RESEARCH ARTICLE

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Short-Term Impact of Dry Needling on Post-Stoke Spasticity and Static Balance: A Pilot Study

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Abstract

Dry Needling (DN) is a therapeutic technique employed to address myofascial trigger points and various pain conditions. There is currently insufficient evidence to support the use of DN in neurological diseases with functional evaluation. This preliminary study looked at how DN affects the spasticity and static balance of the soleus muscle in people who have had a stroke in the past. **Objective**: To investigate the impact of DN on spasticity using the Modified Ashworth Scale (MAS), Modified Tardieu Scale (MTS), and Berg Balance Scale (BBS). **Method:** The study took place as an experiment at a Tertiary care hospital. A pilot study was conducted, involving 10 individuals who had experienced a stroke more than 3 months ago. MAS and MTS were used to assess spasticity as outcome measures. The balance is assessed by using the Berg Balance Scale (BBS). The stroke patients underwent six sessions of DN treatment for the spastic soleus muscle, spanning two weeks. Outcome measures were evaluated again after 2 weeks. **Result:** There was a notable enhancement observed for all three outcome measures ($p<0.05$). The individual demonstrated progress from Grade 3 to 1+ in MAS and exhibited a decline in resistance to passive motions involving the plantar flexor muscles. Ankle ranges show a notable enhancement of 12 degrees according to the Tardieu scale. The Berg balance scale score showed a notable gain of 7 points, reflecting a significant enhancement of balance among stroke patients. **Conclusion**: The application of DN was efficacious in improving spasticity, improving ROM, and enhancing stability maintenance accuracy in stroke patients. The preliminary findings show promise, but additional research is required to confirm the results.

Major Findings: Dry needling (DN) over soleus muscle significantly reduced its spasticity. An improvement in static balance in stroke patients was also seen after DN.

Keywords: BBS, DN, MAS, MTS, Spasticity, Stroke

1. Introduction

Cerebrovascular accidents are a prevalent global ailment and a leading contributor to disability due to their significant effect on functional limitations. Despite the lack of comprehensive understanding, current research has revealed notable distinctions between stroke patients who experience spasticity and those who do not. Individuals who have suffered a stroke and have spasticity frequently encounter additional limb abnormalities, physical impairment, and discomfort that restrict their capacity to carry out fundamental daily tasks, such as taking care of themselves and walking. Stroke survivors with spasticity frequently encounter psychological and emotional challenges, including sadness and a negative self-perception. Spasticity is thought to significantly impair the Health-Related Quality of Life (HRQoL) of individuals who have had a stroke[1]. Approximately 33% of those who have experienced a stroke ultimately develop lower limb spasticity[2]. As a result, many individuals who have experienced a stroke and have muscle stiffness in their lower limbs often report challenges with standing

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and maintaining their balance[3]. The gastrocnemius and soleus muscles are the main muscles in the lower extremity that play a crucial role in maintaining an upright standing position. Individuals with hemiparesis following stroke exhibit reduced force-generating capacity in the ankle plantar flexor muscles, which are crucial for the gait cycle[4]. Stroke patients commonly experience spasticity in their ankle plantar flexors, which means that these muscles become excessively tight and resistant to movement in the direction of gravity[3].

Various pharmaceutical and physical therapy interventions have been suggested to effectively address spasticity in individuals who have experienced a stroke[3]. Recently, there has been a focus on therapeutic methods to decrease spasticity. These methods include: Techniques utilised include muscular stretching techniques, muscle strengthening regimens, physical agent interventions (such as shockwave therapy and functional electrical stimulation), and pain control strategies. These approaches are being merged with traditional pharmacological interventions[5]. Presently, the medication therapies available for patients experiencing spasticity involve the use of the toxin botulinum type A. This drug works by blocking the breakdown of neurotransmitters at the junction between the muscles. It is costly and may potentially cause adverse, enduring consequences for the muscular tissue.

Dry needling is a non-pharmacological treatment option for spasticity[4,6]. Physical therapists have utilised DN to address spasticity. This procedure does not involve the introduction of any chemicals into the body[3]. The American Physical Therapy Association defines dry needling as a precise technique that involves the use of a tiny thread-like needle to enter the skin to address neuromuscular deficits[7]. The DNHS technique is an innovative dry-needling method used to reduce hypertonia and stiffness as well as enhance functional outcomes in patients with central nervous system impairment. DN works by mechanically disrupting the malfunctioning endplate zone. In addition, dry needling has been demonstrated to improve blood circulation and increase oxygen levels in the targeted area[8]. Various dry-needling procedures have been employed to treat people suffering from spasticity[9]. Nevertheless, the impact of DN on spasticity affecting the soleus muscle has not been addressed. The current research on the utilisation of dry needling for neurological diseases with functional assessment has not provided detailed information on the potential effects of the interventions. This case series aimed to investigate the impact of DN on the spastic soleus muscle in individuals with chronic stroke. Hence, the primary aim of the current research was to evaluate the impact of DN on hypertonia and stable balance in stroke patients. This was accomplished by employing the MAS, the MTS to measure spasticity in the soleus muscle, and the BBS.

2. Methodology

A case series investigation was conducted using a single group and a pre-and post-experimental design. After obtaining ethical committee approval, participants signed a consent form before the study commenced. Individuals with long-term strokes who satisfied the specified criteria were recruited. The criteria for inclusion were as follows: (i) The initial occurrence of a stroke affecting just one side of the body (at least 3–4 months since the stroke began); (ii) Paralysis on one side of the body caused by the stroke; (iii) An age range between 40 and 75 years. (iv) The ankle plantar flexors exhibiting spasticity, graded I-III MAS. (v) Cognitive function is intact, with an MMSE grade higher than 24. (vi) The Berg Balance Scale score of 21-56 shows a risk of falling from low to moderate. (vii) Be able to walk, either independently or with the use of a mobility aid. The exclusion criteria encompassed the following: (i) Repeated occurrence of stroke; (ii) Administration of botox within the previous 6 months; (iii) Presence of any other neurological disorder; (iv) Phobia of needles; (v) Any definitive contraindication for DN, ex anticoagulant usage includes infections, bleeds, or psychotic conduct.

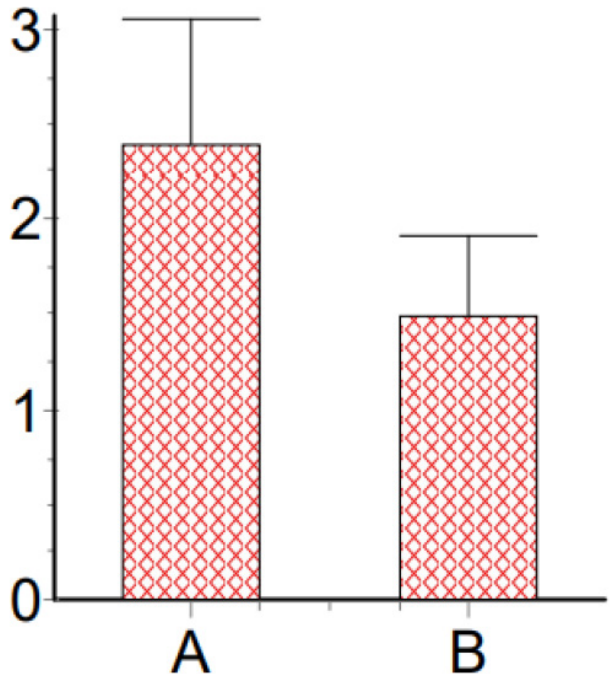
3. Intervention

Before any intervention, authorization was acquired from the neurologist, the committee for research and recognition, and department heads. The research comprised a cohort of ten individuals who had experienced chronic strokes. Following the assessment of eligibility based on certain criteria, the patients provided informed permission. Before the protocol, the patients were provided with an explanation of the procedure. Every patient had before and after assessments using the MAS, MTS, and BBS. Following an initial evaluation, the thought band of the spastic soleus muscle was identified with the use of a pincer-like grasp. After identifying the

site of insertion, the skin above it was sterilised. Then, after one session, DN was performed on the soleus muscle using disposable needles measuring 0.25 x 40 mm. Attached to the DN lever and directing pipe, the needle was positioned at the desired angle to penetrate the skin. The guide tube was removed, and the needle handle was inserted for 30 seconds, then removed (Figure



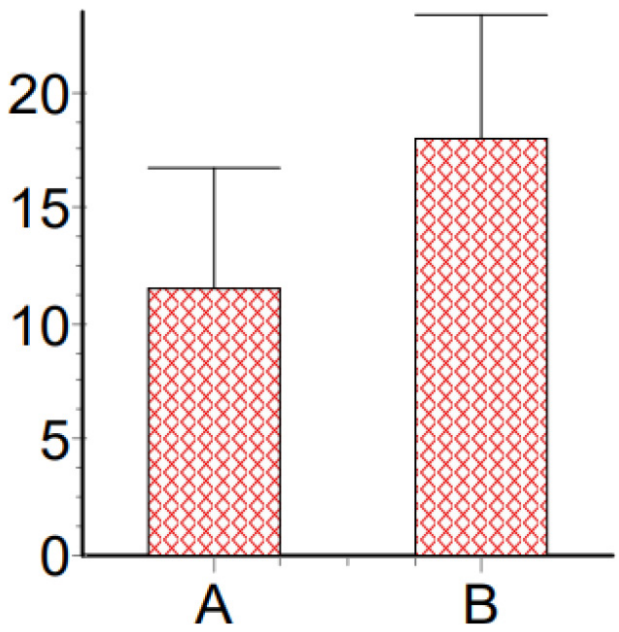
Figure 1. Dry needling on spastic soleus muscle.



Graph 1. Impact of DN on MAS.

Table 1. Impact of DN on MAS

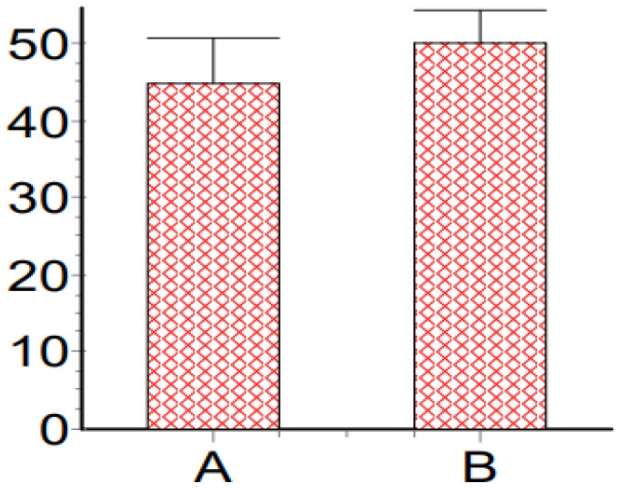
MAS	Pre (A)	Post (B)
Mean+SD	2.4+0.7	1.5+0.4



Graph 2. Impact of DN on spasticity by MTS.

Table 2. Impact of DN on spasticity by MTS

R2-R1	Pre (A)	Post (B)
Mean±SD	11.50±5.29	18±5.37



Graph 3. Effect of dry needling on Berg Balance Scale (BBS).

Table 3. Effect of dry needling on Berg Balance Scale (BBS)

BBS	Pre (A)	Post (B)
Mean±SD	44.80±5.69	49.90±4.33

1). Following the implementation of DN, the patient was instructed in traditional activities to enhance the overall impact. Each patient had six further sessions of DN on the soleus muscle, along with conventional treatment, for two weeks. Following each session, a post-assessment was conducted utilising the MAS, MTS, and BBS scales.

4. Results

Spasticity of ankle plantar flexors showed improvement and was statistically significant ($p<0.05$) after the intervention.

The application of dry needling showed a significant ($p=0.01$) effect on reducing spasticity of the soleus muscle and an increase in the degrees of range of motion of the ankle.

There was a significant ($p<0.05$) improvement in static balance after the application DN by using the Berg balance scale.

5. Discussion

DN is widely recognised for its efficacy in pain management, and only recently has it been suggested as a potential treatment for spasticity management[3,10]. This study is an initial analysis of the impact of DN on spasticity and static balance in individuals who have experienced a stroke. The study's results demonstrated that DN effectively reduced spasticity and significantly improved balance in stroke survivors following its administration[11,12].

By using the MAS and the MTS to measure spasticity, Tables 1 and 2 and Graphs 1 and 2 show statistically significant improvement in spasticity and balance after dry Needling. Our findings corroborated prior research that showed a reduction in spasticity among stroke patients. The MAS and MTS were employed as evidence-based instruments to evaluate spasticity in the plantar flexors[3,13]. The mechanical insertion of needles locally breaks the integrity of soft tissue contractures. This process, known as DN, effectively reduces muscle resistance to passive movement[14-16]. Furthermore, we noted a substantial enhancement in balance following the implementation of DN through the utilisation of the Berge balance scale in Table 3 and Graph 3. Findings in this study agree with those of the previous literature[17,18], which showed that DN was efficient at improving balance in stroke patients by using posturography[19]. Reducing spasticity would thus result in alterations in posture and enhance balance[10,20].

6. Limitations

(i) The study included a limited number of participants. (ii) Additionally, it included immediate assessments in one group.

More research is required to look at what happens when you use dry needling on a larger group of people, for longer periods, and with a wider range of interventions related to dry needling to help reduce spasticity in people with lower limb dysfunction. That being said, it's important to compare and contrast the effects of dry needling with other types of therapy that aim to reduce spasticity and improve balance in people who have had strokes.

7. Conclusion

According to the findings of the present investigation, administering six sessions of dry needling to stroke patients appears to have a beneficial impact on decreasing spasticity and enhancing balance. Following the administration of DN, a decrease in the muscular tone of the spastic soleus is detected based on the MAS and Tardieu scales. Furthermore, the stroke population exhibits a significant enhancement in static balance, as indicated by the BBS.

8. Clinical Implication

DN is effective in lowering muscle tone and enhancing ROM, and improving balance in individuals who have experienced a stroke. The preliminary findings show great promise; however, it is necessary to perform additional studies on a larger sample size to further substantiate the results.

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