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ORIGINAL ARTICLE

Immediate Effect of Functional Dry Needling on the Length of Shortened Hamstring Muscle; A Quasi-Experimental Study

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Author`s Contribution

[1]Conception and design, Collection and assembly of data, [2]Critical revision of the article for important intellectual content, [3 & 5]Statistical expertise, Analysis and interpretation of data, [4]Drafting of an Article [5]Final approval and guarantor of the article.

Article Info.

Received: August 6, 2022
Acceptance: 2023-03-07

Conflict of Interest: None
Funding Sources: None

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Cite this article as: Khan QA, Iqbal MA, Shah R, Abidin Syed ZU, Ahmad U. Immediate Effect of Functional Dry Needling on the Length of Shortened Hamstring Muscle; A Quasi-Experimental Study. JRCRS. 2023; 11(2):121-126
https://dx.doi.org/10.53389/JRCRS.2023110211

A B S T R A C T

Background: Functional dry needling (FDN) is a technique, most commonly used by physical therapist for the management of musculoskeletal disorders. Hamstrings are one of the most commonly observed muscles prone to tightness. Functional dry needling (FDN) is considered a novel technique for the treatment of shortened hamstring.

Objective: To explore the effects of functional dry needling (FDN) on the length of shortened hamstring muscle & lower extremity functional scale.

Methodology: A quasi-experimental single group, Pretest-Posttest clinical design was conducted at Saidu Group of Teaching Hospital, Swat from September 2020 to March 2021. A total of 32 patients whose ages ranged from 18-40 years, had hamstring lengths less than 70^{O} on goniometer during 90-90 SLR test, Subjects with other conditions such as pulled hamstrings, hyper lordosis, and flat back can lead to hamstring shortening were recruited in this study. The data was measured via goniometer, 90-90 SLR test and LEFs (Lower Extremity Functional Scale) before and immediately after treatment. Functional dry needling FDN was applied at certain points on the Biceps femoris, semitendinosus and semimembranosus. Treatment time was kept at 20 sec for each muscle, total treatment time was 1 minute.

Results: The male participants with a mean age of 29.59 ± 5.10 years were recruited. The majority of patients whose hamstring tightness was due to pulled hamstring (37.0%) followed by postural flat back (29.6 %), and lumber hyper lordosis (18.5%). The mean ±SD of hamstring length before and after intervention was 73.37 ± 3.99 & 77.93 ± 4.81. However, the mean ± SD of LEFS scores Pre and Post intervention was 54.44 ± 10.25 & 58.30 ± 11.13 respectively. A significant difference was observed in both Hamstring Length and in LEFS scores between pre- and post-study with a P=0.001 (P<0.05).

Conclusion: This study concluded that functional DN may increase the hamstring length and enhances daily functional activities.

Keywords: Dry Needling, Hamstring Muscle, Muscle Tightness

Introduction

Flexibility is considered to be the most vital component, required for different musculoskeletal activities which improve performance.[1] The most common problem faced by athletes as well as by common people especially young adults is flexion disability specifically in terms of hamstring muscle tightness.[2 3] Muscle tightness is considered, the most common cause or often determined as the predisposing factor of muscle injuries.[3] Based on functions, the muscles are divided into two types, phasic or postural muscles, and hamstrings are a good example of such types i.e. postural muscles that are more prone to tightness and shortening.[4] The hamstrings is a broad muscle consisting of 3 muscles present in the posterior

compartment of the thigh.[5] Primarily they act as hip extensors and also act as an important flexor of the knee. Among the postural muscles, the hamstrings are the leading one that is prone to shortness about 68.56%.[6] Prevalence of the hamstring tightness is very high especially in college students and athletes.[5] Tightness or shortening of muscle is defined as muscular hyperactivity due to loss of the inhibition of muscle tone which results in persistent contraction.[7, 8] Range of motion limitation in hamstring tightness is considered to be range less than 160° at knee full extension while keeping hip flexed at 90°.[9] Different techniques are currently available to release hamstring and lengthen the shorten fibers, hamstring can be treated using a variety of established techniques, including manual therapy, medical and surgical intervention. Similarly targeting trigger point or non-trigger point soft tissue structures.[10]

Methodology

A single pre-test post-test quasi experimental study was conducted at Saidu Group of Teaching Hospital Swat from September 2020 to March 2021. The study protocol was approved by Research ethical committee of Riphah College of Rehabilitation and Allied Health Sciences (RCRAHS) (No: Riphah/RCRCS/REC/letter-00696) and by the ethical committee of Saidu Group of Teaching Hospital Swat. Patients were informed about the purpose of the study while written and verbal consent were obtained prior to the initiation of the intervention. All the confidentiality and rights of the subjects were protected throughout the course of the study. A total of thirty-two male patients were recruited through convenience non-probability sampling method in this study. Sample size was calculated through paired sample formula/Lehr's rule of thumb i.e. $n = \frac{8}{\Delta 2}$ or $c + \frac{2}{\delta 2}$ (n=32) [13, 14] The male participants whom age ranged from 18-40 years, having hamstring length less than 70° on goniometer during 90-90 SLR test, while the subject according to inclusion criteria that suffers from shortened hamstring caused by any of these known cases including knee Osteoarthritis, Spondylosis, LBP, Lumber radiculopathy, also subjects with hyper lordosis were recruited in this study. Subjects suffering from blood clotting disorders such as hemophilia, those with deformities such as leg length discrepancy, compromised immune system, vascular diseases, diabetes, People with congenital or metabolic bone disease. Patients diagnosed with shortened hamstrings were recruited, who full fill our criteria on the basis of inclusion /exclusion criteria; irrespective of their medical conditions. The data was recorded before the intervention and then FDN was applied on 3 different spots on the hamstring muscle and the data was then recorded after the intervention on the same day. A single session of FDN (without any other regimen combined) was given to the patient, without any follow-ups.

The tools used for measuring the outcome were goniometer, the Lower Extremity Functional Scale (LEFS). A goniometer is an instrument which measures the available range of motion at a joint.[15] A study shows that for knee and elbow, goniometer can be reliable that is r=.67 to .70.[16] The purpose of the Passive Knee Extension Test (90-90 SLR hamstring test) is to examine the joint range and its quality of movement; in particular, the 'end feel' of the joint. Passive knee extension tests was used to measure hamstring muscle tightness. The test-retest study for reliability shows the reliability for this test to be 0.87-0.94. these finding suggest its high intra-rater reliability.[17] The Lower Extremity Functional Scale (LEFS) is a questionnaire containing 20 questions relating person's ability to perform everyday tasks. The LEFS can be used to evaluate the functional impairment of a patient with a disorder of one or both lower extremities. A prospective methodological study shows the reliability of LEFS to be high and consistent with anterior knee pain which shows r=0.98.[18]

Screening tests named Galeazzi test was used for screening of hip dislocations and to assess significant leg length inequality and True and apparent leg length test was performed prior to the initiation and inclusion of the subjects in this study to exclude the patient with leg length Discrepancy (LLD). In this study hamstring tightness was considered significant if there was loss of more than 20° degree [19] of knee extension while lying in supine position holding hip in flexion while extending the knee. The hamstring muscles including the Biceps femoris, Semitendinosus and Semimembranosus muscle in prone position were screened for certain points via manual palpation. After the identification of tights spots, the area over the hamstring muscle was cleansed with alcoholic swap to reduce the chances of infections and to ensure the safety of the patient. A physical therapist trained in dry needling performed the method of functional dry needling**.** A needle having size of 60-70* 0.3mm, inserted into the posterior compartment of the thigh, manipulating the needle following Pistoning technique which includes the insertion and withdraw of the needle in the form of screwing, inserting and withdrawing of the needle without fully withdrawn from the skin which in turn elicited local twitch response. A single session functional dry needling was performed for 1 min, 20 sec on each point. After the application of DN, the side effects of Functional dry needling were kept in mind to reduce the possibility of occurrence of the soreness of hamstring muscle and pain, post interventional hamstring stretch were advised to the patient for 10 sec on the day and after for three days. The patients were also advised to perform stretch at home to maintain the flexibility of hamstring

muscle 3 time daily for 10 sec,[20] Also calcium 1000 dispersible tablets were advised for three days OD in combination with stretch to reduce post interventional muscle soreness, which is effective in reducing post DN soreness.[21] The Data was analyzed on SPSS version 25. The normality test was applied using Shapiro Wilk test. The data was normally distributed, therefore paired t test was applied to find the difference between pre and post variables.

Figure 1 90-90 SLR test

Results

A total of 32 patients were recruited after screening. Out of 32 participants five participants denied to be part of this study. Finally a sample of total 27 participants were enrolled in this study to find the immediate effects of functional dry needling on hamstring muscle shortness and function of lower extremity. The male participants with a mean age of 29.59 ± 5.10 were recruited. The participants who were presented at that time were suffering from different diseases that include flat back confirmed through x-rays 29.6 %, Radiculopathy 11.1%, stenosis 3.7, pulled hamstring 37.0% and hyper lordotic 18.5% as mentioned in Table I.

Table I: Patient demographic

Variables	Experimental (*n* = 27) *N (%)*
Age *(yr)*[a]	29.5 ± 5.1
Gender	
Males	27 (100)
Females	0
Leg involved	
Right	12 (44.5)
Left	15 (55.5)
Participants condition with Hamstring tightness	
Posture Flat back	8 (29.6)
Radiculopathy	3 (11.1)
Stenosis	1 (3.7)
Pulled hamstring	10 (37.0)
Hyper lordosis	5 (18.5)

[a]*Mean ± SD*

Table II shows pre and post comparison of variables, the mean ± SD of hamstring length measured by 90-90 SLR before intervention was 73.37 ± 3.99 while the mean ± SD of hamstring length after the intervention was 77.93 ± 4.81. There was a significant difference in hamstring length between pre and post study with a P=0.001(P<0.05).

Table II shows pre and post comparison of variables, the mean ± SD of LEFS scores before intervention were 54.44 ± 10.25 while the mean ± SD of LEFS scores after the intervention were 58.30 ± 11.13. There was a significant difference in LEFS scores between pre and post study with a P=0.001(P<0.05).

Table II: Pre and Post Mean difference of variables

Variables	Mean ± SD		[a]*P*-value
	Pre-test	Post-test	
90-90 SLR	73.37 ± 3.99	77.93 ± 4.81	0.001
LEFS	54.44 ± 10.25	58.30 ± 11.13	0.001

[a]*Paired t test, LEFS: lower extremity functional scale*

Discussion

This study demonstrates that FDN while using a piston technique can significantly improve and release hamstring tightness with better clinical outcomes in patients with shortened hamstrings. This procedure provides immediate release of the hamstring which improves the activities of daily living. Different authors have focused on different techniques such as stretching post facilitations stretch and post isometric relaxation to improve the hamstring flexibility and SLR which requires multiple repetitions and session. The author has focused in this study is to determine the immediate effect of functional dry needling on the length of shortened hamstring muscle as well as to find where this intervention has any effect on the LEFS in opposition to see in contrast to other procedure that requires multiple session and are time consuming. As the time course of clinical outcome is very important to patient which might differ among different techniques. After analyzing the data, this pre-test posttest clinical trials suggested that after application of functional dry needling on the hamstring muscle for 1 minute, manipulating each for 20 sec, subjects showed significant improvement in length of hamstring and functional daily activities. We observed that a single session of functional dry needling can increase the length of hamstring muscle.

These findings are consistent with previous study carried out by Ansari et al in 2019 on 15 healthy individuals, to

find the effects of dry needling on hamstring flexibility. The author suggests that one session of dry needling for one minute improves the hamstring flexibility. In this study, the length of hamstring was measured by active knee extension test.[22] As many variables showed improvement, this study might lay some evidence for clinical relevance of improving length and functional activities that will last more than an hour, after an application of functional dry needling. The author find no significant difference between large and small muscle group such as hamstring against wrist flexor the improvement and release of spasticity different muscle group. This study shows that FDN is equally effective in different muscle group that are affected by different condition. This statement is being supported by "A single group pretest-posttest clinical study by Fakhari Z et al to find the effects of dry needling on wrist flexor spasticity after stroke. Which significantly reduce the spasticity in wrist flexor and improve the function of hand in stroke patient.[23] In addition, this study rechecked the improvements after one hour follow-up and improvements persisted after one hour of dry needling. However, our study didn't recheck the improvement persistent. Future study should focus on long term effects of functional dry needling. The ideal degree of improvement that would remain persistent after one hour or for long term effects is therefore controversial. Despite of the short-term effects in this study we use FDN to lengthen the hamstrings therefore after the treatment we recommend static stretching or home-based exercise to improve the functional outcome and hamstring flexibility to maintain the effects of functional dry needling.

Mendigutia et al, has confirmed that dry needling can significantly reduce the spasticity in shoulder muscle including upper trapezius and pectoralis major and hence increase the range of motion of the shoulder joint.[24] In addition, this study includes the randomization, controlled, repeated measures, double blinded design with 3 sessions, one session per week. However, the result of the former study agrees to ours, in this study the author fails to use randomization and no control group was used to see whether the effects of the dry needling was the actual effects of it was a placebo effect, this problem of doubtfulness and actual effects was further enlightened by the study of Kathleen et al that neither opposes nor support the idea that DN can increase the length of hamstring muscle. The results of the study were uncertain it improves the single hop for distance time meter hop but it does not clarify that whether dry needling improve the hamstring extensibility beyond that of stretching.[25] However, there might be possibility that patients suffering from some past injuries or having some issues that were not related to pain and muscles or the proper method of DN might have not been adopted, or either this might be due to non-proper manipulation of the dry needle.

Our study shows that functional dry needling can improve lower extremity function measured on LEFS immediately after 1st session of dry needling which is consistent with the study of the Sarfaraz et al. The six chronic stroke patients with ankle spasticity and gait impairment were recruited, to see the short-term effect of dry needling on spasticity. Based on the Time Up and Go test, the lower extremity functions were significantly improved. In addition, the Modified Ashworth score show significant reduction in resistance to passive movement. Furthermore, it shows a significant increase in fascial length of gastrocnemius and soleus muscle.[26] This data is also consistent with the study carried out by Ghannadi S et al, to know the effect of dry needling on lower limb dysfunction in poststroke survivors. The author concluded that deep dry needling have positive effects on improving gait, gait stability, time up and go test, 10 meter walk, single leg stance and passive ankle dorsiflexion range where some of the criteria of this study met our study and shows that both study agreed upon some of the parameter of the function of the lower limb.[27]

This study has several limitations. Firstly, this study does not include controlled group to see whether the FDN truly have effects on the length of broad muscles or not. Secondly, this study does not include any other technique in comparison or an adjunct to this. Thirdly, the treatment time was too short as well as no follow-up was included in this study. To find whether the effects of DN last longer, long term follow-up is needed to assess the possibility of persistent long-term effects of functional dry needling. It is highly recommended that this study should be carried out on large number of subjects and should be conducted on large scale, multicenter clinical trials which will focus on the rehabilitation of dry needling compared with other intervention.

Conclusion

This study found that a single session of 1-minute functional dry needling may improve the hamstring length, by reducing the tightness of shortened hamstring muscle. Furthermore, this study demonstrated that functional dry needling may increases the function of lower extremity affected due to shortened hamstring muscle.

Conflict of interest: None
Funding Source: None

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