



Examining the effectiveness of Matrix Rhythm Therapy on hamstring strength and flexibility

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Abstract

Studies in the field of hamstring flexibility shed light on the recently developed Matrix Rhythm Therapy (MRT) technology. MRT is a non-invasive method that reduces muscle tension by vibromassage in tissue depth through a device head that provides resonance from the device to the muscle tissue with mechanical vibrations. Our aim was planned to examine the effectiveness of MRT in hamstring flexibility. As a method in this framework; Pubmed, Google Scholar database was searched in English languages by typing "Matrix Rhythm Therapy and Hamstring". The start date of the search was 2013 and all research on the subject in the specified databases until May 13, 2023, were examined. In these studies, articles related to hamstring flexibility used in Matrix Rhythm Therapy were included. After the first reviews, Pubmed 106, Google Scholar 863, and Science Direct 176 results were found with only the title. Of these articles, three relevant articles were analyzed in detail. As a result, the studies emphasized that the Matrix Rhythm Therapy device should be applied with a cellular focus. Studies show that MRT can be used as a physiotherapeutic treatment in clinical settings.

Keywords: Hamstring muscle, Flexibility, Stretching, Matrix, Vibration

1. Introduction

Hamstrings are a strong skeletal muscle group consisting predominantly of type II fibers located in the posterior part of the femur (1). It has an important biomechanical role in spinal and pelvic movements (2). It provides anterior pelvic tilt and rotation of the pelvis by controlling extension in the hip (3). In the movement of the lower extremity, it contracts eccentrically to slow down the movement in hip flexion and knee extension, and in the backward movement, it provides control of the movement by contracting concentrically with the gluteal muscles in hip extension (4). The hamstrings are an important muscle group in daily life activities such as sitting, standing, walking, and running (5). Prolonged knee flexion, posterior pelvic tilt, sedentary lifestyle, and surgical interventions affect the flexibility of the hamstring muscles negatively. This leads to gait disorders, lower back pain, and poor posture in the long term (2).

Strength and flexibility, which are important components of the musculoskeletal system, are necessary for optimum physical function (6). Flexibility of the hamstring muscles is necessary to maintain an efficient and functional gait (7). Flexibility is one of the most important features of muscle function (8). It plays an important role in sitting-standing,

standing (4), walking, and running movements in daily life activities (5). Furthermore, a decrease in hamstring flexibility may cause pelvic movements, posture, and vertebral curvatures during daily activities (8). Reduced hamstring muscle flexibility has been associated with musculoskeletal problems such as low back pain and lower limb dysfunction. Reduced muscle flexibility can affect the range of motion of a joint, which in turn affects body mechanics. Shortness of the hamstring muscles reduces the range of motion of the joint, creates inappropriate movement patterns, causes muscle imbalance, and decreases muscle strength, leading the person to disorders in the knee and hip joints (6).

Flexibility of the soft tissues around the joint is an important factor in preventing damage or re-injury of the joint and the surrounding soft tissue (9). Hamstring tension may increase the risk of hamstring injuries, low back pain, and patellofemoral pain (8). Muscle tension may result from overuse injuries, trauma, stress, disease, non-flexibility with age, changes in physical characteristics, and decreased physical activity (10). In hamstrings, the risk of injury due to loss of flexibility and muscle tension is high (5,9). Hamstring strain is also associated with strain, eccentric exercise-related injuries, and impaired performance in athletes (8). It is of great interest in sports and health science research because of



its high incidence and recurrence rate (4,11). The stiffness distribution between hamstring muscles during submaximal isometric contractions is heterogeneous (11). In previous biomechanical studies, it was determined that the hamstring muscle had the highest stiffness during contraction and was, therefore, more prone to injury (11). It was reported that the prevalence of strength increase in the hamstring was 82% when measured with the active knee extension test in students aged 18-25 years (12).

This study focuses on the effectiveness of Matrix rhythm therapy (MRT), which is a new development in physiotherapy flow used to reduce pain, improve microcirculation, improve relaxation, and increase blood oxygenation (13).

When the cells in our body are healthy, they move in a certain rhythm. If these rhythmic movements are "disrupted" for any reason, there are disorders in the "connective tissue" or "matrix" tissue in which the cells live and slowdowns occur in cell movements here (13). In this case, the cells cannot be nourished sufficiently and the resulting metabolic wastes cannot be removed from the area. Firstly, there is a mild tenderness in the affected area, which the patient cannot easily recognize, and then serious problems, especially pain, begin to emerge. Over time, the condition affects the muscle, bone, cartilage, connective, vascular and nerve tissues. Here MRT is used against these processes. MRT accelerates metabolism, removes metabolic waste, regulates venous recycling, accelerates lymphatic drainage, improves blood flow, relaxes muscles, and reduces stress by regulating the autonomic nervous system.

At the University of Erlangen in Germany, Dr Ulrich G. Randoll invented the matrix mobile as a result of his extensive cell biology research (14-16). It uses vibrational energy adapted to the frequency range of natural cell rhythms (micro-vibrations) to mobilize fluids in tissues.

Static and dynamic stretching exercises, neurodynamic techniques, dry needling, cold/thermal therapy, massage, electrotherapy, myofascial release, proprioceptive neuromuscular facilitation, muscle energy technique, myofascial release technique are used in hamstring flexibility (8,12,17). In addition to these, Matrix Rhythm Therapy is used to provide complete relaxation with its relaxing effect on the muscular and nervous system in the treatment and prevention of muscle spasms, ligament injuries, muscle and tendon tears in cases of limitation of movement in tissue stiffness and joint stiffness in low back and neck pain.

1.1 Static Hamstring Stretch

Static stretching is a technique applied to stretch tense muscles. In this technique, the muscle is stretched until resistance is felt and the position is maintained for a long time. Static stretching is performed in a static state without any additional movement other than muscle stretching. The musculoskeletal system has a muscle spindle receptor and a Golgi tendon organ to prevent overstretching. These record the change in tension and, when it exceeds a certain threshold, trigger an extension reaction via the spinal cord, causing the muscles to relax. The aim is to improve the viscoelastic

properties and stretch tolerance of the muscle (10). Static stretching in sitting or standing position is repeated in 3 sets with a holding time of 15 seconds (18). Static stretching is often used as part of a warm-up routine to improve flexibility and prevent sports-related injuries (19). The effects of static stretching depend on the duration of stretching. It has been reported that 20 seconds of intense static stretching increases the range of motion of the joint and over 180 seconds decreases the stiffness of the muscle-tendon unit (18). High-intensity static stretching for 20 seconds has been reported to be effective in a warm-up program because reducing muscle-tendon unit stiffness is important to prevent sports-related injuries (19).

1.2 Dynamic Hamstring Stretch

Dynamic stretching is used to improve muscle performance and flexibility, to prevent injuries, and in warm-up programs for athletes before sports competitions. Dynamic stretching is performed by stretching the antagonist muscles in a controlled rhythm in the range of motion of the joint (18). Dynamic stretching is to increase the strength of hamstring and hip muscles, improve neuromuscular control, and normalize biomechanics (17). It has been reported that dynamic hamstring stretching with strengthening exercises has better muscle activation time and clinical results compared with static hamstring stretching with strengthening exercises in patients with patellofemoral pain with inflexible hamstrings (17). Dynamic stretching at high speeds is useful to improve muscle performance compared to low speeds due to the increase in heart rate. However, dynamic stretching at uncontrolled speeds prevents the improvement of muscle performance after stretching (18). Changes in the range of motion after stretching are due to the stretch tolerance and viscoelastic properties of the muscle.

1.3 Proprioceptive Neuromuscular Facilitation

Proprioceptive Neuromuscular Facilitation (PNF) is a special technique for stretching and reducing muscle stiffness. The basic principle is to stimulate as few receptors as possible in the activity according to neuromuscular physiological characteristics, to increase muscle activity, and to enable functional movement to occur. The American College of Sports Medicine reports that PNF is one of the most effective flexibility methods (20). The basic principle is to stimulate as many receptors as possible in the activity according to the physiological properties of the neuromuscular system, to increase muscle activity, and to encourage the realization of functional movement. PNF can be used in the warm-up activity of training, in the relaxation phase after training, or in motor rehabilitation to restore joint mobility (21).

1.4 Flexibility

The recently developed MRT technology sheds light on studies in the field of hamstring flexibility (14). MRT is a non-invasive method that reduces muscle tension by vibromassage in tissue depth through a device head that resonates mechanical vibrations in the range of 8-12 hz from the device to the muscle tissue (15). This treatment is more advantageous in terms of its portability, its ability to be used alone or in combination with other manual therapy methods,

and its post-application effects compared to other applications that show rapid effects, have no side effects, and increase muscle flexibility. The feature that distinguishes MRT from other methods is that it is applied in physiological frequency and amplitude range (15). MRT is a vibration therapy focusing on skeletal muscles. The reason for the success of this treatment is the approach based on cell biology. With MRT, the natural rhythm of the cells is stimulated and while fixed frequencies are used in many treatment methods, MRT takes into account the physiological frequency and amplitude range, thus enabling healthy adaptation of the tissue, which is open to change by nature.

MRT can be applied in neurological and orthopedic cases, people requiring special education, and sports clubs (5). By creating frequencies with mechanical vibrations of the muscle tissue, positive changes at the cell level and reduction of tension and pain levels are achieved. As a result of these changes, oxygenation of the blood, acceleration of circulation, relaxation of the relevant region, and relief of pain are provided (13). This study was planned to determine the effectiveness of the MRT device in hamstring flexibility.

2. Materials and Methods

PubMed, Science Direct, and Google Scholar were searched by typing "Matrix Rhythm Therapy and Hamstring", "hamstring anatomy", "Therapy in hamstring flexibility", Hamstring (strength or flexibility), and (therapy or physiotherapy) in PubMed database in English languages. All relevant articles were analyzed.

Inclusion criteria

- The scanning start date is 2013 and all research on the subject in the identified databases until 13 November 2023,
- In the study, Matrix Rhythm Therapy and all articles in which the therapy was applied and all studies related to the hamstring muscle were included.

Exclusion criteria

- Researchers whose publication language is other than Turkish and English,
- Studies that have not specifically applied Matrix Rhythm Therapy in patients,
- Studies with patients with no results with Matrix Rhythm Therapy,

- Studies that did not focus on hamstring strength and flexibility in Matrix Rhythm Therapy were not included.

When the keywords "Matrix rhythm therapy" were searched in the databases between 2013 and 2023, it was determined that there were 109 studies in the Pubmed database, 863 studies in Google Scholar when searched as "Matrix rhythm therapy + hamstring", and 176 studies in Science direct database when searched as "Matrix rhythm therapy and hamstring".

The following steps were taken to select the studies respectively. Firstly, the titles were read and inappropriate ones were excluded. In the next stage, abstracts were read and inappropriate ones were excluded. Then the last paragraph of the introduction of the article was read and the inappropriate ones were excluded. In the last stage, full texts were read. These stages were carried out by two independent assessors. The screening results were analyzed in detail and three studies that met the inclusion criteria were evaluated. This study aimed to investigate the effectiveness of MRT as a form of therapy for hamstring strength and flexibility.

The studies analyzed focused on the effectiveness of MRT application on hamstring strength and flexibility. The relevant research results are given in Table 1. Comparative results of these treatment approaches were analyzed. In this review, published studies on the effect of Matrix Rhythm Therapy on hamstring strength and flexibility were evaluated. It is thought that the results of the studies in the table will make an important contribution to the literature and will guide the planned research.

3. Results

It was determined that the duration of the treatment was 60 minutes in total, 30 minutes for each region, ranging from 1 to 9 sessions, with an average of 1-3 weeks. The sample size was 30 people on average. Age ranges are between 18-25 years. When the studies were examined, it was seen that Matrix Rhythm Therapy and Passive Stretching were applied as treatment and these applications were performed for the right/left hamstring. In the evaluation, it is seen that the hamstrings were evaluated bilaterally with Range of Motion Measurement, Active Knee Extension Test, and Ultrasonography. In studies, it was found that MRT application increased the range of motion, muscle flexibility, activities of daily living, and functionality (14-16).

Table 1: The effectiveness of Matrix Rhythm Therapy in hamstring flexibility

Authors, Year	Rawtani et al., 2019	Naik et al. 2022	Naik et al. 2021
Research Type	Randomized controlled trial	A Quasi-experimental study	Case report
Sample Group	Experiment Group A, Experiment Group B	Experiment Group	
Sample Size	30 (Female)	30 (17 Female-13 Male)	1
Treatment group	Matrix Rhythm Therapy, Passive Stretching	Length of hamstring muscle (Right/ Left Leg)	Length of hamstring muscle (Right/ Left leg)

Data Collection Instrument	Active Knee Extension Test, Range of joint motion	Active Knee Extension Test, Ultrasonographic assessment (Hamstring muscle length)	Active Knee Extension Test, Color Doppler Ultrasonographic assessment (Hamstring muscle length, tissue thickness, regional blood flow)
Duration of Treatment	3 weeks, 3 times a week (1 session 30 minute)	(1 session 60 minute)	(1 session 60 minute)
Age Range of Sample	18-25 years	18-25 years	22 year
Conclusion	MRT was found to be more effective than passive stretching in increasing hamstring flexibility.	Hamstring length after MRT application, thickness, and blood circulation were significantly increased.	The study concluded that MRT is an effective tool in muscle development.

4. Discussion

Munjewar et al. (2022) reported that MRT application is suitable for the treatment of frozen shoulder, chronic lumbar pain, plantar fasciitis, stroke with spastic hemiplegia, lymphedema, ROM limitation, and scar tissue (13). Rawtani et al. (2019) reported that MRT application had more positive effects than passive stretching in improving hamstring flexibility. Rawtani et al. (2019) found that MRT was effective in shoulder pain and ROM limitation without trauma (14). Naik et al. (2022) found a significant increase in hamstring muscle blood circulation and activities of daily living (15). Naik et al. (2021) mentioned that the matrix device caused the highest level of blood circulation in the hamstring at 22 minutes with mechanical vibrations with a certain frequency (16). It has been stated that the increase in knee flexion with hamstring tension is related to the increase in knee flexion, which is associated with more stress production on the plantar fascia by loading the ankle to the plantar flexion position.

It has been stated that Matrix Rhythm Therapy can be used to increase Hamstring flexibility. There is a need for more long-term follow-up studies with different sample sizes in the literature. It is thought that more people can use it by integrating it into clinical settings, rehabilitation, and sports centers

5. Conclusion

Since the effects of MRT are not only tissue- or limb-oriented but also cell-oriented, it is effective in many conditions such as chronic low back pain, frozen shoulder, stroke, plantar fasciitis, improving quality of life, reducing pain, increasing peripheral blood flow, increasing range of motion, improving the determinants of gait, increasing activities of daily living. It is a method that can be easily applied by the therapist without any painful invasive intervention. There are few studies on the subject. Therefore, more research should be conducted on the hamstring flexibility of MRT.

Conflict of interest

The authors declare that they have no conflict of interest.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

Authors' contributions

Concept: M.Ç, M.T.D, Design: M.Ç, Data Collection or Processing: M.Ç, M.T.D, Analysis or Interpretation: M.Ç, M.T.D, Literature Search: M.Ç, M.T.D, Writing: M.Ç, M.T.D.

Ethical Statement

Ethical permission for the study was not obtained because it was a review.

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