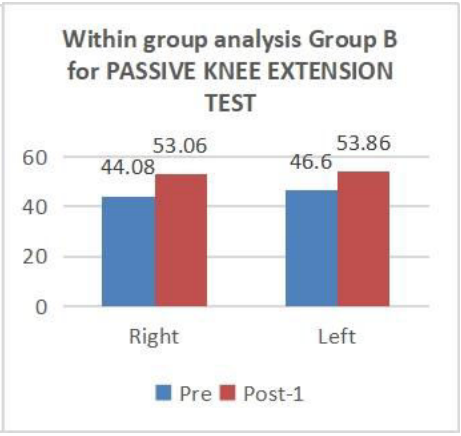
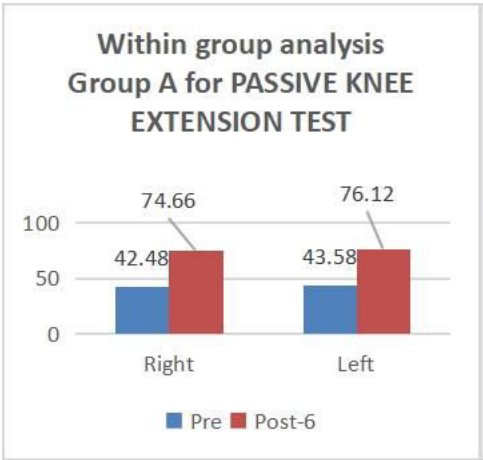


Post 6 Sessions

11.



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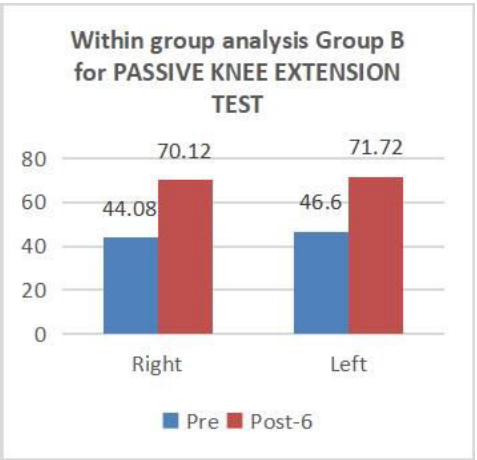

Table 2 - Between group independent samples t test

Variable	Time frame	Side	Group	Mean	SD	t-value	p-value
Sit and Reach Test	Pre	Right	Group-A	16.96	4.02	-0.274	0.785
			Group-B	17.20	4.71		
	Post 1		Group-A	11.78	4.03	-0.797	0.427
			Group-B	12.50	4.95		
	Post 2		Group-A	2.84	2.42	-1.883	0.063
			Group-B	4.02	3.71		
	Pre	Left	Group-A	16.96	4.02	-0.274	0.785
			Group-B	17.20	4.71		
	Post 1		Group-A	11.78	4.03	-0.797	0.427
			Group-B	12.50	4.95		
	Post 2		Group-A	2.84	2.42	-1.883	0.063
			Group-B	4.02	3.71		
Active Knee Extension Test	Pre	Right	Group-A	38.88	8.09	-1.443	0.152
			Group-B	40.98	6.37		
	Post 1		Group-A	47.92	8.64	-0.716	0.476
			Group-B	49.02	6.59		
	Post 2		Group-A	70.92	6.66	3.803	0.001*
			Group-B	66.48	4.88		
	Pre	Left	Group-A	40.26	7.18	-1.199	0.233
			Group-B	41.90	6.48		
	Post 1		Group-A	49.22	7.34	-0.325	0.746
			Group-B	49.66	6.15		
	Post 2		Group-A	72.28	7.11	3.273	0.001*
			Group-B	68.12	5.49		
Passive Knee Extension Test	Pre	Right	Group-A	42.48	8.04	-1.110	0.270
			Group-B	44.08	6.27		
	Post 1		Group-A	51.32	8.05	-1.190	0.237
			Group-B	53.06	6.49		
	Post 2		Group-A	74.66	6.61	3.786	0.001*
			Group-B	70.12	5.31		
	Pre	Left	Group-A	43.58	7.17	-2.212	0.029*
			Group-B	46.60	6.46		
	Post 1		Group-A	52.94	6.81	-0.710	0.479
			Group-B	53.86	6.12		
	Post 2		Group-A	76.12	7.18	3.439	0.001*
			Group-B	71.72	5.50		

Discussion:

The present study was conducted with a purpose to compare the Effect Of Hand-Held Percussion Massage Vs Instrument Assisted Soft Tissue Mobilization On Hamstring Muscle Flexibility In Young Adults -A Randomized Clinical Trial for 6 alternate days in terms of hamstring flexibility.

In this study 100 subjects of age group of 19-29 years were included and were divided into 2 groups each group consisting of 50 members. Group-A consisted of 44 females and 6 males which were given hand-held percussive massage and group-B consisted of 33 females and 17 males who were given instrument assisted soft tissue mobilization (IASTM).With hypothesis, an increase in hamstring flexibility in terms of range of motion was found in both the legs when compared pre and post 1st session and post 6 sessions, there was significant difference between the 2 groups and group-B who received intervention by instrument assisted soft tissue mobilization was found to be more beneficial.

Hamstring tightness is mainly caused when the muscle is unable to deform completely and on the other hand it is also the result of inadequate physical activities which later makes the individual prone to stiffness, osteoporosis and osteoarthritis like conditions. All these will further lead to shortened muscle which further leads to reduced movement at hip and knee. This lack of flexibility may be the end result of myofascial adhesions. Prolonged tightness results into low back pain. There was a study conducted through which revealed the high prevalence of hamstring tightness in college going students among the age group of 18-25years with the active knee extension angle between 30^{o}-45^{o} [9] Restricted movement caused due to the adhesions should be released using instrument assisted soft tissue mobilization(IASTM) technique that indicates improvement in hamstring flexibility according to the literature [9,7,8].

There was a study carried out for duration of 1-2 sessions per week for weeks, to know the therapeutic effectiveness of IASTM for soft tissue injury, in which IASTM given post warm-up exercise of 10-15 minutes and hot pack for 40-120 seconds was found to effective in concern with injuries to tendons rather than muscles or ligaments[6]. But in the present study conducted, IASTM benefitted more in comparison with hand-held percussive massage which was given for shorter duration of 5minutes on each leg for 6 alternate days and with no warm-up exercises provided in concern with hamstring muscle flexibility when compared to the above study.

There was a study conducted in elderly patients among the age group of 65-75years, which compared static stretching and foam roller technique with M²T blade for relieving hamstring tightness which revealed the use of M²T blade given for 5 minutes was to more effective than other techniques used[5]. But in the present study conducted IASTM was found better even in young adults when given for same duration of 5minutes on each leg.

A study was carried out in 2020 which compared the effects on hamstring flexibility of IASTM technique given for 1-2 minutes with vibration massage or light hand massage given for 2-7 minutes which then concluded saying that all the 3 interventions showed the signs of improvement with increase in range of motion and good flexibility of the hamstring muscle being positively effective when given IASTM technique in shorter duration of time than in contrast to gentle hand massage or vibration massage. As this study lacked in finding out the difference between the groups or within the groups, further study was required. It included a study done in 2017 by Eidd et al.,2017 which reported that 10 minutes of IASTM applied either on trunk or on hamstring along superficial back line including the fascia connecting from scalp, neck extensors, back extensors, hamstring, calves, achilles and fascia under the foot increased hamstring flexibility. This was caused by increased blood flow, the flow of interstitial fluid into the bloodstream via dilated blood vessels, and thixotropic tissue alterations, which had a neurological inhibitory effect on the central nervous system. According to the study done by Kim and Yim in 2018 it was also found to be an important part in warm-up/ cool down part of exercises, which also helped in increasing the range of motion of healthy male soccer players on a longer interval basis. Therefore, it resulted IASTM to be more effective even in shorter duration of time of application and providing good effects in short-term. In accordance with the study carried out by Poppendieck et al., 2016 a meta- analysis was done on massage being effective in general and tendency when given in shorter duration between 5 to 12 minutes had a great and better effect when compared to the sessions of longer duration (more than 12 minutes)[8].

In a study done in 2021 stated that the hand-held percussive massage devices are more effective in increasing the range of motion of the lower limb as compared to the foam rolls and other self-myofascial release protocols. However, in our study it was seen that participants in group-B who received IASTM by M²T blade was effective in releasing the adhesions in both male and female participants respectively. It was also seen to significantly increase hamstring flexibility in terms of range of motion[10].

Scope of the Study:

As this study was done in young adults within the age group of 19-29 years , further studies can be done in athletics population within the same age group. Future studies can be carried out using same intervention with other outcome measures as well, to know the effectiveness of the interventions used, hence overcoming the limitations of the study.

Conclusion:

The present study concludes that the interventions given to group A and B using hand-held percussive massage and instrument assisted soft tissue mobilization(IASTM) respectively, both were found equally effective. Whereas, group-B was more effective than group-A in term of active knee extension test and passive knee extension test.

Clinical trial register no. - **CTRI/2022/09/045907**
Conflicts of interest- There is no conflict of interest

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