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Immediate Effect Of Active Release Technique Versus Percussive Therapy By Massage Gun On Hamstring Muscle Tightness Among Young Adults

Dr Shruti Wani[1], Dr.Gira Thakrar[2]

[1]1st year MPT Student, [2]PhD,Senior Lecturer,

JG College Of Physiotherapy,Gujarat University,Ahmedabad,India

Abstract:

Introduction

Hamstring flexibility is crucial for good posture and movement. Tight hamstrings, often caused by prolonged sitting, can lead to stiffness, reduced range of motion, and pain in the lower back, pelvis, knees, and feet. Research shows that up to 40% of college students experience hamstring tightness.

This study examines the immediate effects of Percussive Therapy (PT) and Active Release Technique (ART) on hamstring flexibility in young adults. ART, developed by Dr. Leahy, breaks tissue adhesions to relieve muscle tightness. PT, using a massage gun, loosens muscles, boosts blood flow, and improves flexibility. Research suggests PT can increase range of motion (ROM) without affecting muscle performance.

Objective

To compare the immediate effects of PT and ART on hamstring tightness in young adults and determine the more effective method for improving flexibility and mobility.

Method

This experimental study used simple random sampling to select 30 participants (ages 18–30). They were divided into two groups:

- **Group A (n=15):** Received Percussive Therapy (PT)
- **Group B (n=15):** Received Active Release Technique (ART)

Hamstring tightness was assessed before and after intervention using the Active Knee Extension Test (AKET).

Results

The findings reveal that although both **Percussive Therapy** and **Active Release Technique** are effective in reducing hamstring muscle tightness and enhancing flexibility acutely, **ART demonstrated a significantly greater improvement** compared to PT. The statistically significant outcomes—both within and between groups—highlight the immediate therapeutic benefit of ART over PT in the treatment of hamstring muscle tightness in young adults.

Conclusion

PT and ART effectively reduce hamstring tightness and improve knee extension. However, ART was significantly more effective in increasing hamstring flexibility and range of motion.

Index Terms - Active release technique,percussive therapy,hamstring tightness,Young adults

INTRODUCTION

Hamstring muscles are the primary muscles responsible for flexion of the knee and play a significant role in the normal performance of functional activities. Hamstring muscle tightness is present in all age group populations and increases with age.[1]The hamstrings comprise three large muscles, namely semitendinosus, semimembranosus, and biceps femoris, which originate from the ischial tuberosity. They are located in the posterior compartment of the thigh and span the hip and knee joints. Hence, they are extensors of the hip and flexors of the knee.[4]

Muscle tightness usually results from inadequate or improper rehabilitation following sustained muscle injury or low levels of physical activity in individuals.[2] It could make the musculotendinous unit more susceptible to injury, increase resistance to various anatomical structures, which may lead to overuse syndrome.[3] It could also lead to some pathological conditions at the joint on which the muscle acts, especially on a muscle like the hamstrings, which passes over two joints.[5] Inability to extend the knee completely when the hip is flexed, accompanied by discomfort or pain along the posterior thigh and/or knee, is usually attributed to hamstring muscle tightness.[5] The progressive decline in flexibility with age has been attributed to changes in elasticity and decreased levels of physical activity.[6,7]

Muscle tightness is caused by sedentary lifestyle and inadequate or low levels of physical activity, which leads to a decrease in the ability of the muscle to deform, resulting in reduced range of motion at the joint on which it acts. It could make the musculotendinous unit more susceptible to injury, increase resistance to various anatomical structures, and lead to overuse syndrome. The shortening of hamstrings occurs in those who spend a lot of time sitting, and if they are constantly held in a position that tends to shorten them, they become adjusted to that position. If these people stand with hips and knees fully extended, this will cause both direct pain in the immediate area and referred pain in the low back.

Many people suffer with tight hamstrings, and most of the time it does not cause a problem, but they can be more prone to tear and also limit activity. Tight hamstrings can also be responsible for postural problems and back issues, as they will tend to pull the pelvis out of its normal position (posterior pelvic tilt) and, in the long run, may possibly influence the sacroiliac and lumbar spine dysfunction (reducing lumbar lordosis).[8]In general, an individual with tight hamstrings will have a limited stride length. This translates to taking more steps over a given distance than an individual with more flexibility. More steps mean more work and more impact, greatly increasing the potential for fatigue.[8]

Flexibility is the capacity of any muscle to deform.[9]Flexibility is a very significant aspect of physical fitness for maximizing musculoskeletal function.[10] Prevalence of tightness in the HMC, even among normal individuals, is quite high. The HMC tends to get shortened quickly, losing flexibility.[11]

Techniques frequently used for management of hamstring muscle flexibility include various stretching techniques such as active, passive, and PNF stretching techniques [12,13], manual soft tissue release techniques like positional release [14], dynamic soft tissue mobilization [15], roller massage technique [16], foam roller [17], and massage techniques [18]. These techniques were effective in treating hamstring tightness and improving flexibility. However, there is no agreement on the ideal soft tissue technique to improve flexibility. [19]

A newer technique that has been proven effective for hamstring tightness is **Active Release Technique (ART)**. This approach was developed by a chiropractor, Dr. P. Michael Leahy. He explained it as a soft tissue manipulation technique that works on a variety of tissues—muscle, tendon, fascia, and nerve-related issues. [20] This multidisciplinary technique is used to locate the specific tissues that are restricted and then alleviate them so that the soft tissue can return to its normal texture, tension, and length. This is achieved by numerous hand positions and soft tissue manipulation techniques. [21] He further proposed a mechanism called the "cumulative injury cycle" to explain increased tissue stiffness or tension. In this cycle, repetitive micro-injury in a tight muscle leads to an increase in friction and tension within the myofascial structures. [20]

ART has been used as conservative treatment for many conditions. There are three basic principles: restoring free and unimpeded motion of all soft tissues; releasing entrapped nerves, vasculature, and lymphatics; and re-establishing optimal strength, texture, and function of soft tissues. [22] When applied for hamstring muscle complex (HMC) tightness, ART was quite potent and showed immediate effect. [20,21] ART releases tissue adhesions, allowing the muscle to fully lengthen. By doing so, it also alleviates pain, permitting it to return to its normal condition. [20] This was confirmed by a pilot study done by James W, et al. (2006), to determine the effect of ART on hamstring tightness. The experiment revealed that even a single bout of ART increased hamstring flexibility among a group of young healthy males. [23] This was further demonstrated when studies compared the effectiveness of ART with other techniques, and ART proved to be superior. [20,21,24]

Another current method that is an alternative to stretching exercises in gaining flexibility is **percussion massage therapy**. Percussion massage therapy has gained popularity in the therapeutic and athletic communities over the past few years. Different manufacturers provide percussion devices for both self-massage and massage by a therapist. Such devices can vibrate at different frequencies up to 53 Hz. Depending on the tissue (i.e., soft tissue versus bony tissue), several attachment heads can be fixed to the devices so that local points can be massaged.[25]

This treatment combines elements of traditional massage and vibration therapy. [25–28] With rhythmic contraction and relaxation, the Golgi tendon organ is stimulated, reducing abnormal muscle contraction and improving muscle length. [28] Massage applied for 5 minutes with a hand-held percussion device provides an increase in ROM with the effect of myofascial relaxation. [25]Lim and Park demonstrated that vibration-assisted foam rolling significantly improved hamstring flexibility and jump performance in healthy adults.[28]

To the best of our knowledge, to date, not many studies have investigated the acute effects of handheld percussion therapy (PT) and Active Release Technique (ART) on flexibility of HMC. Since percussive massage treatment has increased in popularity with strength and conditioning coaches and athletes, this represents a significant gap in the literature. Therefore, the purpose of this study is to understand how PT (massage gun) and ART (manual soft tissue release) influence **hamstring flexibility**, **range of motion (ROM)**, **injury prevention**, and **movement efficiency**.

MATERIALS & METHODS

30 Subjects were recruited for this randomized control trial and divided into 2 groups by random sampling. Group A had 15 subjects and ART was used as the intervention. Group B also had 15 participants; intervention used was PT.

As the study includes human subjects, ethical clearance is obtained from ethical committee. Participants of 18-25 years included then active knee extension (AKE) test was conducted and participants with knee extension lag of 20 degrees were selected. Participants with history of lower limb trauma, recent surgeries in lower limb and lower back in last 6months and Participation in sports or gym activities on daily basis were excluded and at last 30 participants were selected.

Participants with HMC tightness were assessed for HMC by Active knee extension test. Outcome measure was taken pre and post intervention. Participants in Group A were assessed with outcome measure and ART was given in the side lying position with the affected leg on top with HMC shortened position. (Hip extension, knee flexion) The therapist palpated knots/ adhesions and applied deep pressure to them while the subject performed hip flexion and knee extension- lengthened HMC. This was repeated 3 times. After this, exercises same as Group A was performed. Post intervention, outcome measures were checked.

Fig.1-ART technique

Participants in group B were assessed with outcome measure and Percussion massage was applied to the dominant hamstring muscle for 5 minutes at 53 Hz frequency with the “hard ball” head of the Hypervolt (Hyperice, California, US) device Semitendinosus and semimembranosus muscles were focused in the first 2.5 minutes of the massage treatment, and the biceps femoris muscle in the second 2.5 minutes. In the first part of the application, the massage was started from the medial side of the muscle, paying attention to the equal amount of pressure applied throughout the massage. Moving the device from distal to proximal and from proximal to distal in a straight line within 20 seconds completed the massage. In the last 2.5 minutes, the massage device was moved laterally at the distal end of the muscle, and the application was made from distal to proximal and then distally. Thus, the massage for each muscle started from the medial and ended laterally.[29]Post intervention, outcome measures were checked.

Fig 2-Percussion massage

Outcome Measure

Active Knee Extension Test: The test was performed in supine position with hip flexion without lifting the contralateral leg. The subject was then asked to extend his knee as much as possible. Following this, the therapist measured the angle of knee extension and popliteal angle with a goniometer.

Statistical Analysis

Data was analysed in spps software .Data was not dormally distributerd so **Wilcoxon test** was used for **within group analysis** and the Mann Whitney U was used for between group analysis.

Table 1 Wilcoxon test

Group A (Percussive therapy)			
	Mean ± SD	Zvalue	P value
Pre test	31.86±2.5	-3.436	0.01
Post test	40.2±2.42		

Table 2 Wilcoxon test

Group B(Active release technique)			
	Mean ± SD	Zvalue	P value
Pre test	32.73±5.4	-3.420	0.01
Post test	48.2±4.44		

Table 3 Mann –Whitney test

Mean difference	SD	U value	P value
8.33	±1.45	0.00	0.00
15.47	± 1.92		

All statistical analyses were performed using SPSS software. The normality of the data was tested using the **Shapiro-Wilk test**, and the results indicated that the data were **not normally distributed**. Therefore, **non-parametric tests** were employed for both within-group and between-group comparisons to assess the **immediate effects** of the two interventions—**Percussive Therapy (PT)** and **Active Release Technique (ART)**—on hamstring muscle flexibility.

Within-Group Analysis

To evaluate the immediate effects of each intervention within its respective group, the **Wilcoxon signed-rank test** was utilized. This test is suitable for paired data when the assumption of normality is violated.

- **Group A (Percussive Therapy)**
  The mean pre-test score was **31.86 ± 2.5**, which increased to **40.2 ± 2.42** in the post-test. The Wilcoxon signed-rank test yielded a **Z-value of -3.436** with a **p-value of 0.01**, indicating that the improvement in hamstring flexibility following Percussive Therapy was **statistically significant** (**p < 0.01**). This result reflects a positive acute response to the percussive intervention in terms of increased range of motion.
- **Group B (Active Release Technique)**
  The mean pre-test value was **32.73 ± 5.4**, which improved markedly to **48.2 ± 4.44** following the intervention. The Wilcoxon signed-rank test demonstrated a **Z-value of -3.420** and a **p-value of 0.01**, also confirming a **highly significant** improvement in flexibility after application of ART (**p <**

0.01). These results suggest that ART effectively reduced hamstring muscle tightness in the immediate post-treatment phase.

Between-Group Analysis

To compare the **relative effectiveness** of ART and PT, the **Mann–Whitney U test** was applied. This test compares two independent groups when data are not normally distributed.

- The **mean difference** in pre- to post-test scores for Group A (Percussive Therapy) was **8.33 ± 1.45**, while for Group B (Active Release Technique), the mean difference was **15.47 ± 1.92**.
- The **Mann–Whitney U test produced a U-value of 0.00**, and the corresponding **p-value was 0.00**, which is considered **highly statistically significant (p < 0.001)**. This indicates that the difference in improvement between the two groups was not due to chance.

These findings clearly demonstrate that although both interventions were effective in improving hamstring flexibility, **Active Release Technique was significantly more effective** than Percussive Therapy in producing immediate improvements. The highly significant p-value further supports the **strength and reliability** of this result.

RESULT

A total of 30 young adults between the ages of 18 and 25 participated in this study. All of them showed hamstring muscle tightness based on the Active Knee Extension (AKE) test. They were randomly divided into two groups: one group received **Percussive Therapy (PT)** using a massage gun (Group A), and the other group received **Active Release Technique (ART)** as a manual intervention (Group B).

Since the data collected did not follow a normal distribution, we used non-parametric tests to analyze the results.

Within Each Group

- **Group A (Percussive Therapy):**
  Before the intervention, the average AKE score was **31.86 ± 2.5** degrees. After applying percussion therapy, this improved to **40.2 ± 2.42** degrees. The change was found to be **statistically significant** with a **p-value of 0.01**, indicating that even a single session of percussion massage was effective in improving hamstring flexibility.
- **Group B (Active Release Technique):**
  This group started with an average pre-test score of **32.73 ± 5.4** degrees, which improved significantly to **48.2 ± 4.44** degrees after the ART session. The results were also **highly significant** (**p = 0.01**), showing that ART led to a noticeable immediate improvement in flexibility.

In both groups, participants showed better flexibility immediately after the session, confirming that each intervention had a positive effect on reducing hamstring tightness.

Comparison Between Groups

When we compared the amount of improvement between the two groups, the difference was clear:

- Group A (PT) improved by an average of **8.33 ± 1.45** degrees.
- Group B (ART) improved by a larger margin—**15.47 ± 1.92** degrees.

This difference between groups was analyzed using the Mann–Whitney U test, which showed a **U-value of 0.00** and a **p-value of 0.00**, meaning the difference was **highly statistically significant (p < 0.001)**.

DISCUSSION

This study set out to explore how effective two different techniques—Active Release Technique (ART) and Percussive Therapy (PT) using a massage gun are in improving hamstring flexibility in young adults. Both methods showed positive effects after just one treatment session, which is encouraging. However, the improvement was noticeably greater in the group that received ART. This suggests that while both techniques help, ART might be the better option when aiming for immediate and more significant results. One reason for this could be the way ART works it's a hands-on technique that actively targets tight or restricted soft tissue while the muscle is being moved, which may help release tension more deeply and effectively. In contrast, Percussive Therapy delivers fast, repetitive vibrations that likely increase circulation a
nd reduce stiffness, but may not address the muscle restriction as specifically as ART does. These findings are in line with earlier studies that have shown the benefits of manual techniques in improving muscle length and mobility. Considering that hamstring tightness is so common—especially in young adults who sit for long hours or are involved in sports—being able to reduce tightness quickly is clinically valuable. The results here suggest that ART could be a go-to method in physiotherapy practice when fast improvements in flexibility are needed, like before athletic performance or during injury prevention programs. Still, it's worth noting that both techniques were effective, which means therapists have more than one tool to choose from based on the individual needs of the patient. Future studies could look at what happens over a longer period or whether combining both approaches offers even better outcomes.

CONCLUSION

The findings of this study demonstrate that both Active Release Technique (ART) and Percussive Therapy (PT) are effective in reducing hamstring muscle tightness immediately after a single intervention session in young adults. However, ART produced significantly greater improvements in hamstring flexibility compared to PT, as evidenced by higher mean gains and highly significant statistical outcomes. These results suggest that ART may be a more effective option for clinicians seeking rapid and targeted improvements in muscle length, especially in athletic or rehabilitation settings. Future studies should explore the long-term effects, multiple-session interventions, and the potential combined use of both techniques for enhanced outcomes.

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