

# Immediate Effect of Hammer Tone on Hamstring Flexibility

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**Abstract:** ***Background:** Hamstring tightness is one of the most common causes of hamstrings strains and injuries. Maintaining optimal Hamstring flexibility is key to prevent injuries. Hamstring tightness contributes to biomechanical dysfunctions. With hamstring tightness being highly prevalent, newer and effective techniques must be brought into light that show immediate effects. **Objective:** to study the immediate effect of hammer tone on hamstring tightness. **Method:** 26 participants between the ages 18-60 years were selected in the study based on inclusion and exclusion criteria. The hamstring flexibility was tested using passive SLR and toe touch tests. The data was collected and statistically analyzed. **Results:** The toe touch and passive SLR test values show statistically significant improvements, with  $p$  value  $<0.001$ . **Conclusion:** This study concludes that hammer tone is an effective technique in giving immediate results in increasing the hamstrings flexibility.*

**Keywords:** hamstring tightness, hamstring injuries, soft tissue release, lower cross syndrome, posterior pelvic tilt

## 1. Introduction

The ability of a muscle to stretch is important to prevent injuries. <sup>[1]</sup> Hamstring tightness is a commonly observed in the age group of 18-25 years. <sup>[2]</sup> Hamstring tightness contributes to biomechanical dysfunctions. This makes the muscle susceptible to injuries and strains. <sup>[3]</sup> Hamstring tightness causes increased posterior tilting of pelvis. This obliterates lumbar lordosis thereby causing low back pain. <sup>[4]</sup>

Along with stretching, various techniques have been in use for increasing muscle extensibility and range of motion. Cryo-stretching is one such technique that incorporates use of ice along with stretching. It has shown to have short term effects on increasing hamstring flexibility. <sup>[5]</sup> Short wave diathermy when used in addition to prolonged stretching has shown to improve hamstring flexibility. <sup>[6]</sup>

Massage is one of the most widely used therapeutic interventions in sports <sup>[7]</sup>. It is used for its mechanical effects of stimulation of touch, pressure and proprioceptive receptors thereby improving blood and lymphatic circulation. <sup>[8]</sup> Other effects include soft tissue release, breaking adhesion, improving tissue elasticity and permeability <sup>[9]</sup>. Muscle tension, pain, stiffness and spasm indicate restricted blood supply, thereby receiving insufficient oxygen and nutrients. Such an undernourished muscle is more susceptible to injuries. Releasing these constricted muscle fibers with sports massages allows better blood circulation to the muscle fibers. The techniques include warming up the muscle first using a heating pad or warm hands to prepare for deeper treatment. Effleurage, petrissage, friction, tapotment, vibration are strokes used in massage. The application of rhythmic strokes sends signals to brain. The brain causes endorphins to be released that are responsible for reducing

stress and the tranquilizing effect provides a sense of well-being. Swedish massage is proven to wash-out toxins, enhance blood and lymphatic circulation, relieves muscle tension, spasm and soreness. One important effect is the increase in muscle flexibility thereby improving ROM. <sup>[10]</sup> <sup>[12]</sup> Lactic acid and associated hydrogen ions are washed out as the affected muscle is compressed. <sup>[10]</sup> <sup>[13]</sup> <sup>[14]</sup> On releasing the pressure, fresh blood is allowed to flow through. The pathophysiological reflex circuits are interrupted as a result of these compressions, ultimately relieving pain. The normal muscle tone is achieved as Homeostasis is restored as nervous and musculoskeletal systems are brought back to harmony. <sup>[10]</sup> Sports massage also facilitates stretching of tendons <sup>[11]</sup>

In 1986, hammer tone, a new technique was developed at Bombay Hospital in Mumbai for increasing range of motion. A hammer was used which was made of galvanized pipe with a cylindrical attachment at the end. The ends were cushioned using rubber. The second part of the tool was the hammer's tone which was made from a thick rubber slipper, carved in an S-shape to conform to the body's contours. Furthermore, there are multiple poles of the same tubing composition with different shaped rubber ends suitable to mobilise various joint structures such as the spinous process, transverse process, tibia, metacarpals, and soft tissues.

Hammertone was first used in cases of frozen shoulder to increase range of motion. Tapping and chipping were the two methods of application. The treatment started with tapping over the muscle belly to warm up the muscles followed by chipping method and ended with tapping method. Suitable poles were used depending on the muscle/joint. The tapping method entails striking the hammer in a rhythmic pattern on a tone that is placed at various spots throughout the treatment area much like tapotment with its vibratory and percussive aspects. On the other hand, chipping entails the hammer being swung

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over the tone, which is angled horizontally over the proximal end of the muscle, in a rhythmic motion. The hammer's push on the tone causes it to move distally. The tone moves from the muscle's proximal to distal end. The percussive impact goes deeper into the fascia and muscle. The unpublished study done on hammer in 1986 stated the physiology that Hammer Tone breaks up of the adhesions and fibrous elements by creating a vibratory effect at the level of soft tissues and muscles and a massaging effect.

There are no studies published showing the effect of hammer tone in increasing the flexibility of the hamstring muscle or any other muscle in the body and the previous studies were done only on patients with joint stiffness. No literature is found supporting any of these studies till date which have an effect in increasing the flexibility of the hamstring muscle which therefore increases the range of motion. The purpose of the study was to study the immediate effect of hammer tone on hamstring tightness.

## 2. Literature Survey

Hamstring tightness, hamstring strains, hamstring injuries, soft tissue release techniques were the key words used to refer to the existing literature on the topic. Pubmed and Google scholar were the databases searched for the purpose of this study. Randomized and non-randomized trials, quasi experimental trials, case studies and systemic reviews articles were included in the study. Books on massage therapy were also referred.

## 3. Material and Methods

The study was an interventional study conducted on subjects with hamstring tightness. Convenient sampling method was used and a sample size of 26 subjects. The materials used in the study were weighing machine, measuring tape, universal goniometer, Hammer tone set.

**Inclusion criteria:** 1. Normal asymptomatic subjects in the age group of 18 to 60 years. 2. Unable to touch toes in standing with knee extended/ SLR less than 90 degrees. 3. Patients willing to participate. **Exclusion criteria:** 1. Recent fractures. 2. Diagnosed case of Osteoarthritis of hip or knee. 3. Recent hamstring injuries. 4. Inflammatory arthropathy of knee joint. 5. Open wounds. 6. Presence of implants in the lower extremities.

**Outcome measures:** Two tests were used to assess hamstring flexibility, pre and post the application hammertone technique. 1. In the toe touch test, the measurements were taken in standing position. The subjects were asked to try and touch their toes. The vertical fingertip-floor distance was measured and noted. Reliability of the toe touch measure is 0.97. [27] 2. A passive straight leg raise was performed in supine position. The examiner passively lifts the test leg with the knee extended, flexing at the hip maintaining the contralateral extremity extended on the plinth. At the end of the range of motion, the angle at the hip was measured with a universal goniometer. The reliability of this test if 0.92 [28]

**Procedure:** 26 subjects who were willing to participate were included in the study. The participants were screened as per inclusion and exclusion criteria. Prior to the study, the subjects were explained the purpose of the study and procedure. The hamstring flexibility was tested using passive SLR and toe touch tests.

With the subject in prone lying and the knees were extended and the therapist standing on the same side of the lower limb on which the intervention has to be given. First the tapping method was done over the muscle belly for 30 seconds. Tapping involved hitting the hammer rhythmically on the tone which is placed on the various spots covering the medial, lateral and middle hamstring fibers. After the tapping method, chipping method followed which involved rhythmic striking the hammer over the tone which is angled horizontally over the proximal end of the muscle for 30 seconds. The force of the hammer over the tone slides the tone distally covering all the three fibers of the hamstring muscles. This made up one cycle of hammer tone. This cycle of tapping and chipping was repeated with the total treatment duration of 2 minutes, done bilaterally. The post intervention readings were measured by the passive SLR test and toe touch test to measure the flexibility of the hamstrings muscle. The data collected was analysed statistically.



Figure 1A: Illustrates the tapping method



Figure 1B: Illustrates the chipping method

**1. Statistical analysis:** Data was analyzed using SPSS version 28.0.0.0 (190). The paired t test was used to analyze Pre and the Post treatment values. Descriptive statistics was done for age, height, weight, BMI.

**2. Results:** 26 participants between the ages 18-60 years were included in the study, out of which 10 were male and 16 were females with an average age of 34 ( $\pm 13$ ) years, average height of 165.61 ( $\pm 8.01$ ) cms, average weight of 72.5385 ( $\pm 21.22$ ) kgs, average BMI of 26.17

(±6.12). A basic demographic data of the participants was recorded, shown in table 1 given below.

**Table 1:** Demonstrates the demographic data of participants

Mean Age	34 (±13)
Mean Height	165.61 (±8.01)
Mean Weight	72.53 (±21.22)
Mean BMI	26.17 (±6.12)

Hamstring tightness was assessed using the modified toe-touch test and passive SLR test. The pre-treatment mean of toe-touch reach distance was 15.40 (±9.19), left lower extremity SLR was 67.30 (±13.80), right lower limb SLR was 69.23 (±13.39). The mean post treatment values of toe-touch test were 8.25 (±8.62), left lower limb SLR were 79.80 (±11.08), SLR of right lower limb were 84.03 (±12.33) as given in the table 2 below.

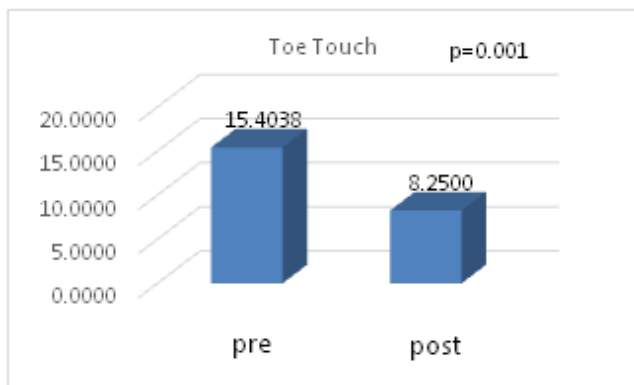
**Table 2:** Demonstrates the average of Pre and Post values of the toe-touch test and SLR test

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Toe_Touch_pre_treatment	15.40	26	9.18	1.80
	Toe_Touch_post_treatment	8.25	26	8.62	1.69
Pair 2	SLR_left_pre_treatment	67.30	26	13.80	2.70
	SLR_left_post_treatment	79.80	26	11.08	2.17
Pair 3	SLR_rightt_pre_treatment	69.23	26	13.39	2.62
	SLR_right_post_treatment	84.03	26	12.33	2.41

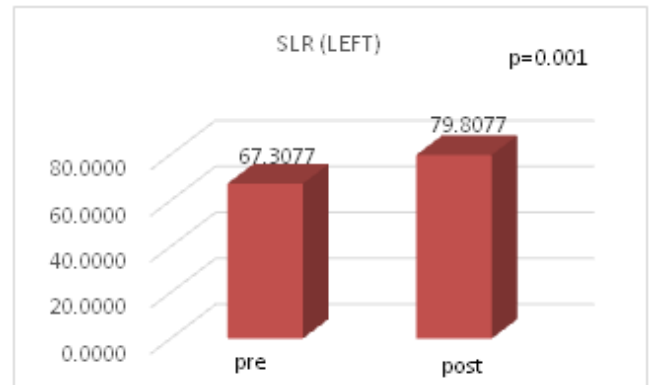
The Pre and the Post values of the Hammer Tone were analyzed by using paired t test and the test indicates a p value of less than 0.001 suggesting that it was statistically significant as indicated in the table 3 given below.

**Table 3:** Demonstrates the p value by the paired t test

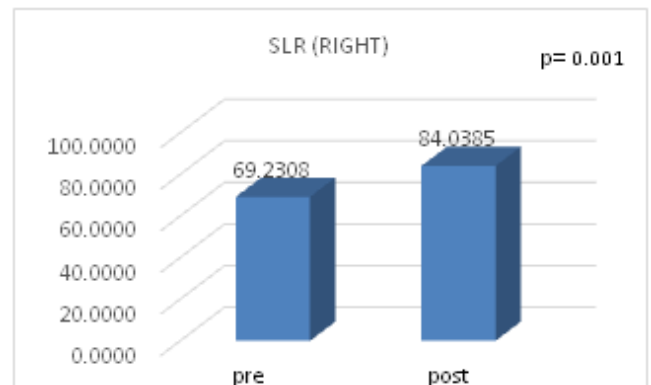
		t	df	One-Sided p	Two-Sided p
Pair 1	Toe_Touch_pre_treatment	11.35	26	<.001	<.001
	Toe_Touch_post_treatment				
Pair 2	SLR_left_pre_treatment-	-9.55	26	<.001	<.001
	SLR_left_post_treatment				
Pair 3	SLR_rightt_pre_treatment-	-11.79	26	<.001	<.001
	SLR_right_post_treatment				



**Graph 1:** demonstrates the comparison of pre and post-hammertone toe-touch test scores.



**Graph 2** demonstrates the comparison of pre and post-hammertone SLR test scores of the left lower limb.



**Graph 3** demonstrates the comparison of pre and post-hammertone SLR test scores of the right lower limb.

#### 4. Discussion

The present study assessed the immediate effective of hammer tone on hamstring flexibility. This study found a significant improvement in hamstring flexibility when assessed using SLR and toe touch tests. There is no literature published showing the effect of hammer tone in increasing the flexibility of the hamstring muscle or any other muscle in the body and the study done by this technique is done only on patients with joint stiffness. In this study, we found a significant p value of less than 0.001, which supports the hypothesis stating that hammer tone shows immediate effects in increasing the hamstrings flexibility. Van Tulder et al. in his study stated that fascia is a continuous fibrous tissue that divides and surrounds each muscle fibre, thus muscle and fascia cannot be separated. The fascia not only surrounds the muscle, but invaginates the muscle tissue to cellular level and ends in the tendon that attaches muscle to the bone. When an external force is applied to the tissues, it normalizes the tension and elongates; thus supporting this study. Thomas Myers et al. in his study found the existence of 12 myofascial lines. A myofascial meridian connects the entire posterior surface of the body from the plantar surface of toes to the frontal bone on the forehead.

Spinal reflex physiology and receptors of muscle spindle, Golgi tendon organ and joint mechanoreceptors play a role in stretching and maintaining optimal range of motion with an additional effect of inducing muscle relaxation.<sup>[15]</sup> With regular stretching, the receptors desensitize to stretch. By increasing the passive tension from stretch, the

Golgi tendon organ and joint receptors are activated leading to autogenic inhibition reflex and inhibiting the motor neuron of the stretched muscle decreasing the tension in the muscle, ultimately leading to relaxation.<sup>[15]</sup>

Hammer tone is hypothesized to work on the physiology of massage techniques of tapotment. Hacking and pummeling tapotment techniques are similar to the methods of tapping and chipping used in hammer Tone. Crosman et al. concluded in his study that massage treatment given to the posterior aspect of one randomly assigned lower extremity immediately increases the range of motion.<sup>[16]</sup> Burman and Friedland (2006)<sup>[17]</sup> consider tapotment to produce vibratory effect with percussive 'striking', like playing a percussion instrument on a rhythm or beat.

Tapotment has a mechanical, neural, chemical and psychological impact to the body. Lerdermann<sup>[18]</sup> explains two underlying mechanisms in describing massage pathway. A Somatovisceral effect is produced when the application of manual pressure on tendons elicits a reflex arc to decrease motor neuron excitability. On giving pressure and muscle tapping it has been shown that there is a reduction in the level of motor neuron excitability and consequently of muscle reflex activity.<sup>[19]</sup><sup>[20]</sup> Cutaneous receptors have been seen to contribute in relation to pressure<sup>[19]</sup> and muscle tapping.<sup>[20]</sup> Muscular mechanoreceptors are also activated and based on current evidence which states that the mechanism responsible involves a combination of both types of receptors. During the intermittent pressure in massage the same receptors are activated.<sup>[21]</sup> A study was done to see the role of cutaneous mechanoreceptors in amplitude changes of the H reflex both neurologically healthy<sup>[22]</sup><sup>[23]</sup> and neurologically impaired persons<sup>[24]</sup><sup>[25]</sup> and concluded that on desensitizing the skin by the application of a topical anesthetic resulted in an increase in the H reflex amplitude concluding that cutaneous mechanoreceptors presumably activated during massage, exert an inhibitory effect on the central nervous system during massage and other techniques like tendon pressure and muscle tapping whereas the role of these cutaneous mechanoreceptors in the depression of the H reflex during muscle stretching was also examined and concluded that inhibitory response to muscle stretch was mediated primarily by the activity of secondary muscle spindle afferent.<sup>[26]</sup> Some evidence states that pressure mechanoreceptors may play a role in the inhibitory response. Sustained heavy tapotment techniques result in superficial vasodilatation, pain relief and relaxation.

The two reasons of inhibition of the motor neuron excitability can be due to when performing several minutes of tapotment an anesthetic effect on hypersensitive nerve endings is created and there is stimulation of the inhibitory interneurons present at the posterior horn of the spinal cord. The branches (collaterals) from the Ia spindle afferents stimulate the inhibitory interneurons leading to depressed activity of the alpha motor neurons.

Belanger et al (1989) investigated the effects of muscle tapping on soleus muscle motor-neuron excitability. The study suggests that tapping produces effect resulting soleus motor-neuron excitability to reduce. The researchers concluded that tapping resulted in the activation of afferent nerve fibers and the muscle receptors — the Golgi tendon organs and muscle spindles. This effect can be used to reduce muscle tone in hypertonic muscle in various neurological, orthopedic and musculoskeletal conditions.

This study recommends the incorporation of a newer and effective technique like hammer tone for release of various tight structures. The technique can be used in sports practice as a means of soft tissue release for immediate results as it is quick, effective, portable, inexpensive and hypothesized to give a relaxation effect. It can be used for relaxation and to increase flexibility of the muscle before and after the performance.

## 5. Conclusion

26 subjects between the age of 18-60 years were included in this study. This study concludes that hammer tone was an effective technique in giving immediate results in increasing the hamstrings flexibility. The pre and post values of toe touch test, SLR were analyzed statistically indicating a significant improvement in hamstring flexibility with a p value of less than 0.001. Hammer tone can be incorporated in treatment protocols for hamstring tightness and related biomechanical dysfunctions.

## 6. Future Scope

Further studies can be done to see the long term effects on maintaining the flexibility of the hamstring muscles with this technique.

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## References

- [1] Corbin. CB, Noble L. Flexibility: a major component of physical fitness. *J Phys Educ Recreat Dance*.1980; 51: 57-60
- [2] Bhagyashree K. Koli, Deepak B. Anap. Prevalence and severity of hamstring tightness among college student: A cross sectional study. *Int. j. clin. biomed. res*.2018; 4 (2): 65-68
- [3] Hopper D, Deacon S, Das S, Jain A, Riddell D, Hall T, Briffa K. Dynamic soft tissue mobilisation increases hamstring flexibility in healthy male participants. *Br J Sports Med* 2005; 39: 594–598.
- [4] Dipesh Thakur, Sumi Rose. A study to find out the correlation between the right and left hamstring length in both gender to determine the prevalence of hamstring tightness among college students. *Nitte university journal of health science*.2016; 6 (4): 46-52.



- [5] Brodowicz GR, Welsh R, Wallis J. Comparison of stretching with ice, stretching with heat, or stretching alone on hamstring flexibility. *J Athl Train.*1996; 31 (4): 324-327
- [6] Draper DO, Castro JL, Feland B, Schulthies S, Eggett D. Shortwave diathermy and prolonged stretching increase hamstring flexibility more than prolonged stretching alone. *J Orthop Sports Phys Ther.*2004; 34 (1): 13-20
- [7] Brian J. Hemmings, Physiological, psychological and performance effects of massage therapy in sport: a review of the literature, *Physical Therapy in Sport*, Volume 2, Issue 4, 2001, Pages 165-170
- [8] Jacobs M. Massage for the relief of pain: anatomical and physiological considerations. *Phys Ther Rev.*1960 Feb; 40: 93-8; doi: 10.1093/ptj/40.2.93. PMID: 14406374
- [9] Calder A Recovery: restoration and regeneration as essential components within training programmes. *Excel* 1990; 6: 15±19
- [10] Levine, AS and Levine, VJ. *The Bodywork and Massage Source Book*. Los Angeles, CA: Lowell House, 1999.
- [11] Samples P. Does 'Sports Massage' Have a Role in Sports Medicine? *Phys Sportsmed.*1987 Mar; 15 (3): 177-83. doi: 10.1080/00913847.1987.11709311. PMID: 27463583.
- [12] Dubrovsky V Changes in muscle and venous blood flow after massage. *Soviet Sports Review* 1983 18: 134±135
- [13] Gupta S, Goswami A, Sadhukhan K, Mathur D Comparative study of lactate removal in short term massage of extremities, active recovery and a passive recovery period after supramaximal exercise sessions. *International Journal of Sports Medicine* 1996; 17: 106±110
- [14] Belcastro A, Bonen A Lactic acid removal rates during controlled and uncontrolled recovery exercise. *Journal of Applied Physiology* 1975; 39: 932±936
- [15] Alter, Michael J: *Science of flexibility*, 1952, Third Edition.
- [16] Crosman LJ, Chateauvert SR, Weasberg J: The effects of Massage to the hamstring muscle group on Range of Motion, *J. Orthop. Sports Phys Ther*, 1984, 6 (3); 168-172.
- [17] Burman I, Friedland S: *Touch abilities essential connections*, Thompson Delmar Learning, Canada, 2006
- [18] Lendermann E et al: *Fundamentals of Manual Therapy*, First Edition, London, Churchill, Livingstone, 1997.
- [19] Kukulka CG, Beckman SM et al: Effects of Intermittent tendon pressure on alpha motor neuron excitability, *Phys Ther*, 1986; 66: 1091-1094.
- [20] Belanger AY, Morin S et al, Manual Muscle Tapping decreases soleus H-reflex amplitude in control subjects, *Physiotherapy Canada*, 1989; 41: 192-196
- [21] Sullivan Jonh S, Williams RT Leslle et al; Effects of Massage on Alpha Motorneuron Excitability, *Phys. Ther*, 1991, August; 71: 555-560.
- [22] Sabbahi MA, Deluca CJ: Topical Anaesthetics modulation of the monosynaptic reflexes by desensitizing the skin, *Electroencephalor Clin Neurophysiol.*1982; 54: 677-688.
- [23] Wolf SL, Minkowitz JA: Topical anaesthetics effects on Achilles Tendon and H-reflexes, I able bodied subjects, *Arch Phys Med. Rehabil*, 1989; 70: 531-536.
- [24] Sabbahi MA, Delvea CJ et al: Topical anaesthesia: a possible treatment method for spasticity, *Arch Phys Med Rehabil*, 1981; 62: 310-314.
- [25] Wolf SL, Minkwitz JA: Topical anaesthetic effects on Achilles Tendon and H-reflex, II; Stroke patients, *Arch Phys Med Rehabil*, 1989; 70: 673.
- [26] Robison KL, Mc Comas AJ et al: Control of the soleus motorneuron excitability during muscle stretch in man, *Neurol Neurosurg Psychiatry*, 1982; 45: 699-704
- [27] Kippers V, Parker AW. Toe-touch test. A measure of its validity. *Phys Ther.*1987 Nov; 67 (11): 1680-4. doi: 10.1093/ptj/67.11.1680. PMID: 3671506.
- [28] Davis, D Scott; Quinn, Rich O; Whiteman, Chris T; Williams, Jason D; Young, Corey R. Concurrent Validity of Four Clinical Tests Used to Measure Hamstring Flexibility. *Journal of Strength and Conditioning Research*: March 2008-Volume 22-Issue 2-p 583-588 doi: 10.1519

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