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To compare the effect of myofascial release technique versus foam rolling on hamstring spasticity in spastic Diplegia: Pilot study

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Abstract
The purpose of this study was to compare the effectiveness of myofascial release and foam rolling on hamstring spasticity in spastic diplegia. 20 subjects, fulfilling the inclusion and exclusion criteria were selected and assigned randomly into 2 treatment groups. Group A received myofascial release technique, Group B received foam rolling rolling and both the groups received conventional therapy including Bridging, Abdominal facilitation, sit to stand training and balance training 5days/ week for 4 weeks. Spasticity was measured using Modified Ashworth Scale (MAS), Tardieu test respectively pre and post intervention. There was significant improvement in both groups. Statistical comparison of the result showed that Group A had greater reduction in spasticity as compared to Group B.

Keywords: spastic diplegia, myofascial release, foam rolling, hamstring spasticity

1. Introduction

Cerebral palsy was first described by the English physician Sir Francis William Little in 1861 and was known as Little's disease for long time. Cerebral palsy is an umberella term covering a group of non-progressive, but often changing, motor impairment syndromes, secondary to lesions or anomalies of brain arising in early stages of development [1]. Cerebral palsy (CP) describes a group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication, and behaviour, by epilepsy, and by secondary musculoskeletal problems [2].
Prevalence of C.P. is in the range of 1.5 to 2.5 per 1000 live births. Until 1980s there were consistent reports of rises in the prevalence amongst live births of cerebral palsy and of its severity, particularly amongst preterm infants [3]
CP encompasses a spectrum of motor disorders of varying tone, anatomical distribution and severity. Classification is based on the change in muscle tone; anatomical region of involvement and severity of the problem [6]. Predominant types are (a) Spastic (b) Dyskinetic (c) (Dystonia. and. Choreoathetosis) (d) Ataxic (e) Mixed. The spastic type can be further classified according to the distribution as hemiplegic, diplegia and quadriplegia [4].

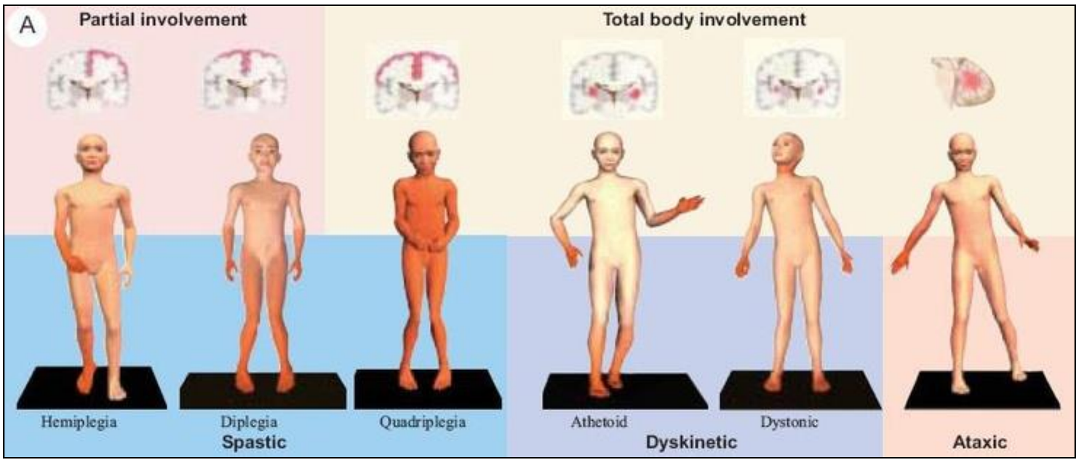

Fig 1

According to Howle, a white matter infarct in the periventricular areas caused by hypoxia can with diplegia. Lower extremities are severely involved and the arms are mildly involved. Intelligence usually is normal and epilepsy is less common. Fifty percent of children with spastic CP have diplegia. Diplegia is becoming more common as more low-birth-weight babies survive [4].
Spasticity is a major neuromuscular problem in CP. In normal physiology of movement afferent input from the internal organs the musculoskeltal system and skin converge on the medulla spinalis. This afferent input activates both stretch reflex both directly and through the interneuron and

result in a reflex motor response. The same afferent information goes to the cerebellum and the somatosensory cortex. It is processed in those center as well as in the basal ganglia [5].

The resulting motor response is relayed to the lower motor neuron through the pyramidal and extrapyramidal system tracts. Pyramidal tracts go directly to the the lower motor neuron whereas whereas extrapyramidal end at the interneuron. The cerebellum basal ganglia and extrapyramidal system nuclei modify the motor response as it goes to the medulla spinalis. In this way all motor output is influenced by the incoming sensory input and converges on the lower motor neuron [6].

The interneurons in the medulla spinalis regulate the activity of the motor neuron. The modulation of stretch reflex is important in the control of motion. Spasticity is manifested by increased stretch reflex which is in testified with movement velocity. This results in excessive and inappropriate muscle activation which contribute to muscle hypertonia. Clinically spasticity can be measured with modified ash worth and tardieu. Clinically spasticity leads to increased to reduced mobility and increased in the adherence of fascia [7] Fascia is a three dimensional web of connective tissue which runs continuously throughout the body. This fascial continuity means that there is: Continuous networking from head to toe, Continuous networking from superficial to deep, Continuous networking from microscopic to macroscopic. Therefore, the fascial system is not segmented or divided structurally. The tissue quality within this single system varies in terms of density and function [8].

Fascia is composed of an elastocollagenous complex with elastin fibers, and collagen fibers, embedded in a gelatinous ground substance which allows fiber mobility, as well as cellular circulation. The collagen molecule begins as a fragile protein chain produced in a fibroblast cell. This single protein chain is twisted into a left handed spiral and floats inside the fibroblast until it comes in contact with other two single chains. These three single chains will align and spiral or twist around each other toward the right, consequently increasing its structural strength. This triple helix forms the single collagen molecule [9].

When released from the fibroblast, it migrates through the body’s ground substance to the site of injury, infection or stress. Ground substance is a gel like consistency of raw egg white. It reduces friction between muscle fibers creating ease of motion. These single collagen molecules line up side by side overlapping in a staggered pattern akin to a brick wall. They are attached to each other through a process of hydrogen bonding forming a tough stable fabric. Throughout once life, fibroblasts retain the ability to migrate any point in the body. They alter their internal chemistry in response to local conditions, manufacturing specific forms of tissue according to needs of the body. Scar tissue is new collagen that has been secreted by ground substance, which is manufactured by fibroblasts, will help determine the way the molecules will join together [10].

The viscosity or density of the ground substance can vary from very thick to watery. The thicker the ground substance, the thicker and less mobile the tissue is. The fascia can be simply described as consisting of three layers. 1. Superficial fascia 2. Deep fascia 3. Subserous fascia Subserous fascia lines the body cavities and surrounds the organs. It surrounds blood vessels and nerves as well. Here the ratio in the number of fibers to fluid is low, giving it a soft, flexible quality. This is the type of tissue that supports shunts and gastric tubes. The superficial fascia lay directly under the skin. It has a greater ratio of fiber to fluid than the subserous but the fibers are arranged in a loose, irregular lattice pattern allowing for great mobility in all the directions. With long term spasticity the superficial layer losses its mobility, the skin become shiny and taut. This is especially evident in the web space of the thumb in the spastic hand, over the flexor surface of the elbow and the adductor surface of the hip in spastic diplegia. The deep fascia has a more compact weave with a high fiber to fluid ratio. It has a irregular arrangement of fibers that modify itself depending upon the forces placed on it [11].

Muscles are embedded in deep fascia. When in the healthy state, this fascia is soft and pliable, allowing the muscle fibers to contract and lengthen efficiently. This same deep fascia, in a more compact form, creates compartment that separate muscle from muscle. It forms regional sheaths or wrapping around the trunk and extremities. It aligns itself in a compact, more orderly and parallel fashion to create tendons and ligaments. The deepest fascia forms the dural tube which surrounds and supports the central nervous system. In children with spasticity the deep fascia also becomes tight [12].

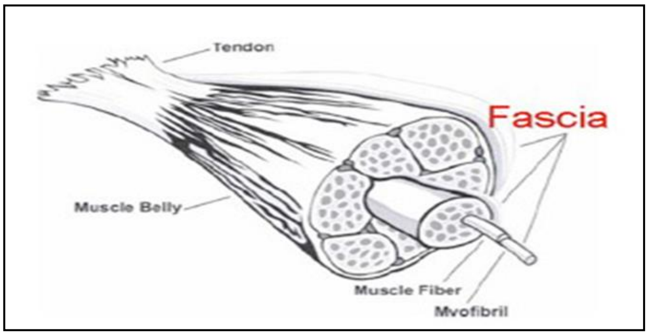

Fig 2

Myofascial Restriction

Unwanted bonding may occur with inflammation, injury, postural stress (such as found in cerebral palsy) or lack of full, active range of motion. In an attempt to support the body, the system contracts and bonds to neighboring structures in the same shape and form as the asymmetrical skeleton. Structures that were originally designed to be functionally separate will form adhesions which will impair their ability to slide freely over one another [13].

Where these adhesions develop, individual muscle action is impaired. Adhesions in the neurologically impaired patients develop secondary to the imbalance in postural tone. Unwanted bonding creates excessive deposits of tissue. This results in thick bandaging around joints, fibrous masses, along with tough fibrotic ropes and cysts in the muscle bellies [14].

Myofascial restriction weakens the muscle and holds the skeleton in an inefficient alignment, altering the kinesiological angle of pull. Excessive deposits of connective tissue correlate with areas of spasticity. Adhesions branch out to neighboring structures from these central points. Unwanted bonding can be the results of faulty muscular activity. The child with fluctuating tone holds and braces posturally in an effort to grade the range and speed of movement [15].

Bracing patterns encourage the development of myofascial restriction. The patterns of fascial restriction are like an historical account of the patients adoptions to gravitational forces. When using myofascial release, the therapist alters the density of the ground substance, thus allowing the collagen fibers to separate [16].

The therapist gently lengthens the fibers, following the release of associated restriction throughout the body. Keep in mind that the elastin allows the tissue to return to its original form and flexibility, thus returning the skeleton to proper biomechanical alignment. As we add graded movement the patients immediately learns to use this new mobility, carrying it over into functional skills. Combining the concepts of myofascial release and neuro-development treatment allows the patients to let go of the past and move forward towards independent functions [17].

Concepts of Myofascial Release Technique

The first concept in this system is that of tight loose. This concept is tightness creates and weakness permits asymmetry. There are both biomechanical and neural reflexive elements to this tight loose concept. Increased stimulation causes an agonist muscle to become tight, and the tighter it becomes, the looser its antagonist becomes by reciprocal inhibition. Shortening of the fascia surrounding the hypertonic, contracted muscle requires loosening of the fascia in the opposite direction in accommodation. In acute condition the cycle can be described as continuing spasm-pain-spasm. This results in tightness and can progress from the acute condition of the muscle contraction to actual contracture of the muscle leading to chronicity. In chronic condition the cycle is described as pain-looseness-pain. The application of the tight loose concept is fundamental to the therapeutic use of the MFR [18].

The second concept is that of the role of the palpation in myofascial pain syndromes. There are many diagnostic and therapeutic systems built upon peripheral stimulation. Palpation of the myofascial elements can frequently identify a safe site of initiation for myofascial pain which can be therapeutically addressed by the hands. A significant proportion of the myofascial sensitivity appears to be mediated by the autonomic nervous system; some of the symptoms found with myofascial pain are probably mediated by sympathetic nervous system reflexes. It is interesting to note the frequent occurrence of myofascial pain in areas of soft tissue looseness.

The third concept deals with the neuroreflexive change that occurs with the application of manual force on the musculoskeletal system. The hands on approach offers afferent stimulation through receptors, which require central processing at the spinal cord and cortical levels for a response. Afferent stimulation frequently results in efferent inhibition. This principal is used in MFR technique when the afferent stimulation of a stretch is applied and the operator waits for efferent inhibition to occur so that relaxation results in tight tissue. Neuroreflexive response is individualistic and appears to be modified by the amount of pain, the patient’s pain behavior the level of wellness, tress response and basic life style of the individual, particularly the use/abuse of alcohol, tobacco and drugs including medications [19].

The fourth concept is that of the “release” phenomenon. This concept is shared with other forms of manual medicine; particularly the cranio sacral technique and the ease bind principle of functional indirect technique. Release, in MFR concept, is the tissue relaxation, which follows the appropriate application of stress on the tissue. The tightness “gives way” or melts under the application of the load. Release becomes an enabling and terminal objective of the application of MFR. Release of tightness is sought to achieve improvement in symmetry of function and form [20].

Reactions to myofascial release when utilizing myofascial methods for improving mobility of the structures symptoms may occur in the patient. These reactions to the tissue unwinding express themselves in several ways. The following is a short list of possible reactions, which may occur during of the following the treatment [29].

Vasomotor reactions to the elongation of the tissues may occur. The skin may flush and redness may be observable. The pattern of distribution of this reddening may travel beyond the placement of the hands. Vasomotor responses may indicate other area of possible restriction.

The perception of increased flow of energy in tight area, which is releasing. The therapist or the patient may experience the perception of a buildup of heat from the area, a throbbing or vibration in the tissues or a pulsation below the hand. The patient may describe itching, pulsing, or burning sensation, which has a crescendo or a rise and fall [21].

The patient may experience an autonomic nervous system response such as becoming light headed, change in body temperature or hear rate. Respirator cycles also may change during the process. These changes are temporary in reaction to the tissues opening and will reside momentarily. Caution should be taken to not to move quickly if these reactions are occurring [21].

Foam Roller

A foam roller is the largest implement we would use from a pressure perspective. The foam roller is very versatile, as you can work almost every muscle group using a foam roller alone. Rollers also come in varying densities, which allows for progression as well.

The GTO is a mechanoreceptor found at the muscle-tendon junction; for lack of a better description, it tells us the level of tension within the muscle/tendon group. When tension increases to the point of high risk of injury (e.g., tendon rupture), the GTO stimulates muscle spindles to relax the muscle in question. This reflex relaxation is autogenic inhibition. The muscle contraction that precedes the passive stretch stimulates the GTO, which in turn causes relaxation that facilitates this passive stretch and allows for greater range of motion. With foam rolling, you can simulate this muscle tension, thus causing the GTO to relax the muscle.

Foam rolling - 1. Improves mobility and range of motion 2.Reduction of scar tissue and adhesions 3. Decreased tone of overactive muscles 4. Improved quality of movement Contraindications - 1.Recently injured areas 2.Circulatory problems 3. Chronic pain conditions (e.g., fibromyalgia) [22].

Myofascial release technique and foam rolling both are expected to have an effect on spastic muscle but there are limited evidence about which of the either technique is more efficient than other to reduce spasticity. Thus purpose of the study is to compare the effect of both techniques on hamstring spasticity.

Materials and Methodology
2.1 Methodology
Study design: Comparative study
Study setting: Institutions approved by college
Sampling method: Simple random sampling
Sample size: 20 subjects

2.2 Inclusion criteria
Age group 2-8years
Male and female both.
Diagnosed case of spastic diplegia.
Modified ashworth scale grade 2 hamstring spasticity

2.3 Exclusion criteria
Subjects who has undergone prior orthopaedic surgeries
Subjects who has recieved botulium toxin injection in past 6 months
Subjects who has undergone serial casting in past 6 months.
Subjects who has lower extremity contracture.

2.4 Materials Required
Plinth
Goniometer
Foam roll (Blue)

2.5 Outcome Measures
Modified Ashworth scale Tardieu scale

Results
Data were obtained for each subject on 1st day and after 4 weeks Data was collected for each subject by calculating the average value of the variables of all the 20subjects.
Wilcoxon signed rank tests and paired t test was used to compare the variables within the group and Mann Whitney Rank Sum test and unpaired test was used to compare the variables between the groups. Statistical analysis is done using primer of Biostatistics
Table 1, and fig 3, shows pre and post values for modified Ashworth scale pretreatment and post treatment for group A. Group A mean decreased significantly from 2 to 0.9 the P value for this group is > 0.005 which statistically significant hence statistically and graphically significant change is seen in pretreatment and post treatment values of both Group A
Group an Effect of Myofascial Release Technique on Hamstring Spasticity

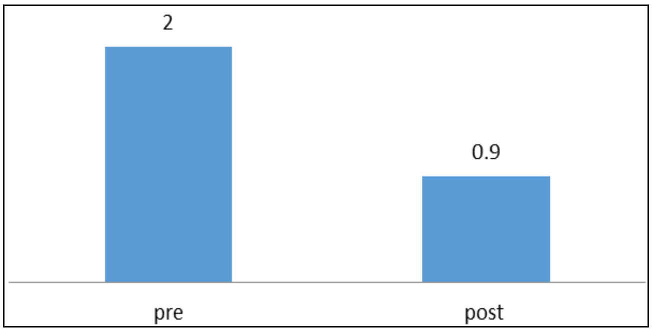

Fig 3: Mean difference in grade of hamstring spasticity pre and post treatment using Modified Ashworth Scale in Group A

Table 2 and fig 4 shows, pre and post values for tardieu scale pretreatment and post treatment for group A. Group A mean decreased significantly from 6.4 to 3 the P value for this group is > 0.005 which statistically significant hence statistically and graphically significant change is seen in pretreatment and post treatment values of Group A

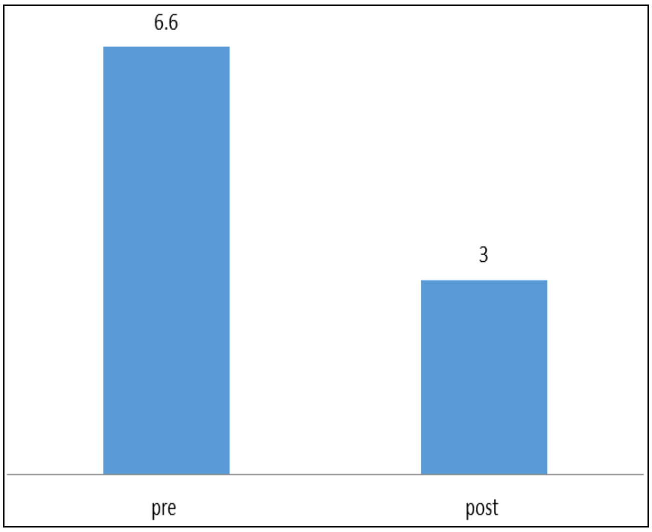

Fig 4: Mean difference in range pre and post treatment using Tardieu scale in Group A

Table 3 and Fig 5, shows pre and post values for modified Ashworth scale pretreatment and post treatment for group B. Group B mean decreased significantly from 2 to 1.3 the P value for this group is > 0.005 which statistically significant hence statistically and graphically significant change is seen in pretreatment and post treatment values of both Group B

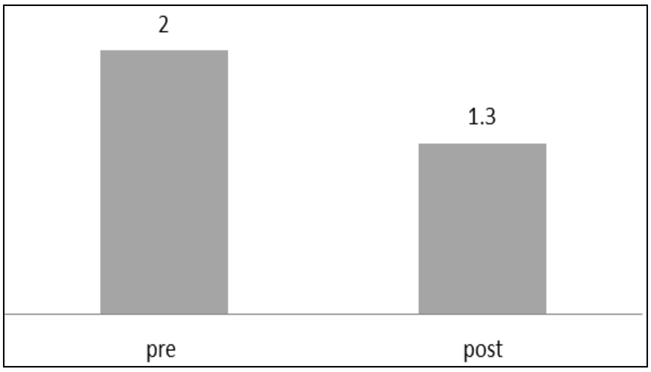

Fig 5: Mean difference in grade of hamstring spasticity pre and post treatment using Modified Ashworth Scale in Group B

Table 4 and fig 6 pre and post values for tardieu scale pretreatment and post treatment for group B. Group B mean decreased significantly from 6.6 to 4.the P value for this group is > 0.005 which statistically significant hence statistically and graphically significant change is seen in pretreatment and post treatment values of Group B

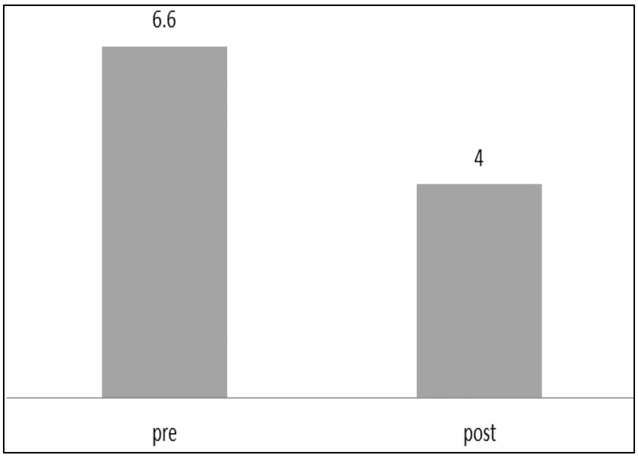

Fig 6: Mean difference in range using Tardieu scale in GROUP B

Table 5 and fig 7 shows difference in mean of modified ashworth scale both the groups. Group a showed better results than Group B statistically

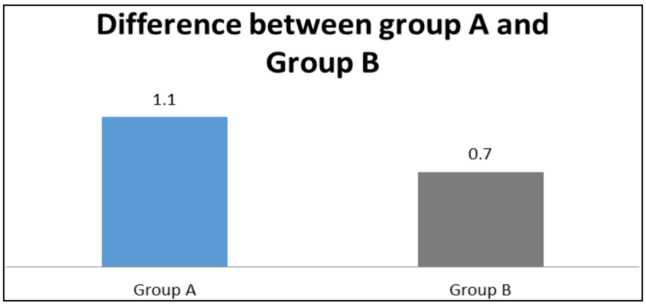

Fig 7: Comparision of differences of mean in Group A and Group B Modified Ashworth Scale

Table 6 and fig 8 shows difference in mean of tardieu scale both the groups. Mean difference was -0.1 there was hardly any difference between the mean. The p value is 0.732 which is statistically not significant which indicate that both the treatment was equally effective

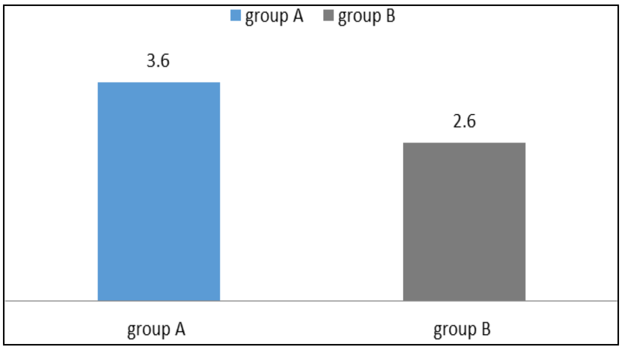

Fig 8: Comparision of differences in mean of Group A and Group B Tardieu scale

Discussion

The result obtained by assessing the hamstring spasticity of 20 subjects selected with the base inclusion exclusion criteria. In this study the results showed that statistically significant difference exist between pre and post treatment values in both group with reduction in hamstring muscle spasticity. Group A treated with myofascial release technique showed statistically significant result in reducing hamstring spasticity. *Sandra L, et al. (2010)* in their study found when MFR was applied to children with cerebral palsy benefits were observed in some of the children, including decreasing spasticity, improved body symmetry range of motion. The same improvement in muscle tone, body function, clinical parameter would not have been observed in control group who did not received these treatment. Myofascial release may be value to reduce spasticity and improve the quality of life in children with cerebral palsy. The current study result coincide with this study. *Chandan Kumar, et al. (2014)* found effect of myofascial release on spastic cerebral palsy and lower extremity function and found that group with myofascial release sowed more reduction in spasticity a compared to control group.

Shraddha Divan, et al. (2014) in her study found the effect of Effect of anterior chest wall myofascial release on thoracic expansion in children with spactic cerebral palsy and the results showed that Result showed that the chest expansion increased significantly. The probable mechanism for results could deal with neuroreflexive change that occurs with the application of manual force on the musculoskeletal system while giving MFR. The hands on approach offer afferent stimulation through receptors, which gives response by central processing at the spinal cord and cortical levels. Afferent stimulation frequently results in efferent inhibition. This principal is used in MFR technique when the afferent stimulation of a stretch is applied and the operator waits for efferent inhibition to occur so that relaxation results. Salvi Shah *et al*. reviewed some articles on Myofascial release and concluded that Myofascial Release is a very effective, gentle and safe hands-on method of soft tissue mobilization, it enhance the body’s innate restorative powers by improving circulation and nervous system transmission. This low load sustained stretch gradually, over time, allow the myofascial tissue to elongate and relax, thus allowing increased range of motion, flexibility and decreased pain.

Group B treated with foam showed statistically significant result in reducing hamstring spasticity. *John Davis et al* (2008) in their study found out that foam rolling is effective to reduce spasticiy tand improve range of motion in spastic cerebral palsy patients. Similar results are also seen in the present study. The GTO is a mechanoreceptor found at the muscle-tendon junction; for lack of a better description, it tells us the level of tension within the muscle/tendon group. When tension increases to the point of hi gh risk of injury (e.g., tendon rupture), the GTO stimulates muscle spindles to relax the muscle in question. This reflex relaxation is autogenic inhibition. The muscle contraction that precedes the passive stretch stimulates the GTO, which in turn causes relaxation that facilitates this passive stretch and allows for greater range of motion. With foam rolling, you can simulate this muscle tension, thus causing the GTO to relax the muscle.

When both the groups were compared group A had greater reduction in spasticity as compared to group B

Acknowledgment

I thank almighty for hi blessings he always sends.

I am thankful to My Guide and Principal Sir for the guidance and support.

Im thankful to all the teachers, friends and family for the support, help and guidance.

Conclusion

Thus, this study concludes that myofascial release technique is more effective than foam rolling to reduce hamstring spasticity in sastic diplegia.

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