Does Dry Needling Treatment Make an Extra Contribution to Conventional Treatment in Hemiplegic Shoulder Pain? A Randomized Controlled Study

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July 26, 2021

Abstract

Aim: To evaluate the effect of adding dry needling treatment to conventional rehabilitation on pain, range of motion, and functionality on hemiplegic shoulder pain. Methods: A total of 38 patients with hemiplegic shoulder pain were divided into two groups. A multimodal rehabilitation protocol including physical therapy methods and exercise treatments was applied to both groups (5 sessions per week for a total of 15 sessions). In addition to the rehabilitation, three sessions of dry needling treatment were applied for dry needling group. Pain with visual analog scale, range of motion with a goniometer, functionality was evaluated by quick disability of the arm, shoulder, and hand and fugl meyer assessment upper extremity. Evaluations were made before treatment, after treatment, and at the third month of treatment. Results: Patients aged from 30-60 years (mean±SD=53.1± 5.3). The average duration of HSP was 6.7±1 months. While a significant improvement was observed in both groups in all parameters after the treatment, a statistical superiority was found in the dry needling group ($p<0.05$). At the 3rd month follow-up, there was no difference in pain and functionality parameters between the groups, while flexion and abduction measurements were higher in the dry needling group ($p <0.05$). Conclusion: Adding dry needling treatment to conventional rehabilitation did not show any difference except for some joint range of motion measurements in the subacute period.

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Results: Patients aged from 30-60 years (mean±SD=53.1± 5.3). The average duration of HSP was 6.7±1 months. While a significant improvement was observed in both groups in all parameters after the treatment,

a statistical superiority was found in the dry needling group ($p<0.05$). At the 3rd month follow-up, there was no difference in pain and functionality parameters between the groups, while flexion and abduction measurements were higher in the dry needling group ($p <0.05$).

Conclusion: Adding dry needling treatment to conventional rehabilitation did not show any difference except for some joint range of motion measurements in the subacute period.

Keywords: Hemiplegia, shoulder pain, myofascial trigger point, dry needling.

What's the known

Hemiplegic shoulder pain is a common entity that negatively affects the rehabilitation process.

Hemiplegic shoulder pain is a complex condition in which many different etiologies may coexist and a multimodal approach is essential in its treatment.

What's the new

- Myofascial trigger points should not be ignored in the treatment algorithm in hemiplegic shoulder pain.
- Dry needling treatment, which is applied in addition to conventional rehabilitation, contributes to the shoulder pain and joint range of motion parameters of the patients in the acute period.
- In the subacute period in hemiplegic shoulder pain, an extra contribution has been detected only on range of motion with dry needling.

INTRODUCTION

Hemiplegic shoulder pain (HSP) is one of the most prevalent upper extremity complications after stroke.[1] The incidence of HSP ranges from 16% to 84%.[2] Mostly occurring from the second month after stroke, it can also occur in the first two weeks to a lesser extent.[3] HSP accompanying the rehabilitation of hemiplegic patients is a significant problem since it limits daily activities, prolongs hospital stay, and adversely affects rehabilitation outcomes.[1] Impaired motor control and tone changes (subluxation, scapular dyskinesia, spasticity), development of soft tissue lesions (shoulder impingement syndrome, rotator cuff tendinopathy, bicipital tendinopathy, adhesive capsulitis, myofascial pain syndrome), and changes in peripheral and central nervous system activity (entrapment neuropathies, complex regional pain syndrome, central post-stroke pain, central hypersensitivity, brachial plexopathy) play an important role in the etiology of HSP.[4]

Myofascial pain syndrome, which may play a role in the etiology of HSP, is a condition characterized by a taut band and trigger point, accompanied by sensory, motor, and autonomic symptoms.[5] The formation of myofascial trigger point (MTrP) may be due to the deterioration of the biomechanics of the region as a result of a muscle imbalance in the shoulder girdle of the patients. It can also be due to structural changes caused by spasticity in the muscle tissue, asymmetric tension forces on the joint, and postural dysfunction due to the weakening of the muscles involved in trunk stabilization.[6] Thorough physical examination of the shoulder girdle and adjacent musculature is essential in its diagnosis, and it is necessary to distinguish whether MTrP is active or latent.[7] While pain is continuous in an active MTrP, there is no spontaneous pain in latent MTrP and is provoked by palpation.[8] Medical treatments, physical therapy modalities, exercise approaches, and invasive interventions (dry needling, local anesthetic injection, botox) are available in the treatment options.[9] Although there is no consensus in the literature on how many sessions and intervals these treatments should be performed, the general opinion is that invasive treatment approaches should be performed as sessions at regular intervals. Dry needling (DN) treatment is an increasingly popular, microinvasive, cost-effective treatment approach with a low risk of side effects in the treatment of MTrP.[10]

Numerous studies have been conducted on invasive treatment approaches, such as subacromial injection, glenohumeral injection, and suprascapular nerve block in HSP.[11] Furthermore, some studies have used local anesthetic and DN for the treatment of MTrPs that cause HSP.[12-14] There are limitations in these studies, such as the number of sessions and the muscles treated are not standardized, and the follow-up periods are short. The present study aims to show that DN treatment performed in addition to conventional rehabili-

tation practices provides additional improvement in patients' pain, joint range of motion, and functionality parameters.

PATIENTS AND METHODS

Study design and patient enrollment

This study was conducted as a prospective randomized controlled trial. All participants were informed about the study and their written informed consent was taken. It was registered prospectively at ClinicalTrials.gov (ref. NCT04790071) and conducted in accordance with the Helsinki Declaration. The study protocol was approved by the local ethical committee of the Biruni University, Turkey (2015-KAEK-43-20-12).

The participants in this study were patients aged 30–60 who were diagnosed with HSP and administered to the physical medicine and rehabilitation polyclinic of our hospital between May 2019 and June 2019. These participants had an active MTrP in the upper trapezius, subscapularis, supraspinatus, infraspinatus, teres minor, pectoralis major, and biceps brachii muscles. The diagnosis of HSP was made based on the patient's history, physical examination findings, and magnetic resonance imaging techniques.[15] The diagnosis of MTrP was made based on the criteria defined by David G. Simons.[8] Initially, 46 patients were included in the study, but two patients refused to participate. Two other patients did not meet the inclusion criteria since they had used painkillers for shoulder pain one week ago. Throughout the study, two patients from each group could not complete the treatment process. Finally, the study was conducted with 38 patients. The flow chart of the study is illustrated in Figure 1. The patients were randomized into two groups: the conventional treatment group and the conventional treatment–DN combination group. The randomization sequence was created using Excel 2016 (Microsoft, Redmond, WA, USA) using block sizes of 2 and 4. Sample size was calculated using the study by Mendigutía-Gómez et al.[12] in which pain intensity before and after treatment was equal to 7.0 (1.3) and 2.1 (1.6) in dry needling group and 7.0 (1.4) and 6.5 (1.5) in conventional group, and considering 80% of power and alpha of 0.05, as well as two-tailed difference in pain intensity before and after treatment in each group. As there was a possibility that some patients do not complete the study, 23 patients were included in each group.

Inclusion criteria:

1- History of first stroke

2- At least three months have passed since the stroke

2- A Mini-Mental State Exam score above 24 points

3- No history of shoulder pain before the stroke

4- No medication used for shoulder pain in the last two weeks or no injection (botox, steroid, local anesthetic) in the past three months

5- Stability hemodynamics to tolerate rehabilitation

6- Patients aged 30–60

7- Hypertonicity in the upper extremity (modified Ashworth scale [?]2)

8- Detection of referred pain patterns by palpation of MTrPs

9- Active MTrP in the upper trapezius, subscapularis, supraspinatus, infraspinatus, teres minor, pectoralis major, and biceps brachii muscles

Exclusion criteria:

1- Recurrent stroke history

2- Absence of active MTrP in the shoulder muscles

3- Cognitive dysfunction in the patient

4- The use of anticoagulants that are contraindicated to DN or the presence of infection

5- The patient has a cardiac pace-maker

6- History of physiotherapy treatment in the last three months due to shoulder pain

7- Neuropathic pain in the patient

8- Frozen shoulder, rotator cuff lesion

Interventions

A multimodal rehabilitation protocol including physiotherapy and exercise treatments was applied jointly to both groups. This protocol consisted of a total of 15 sessions for three weeks, five sessions per week. On the first, eighth, and fifteenth days of the treatment, three sessions of DN were additionally performed on the conventional treatment–DN combination group.

The conventional rehabilitation protocol included 20 min of hot packs, 30 min of high-intensity transcutaneous electrical nerve stimulation, and 30 min of exercise per session. The exercise protocol incorporated the entire upper extremity on the affected side, including the patient's shoulder, elbow, and wrist. Initially, flexion, abduction, extension, moderate external rotation, and internal rotation movements of the shoulder region were performed passively by the physiotherapist. Movements were performed at the pain limit in order to prevent rotator cuff damage during the abduction movement. Then, mobilization exercises for the glenohumeral and scapulothoracic joints were added. The active range of motion exercises and isometric strengthening exercises for the shoulder abductors and elbow flexors were added to the treatment program in patients with a manual muscle test greater than 3/5. Walking, balance, and coordination exercises with an assistive device were also included in the rehabilitation program.

DN treatment was administered by a physician (F.B) with eight years of experience. First, active MTrPs in the muscles were identified through a physical examination. The area to be treated was cleaned with alcohol. The Seirin J-type sterile acupuncture needles (Seirin Corporation, Shizuoka, Japan) for the upper trapezius, subscapularis, supraspinatus, infraspinatus, teres minor, pectoralis major, and biceps brachii muscles targeted and penetrated the skin. Intramuscular navigation was performed until a local twitch response was obtained. If there was more than one trigger point in a muscle, the treatment was applied to the most painful point. After the needle was removed, a localized hematoma was prevented by applying pressure with cotton for 1 min. DN was performed in the prone position for the upper trapezius, infraspinatus, teres minor, and subscapularis muscles; supine position for the pectoralis major muscle; and side-lying position for the supraspinatus (Figure 2).

Outcome measures

The visual analogue scale was used to evaluate the shoulder pain severity of the patients. For this purpose, a 10-cm long line was drawn and numbered at 1 cm intervals. The patient was explained that zero corresponded to no pain and ten to the most severe pain and then asked to mark the value corresponding to his pain on the scale. The joint range of motion measurements in the flexion, abduction, and external rotation were recorded. The functionality of patients was analyzed using the Quick Disability of the Arm, Shoulder, and Hand (Q-DASH) and the Fugl-Meyer Assessment of the Upper Extremity (FMA-UE). The Q-DASH is the short version of the Disability of the Arm, Shoulder, and Hand (DASH) questionnaire for the assessment of upper extremity problems. The difficulties faced by individuals while performing their daily living activities due to upper extremity problems were assessed using 11 items in this questionnaire. Each item of the questionnaire was scored between 1 and 5. A score between 0 and 100 (0 = no disability, 100 = maximum disability) was calculated from each section in the Q-DASH questionnaire. In contrast, FMA-UE is a disease-specific, objective motor impairment scale designed specifically to evaluate the recovery in post-stroke hemiplegic patients. It includes subsections that evaluate joint movements, coordination, and reflex activities related to the shoulder, elbow, forearm, wrist, and hand. The highest score that can be obtained from this assessment

is 66, and a high score indicates good functionality. In this single-blind study, a physiotherapist (A.A) made the evaluations before treatment, after treatment, and at follow-up.

Statistical analysis

Mean, standard deviation, median, minimum, maximum value frequency and percentage were used for descriptive statistics. The distribution of variables was checked with kolmogorov-simirnov test. Mann-whitney U test were used for the comparison of quantitative data. Wilcoxon test were used for the repeated measurement analysis. Chi-Square test was used for the comparison of the comparison of qualitative data. SPSS 27.0 was used for statistical analyses. Statistical significance was indicated as ?[?]0.05.

RESULTS

The mean age of the patients included in the study was 53.1 +- 5.3 years. The majority consisted of patients with hemorrhagic stroke. There was no difference between the groups with respect to the duration of HSP and the mean duration was 6.7 +- 1 months. Sociodemographic and clinical characteristics of the patients are presented in Table 1. There was no statistical difference between the groups in terms of pain, joint range of motion, and functionality before treatment. When the pretreatment and posttreatment pain parameters were compared, a significant improvement was achieved in both groups, while a statistical superiority was observed in the DN group ($p = 0.02$, Table 2). The results of the third month did not indicate any difference between the groups. There was a significant increase in the joint range of motion measurements after treatment in both groups (Figure 3). Comparison between groups showed that the DN group had an advantage after treatment. However, the results of the third month showed that this advantage was preserved only in the flexion and abduction movements ($p = 0.025$, $p = 0.008$; respectively; Figure 3). Although the functionality parameters evaluated by Q-DASH and FMU-ES exhibited a statistically significant improvement after the treatment in both groups, no difference was found between the groups in the results of the third month ($p = 0.131$, Table 3). During the study, except post needling soreness, no adverse effects were observed in the four patients who depended on DN treatment.

DISCUSSION

Myofascial pain syndrome is more prevalent than it is assumed to be. Furhermore, its occurrence should be considered in HSP rehabilitation as a primary etiology or sometimes accompanying the primary pathology.[15] Studies have described it as an underdiagnosed issue since it is frequently overlooked. HSP has a complex mechanism in which nociceptive and neuropathic pains play a role.[16] Conditions such as muscle imbalance, postural disorders, immobilization, and emotional stress in stroke patients may cause both the emergence of MTrP and the activation of latent MTrP in the shoulder region.[6,13] As a result, a multimodal treatment approach is offered by both attempting to restore the neurological deficit and targeting MTrP. In this context, this study aimed to evaluate whether combining DN treatment with conventional rehabilitation contributes to improving pain, joint range of motion, and functionality parameters and clarify the significance of MTrP in HSP. While designing the study, we aimed to evaluate the parameters of pain, joint range of motion, and functionality at the end of three months. Therefore, the included patient population was clearly standardized and the frequently affected muscles in the shoulder girdle and periscapular region were targeted. The results showed that DN treatment did not provide an extra advantage on pain and functionality in HSP in the subacute period but contributed to improving joint range of motion both in the acute and subacute periods.

The prevalence of MTrP is higher in patients with HSP compared to that in the healthy population.[6] Moreover, studies have emphasized the importance of both latent trigger points and active trigger points in HSP and stated that the number of MTrP may be correlated with pain and dysfunction.[6] Among the studies examining MTrP in HSP treatment, there are some current ones using the myofascial release technique, local anesthesia, and DN treatments.[12-14,17] In general, these studies combined MTrP therapy with conventional rehabilitation. Indeed, evaluating MTrP treatment as the primary treatment would be an incomplete approach for a complex pathology like HSP.

Neurophysiological mechanisms leading to anti-nociceptive effects on the myofascial trigger point and central

nervous system can be initiated by DN treatment.[18] Spinal dorsal horn activity is modulated by eliminating the source of peripheral nociception, and peripheral and central sensitization can be reduced by activating central inhibitory pain pathways.[18,19] Moreover, with the elimination of the pain-spasm-pain vicious cycle, pain relief and improvement in joint range of motion is achieved, contributing to the biomechanics of the region.[20,21]

There are a limited number of publications on DN treatment for HSP. DiLorenzo et al., for instance, administered conventional rehabilitation to one group and DN treatment combined with conventional rehabilitation to the other group of patients with HSP.[14] The results showed that there was a statistically greater improvement in pain level in the acute period in the DN group. Similarly, in our study, there was a greater improvement in posttreatment pain level in the DN group. However, this difference was no longer significant in the third month. In the studies of Dilorenzo et al., the lack of standardization in applying DN to the muscles was a disadvantage; while there were many applications on some muscles during the conventional treatment, some muscles received only two sessions.

Another point is that the aforementioned study evaluated functionality with mobility, and superior results were observed in the DN group. On the other hand, in our study, more objective and specific assessment scales for the upper extremity were used, and more improvement was observed in the DN group after treatment. However, there was no difference between the groups on the third month. Previous studies have reported that latent MTrPs also affect functionality in patients with HSP, and the fact that latent MTrPs were not treated in our study may have led to this result.[6]

Mendigutia-Gomez A. et al. found that the combination of conventional rehabilitation and single-session DN treatment reduced HSP more in the acute period compared to only conventional rehabilitation.[12] While the results after treatment were similar in our study, this difference was not observed in the third month. The rehabilitation in our study, unlike the mentioned study, was in the form of a protocol covering a certain period for each group in accordance to the literature. Similarly, there were three sessions based on the general application of DN in sessions. Another important dissimilarity in our study is the demonstration of data for the subacute period. Furthermore, the duration of shoulder pain of the patients was not stated in the aforementioned study. The fact that the participants in our study had an average of six months of shoulder pain and that this condition contributed to the mechanisms of chronic pain may also explain the unresponsiveness to MTrP treatment in the subacute period. Indeed, MTrP is an entity that has the potential to become chronic regardless of the etiology and is easier to diagnose and treat in the acute phase.[22]

MTrP treatment using local anesthesia has similar effects as using DN and its effectiveness in reducing pain is independent of the injected drug.[23] From this perspective, Liporaci FM et al. administered local anesthesia to MTrPs in HSP, and the results indicated that there was a decrease in pain intensity after treatment, while no change was observed at the end of the four-month follow-up.[13] On the other hand, abduction measurements increased significantly. The disadvantage of this study was that conventional rehabilitation was not used in the treatment and there was no control group. In contrast, our study indicated predominance in the flexion and abduction movements compared to the control group at the end of the third month. Therefore, it can be concluded that MTrP treatment for HSP is more effective on improving joint range of motion when combined with conventional rehabilitation.

LIMITATIONS OF THE STUDY

First, the quality of sleep and pain pressure threshold were not evaluated. Moreover, MTrPs were not treated. These parameters may have affected the study results. In addition, there was no third group that received only DN or placebo treatment, and no long-term follow-up was conducted.

CONCLUSION

our study is the first in the literature to present the results of the subacute period of DN treatment for HSP. The outcome of the combination with DN did not differ from that of conventional rehabilitation, except for improving some joint range of motion measurements. In this regard, there is a need for studies with larger

samples including longer follow-up periods.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, author- ship, and/or publication of this article.

References

1. Pan R, Zhou M, Cai H, et al. A randomized controlled trial of a modified wheelchair arm-support to reduce shoulder pain in stroke patients. *Clin Rehabil.* 2018;32(1):37-47.

2. Koog YH, Jin SS, Yoon K, Min BI. Interventions for hemiplegic shoulder pain: systematic review of randomised controlled trials.*Disabil Rehabil.* 2010;32(4):282-291.

3. Adey-Wakeling Z, Arima H, Crotty M, et al. Incidence and associations of hemiplegic shoulder pain post-stroke: prospective population-based study. *Archives of physical medicine and rehabilitation.*2015;96(2):241-247. e241.

4. Murie-Fernandez M, Carmona Iragui M, Gnanakumar V, Meyer M, Foley N, Teasell R. [Painful hemiplegic shoulder in stroke patients: causes and management]. *Neurologia.* 2012;27(4):234-244.

5. Bagcier F, Yilmaz N. The impact of extracorporeal shock wave therapy and dry needling combination on pain and functionality in the patients diagnosed with plantar fasciitis. *The Journal of Foot and Ankle Surgery.* 2020;59(4):689-693.

6. Villafane JH, Lopez-Royo MP, Herrero P, et al. Prevalence of myofascial trigger points in poststroke patients with painful shoulders: A cross-sectional study. *Pm&r.* 2019;11(10):1077-1082.

7. Villafane JH, Herrero P. Conservative treatment of Myofascial Trigger Points and joint mobilization for management in patients with thumb carpometacarpal osteoarthritis. *Journal of Hand Therapy.*2016;29(1):89-92.

8. Fernandez-de-Las-Penas C, Dommerholt J. International consensus on diagnostic criteria and clinical considerations of myofascial trigger points: a Delphi study. *Pain Medicine.* 2018;19(1):142-150.

9. Navarro-Santana MJ, Sanchez-Infante J, Gomez-Chiguano GF, et al. Effects of trigger point dry needling on lateral epicondylalgia of musculoskeletal origin: a systematic review and meta-analysis. *Clinical Rehabilitation.* 2020;34(11):1327-1340.

10. Rha D-w, Park G-Y, Kim Y-K, Kim MT, Lee SC. Comparison of the therapeutic effects of ultrasound-guided platelet-rich plasma injection and dry needling in rotator cuff disease: a randomized controlled trial.*Clinical rehabilitation.* 2013;27(2):113-122.

11. Aydın T, Şen Eİ, Yardımcı MY, Kesiktaş FN, Öneş K, Paker N. Efficacy of ultrasound-guided suprascapular nerve block treatment in patients with painful hemiplegic shoulder. *Neurological Sciences.*2019;40(5):985-991.

12. Mendigutía-Gómez A, Quintana-García MT, Martín-Sevilla M, et al. Post-needling soreness and trigger point dry needling for hemiplegic shoulder pain following stroke. *Acupuncture in Medicine.*2020;38(3):150-157.

13. Liporaci FM, Mourani MM, Riberto M. The myofascial component of the pain in the painful shoulder of the hemiplegic patient. *Clinics.*2019;74.

14. DiLorenzo L, Traballesi M, Morelli D, et al. Hemiparetic shoulder pain syndrome treated with deep dry needling during early rehabilitation: a prospective, open-label, randomized investigation. *Journal of Musculoskeletal Pain.* 2004;12(2):25-34.

15. Vasudevan JM, Browne BJ. Hemiplegic shoulder pain: an approach to diagnosis and management. *Physical Medicine and Rehabilitation Clinics.* 2014;25(2):411-437.

16. de Oliveira RAA, de Andrade DC, Machado AGG, Teixeira MJ. Central poststroke pain: somatosensory abnormalities and the presence of associated myofascial pain syndrome. *BMC neurology.*2012;12(1):1-9.

17. Park D-J, Hwang Y-I. A pilot study of balance performance benefit of myofascial release, with a tennis ball, in chronic stroke patients. *Journal of bodywork and movement therapies.* 2016;20(1):98-103.

18. Dommerholt J. Dry needling—peripheral and central considerations. *Journal of Manual & Manipulative Therapy.* 2011;19(4):223-227.

19. Cagnie B, Dewitte V, Barbe T, Timmermans F, Delrue N, Meeus M. Physiologic effects of dry needling. *Current pain and headache reports.* 2013;17(8):348.

20. Morihisa R, Eskew J, McNamara A, Young J. Dry needling in subjects with muscular trigger points in the lower quarter: a systematic review. *International journal of sports physical therapy.* 2016;11(1):1.

21. Jafri MS. Mechanisms of myofascial pain. *International scholarly research notices.* 2014;2014.

22. Xu Y-M, Ge H-Y, Arendt-Nielsen L. Sustained nociceptive mechanical stimulation of latent myofascial trigger point induces central sensitization in healthy subjects. *The Journal of Pain.*2010;11(12):1348-1355.

23. Cummings TM, White AR. Needling therapies in the management of myofascial trigger point pain: a systematic review. *Archives of physical medicine and rehabilitation.* 2001;82(7):986-992.

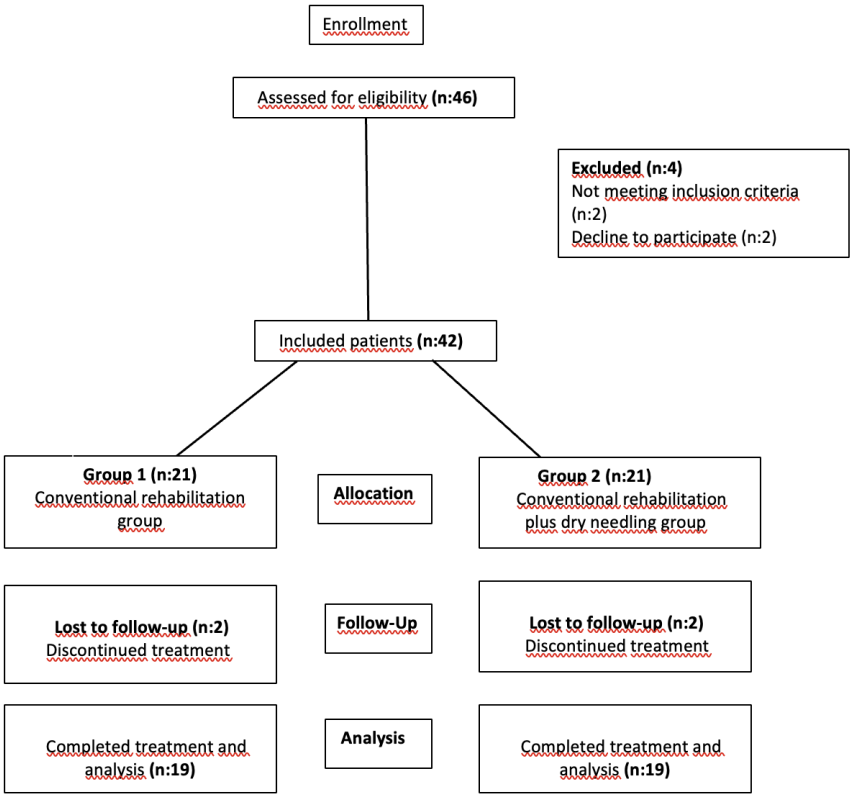
Figure Legends

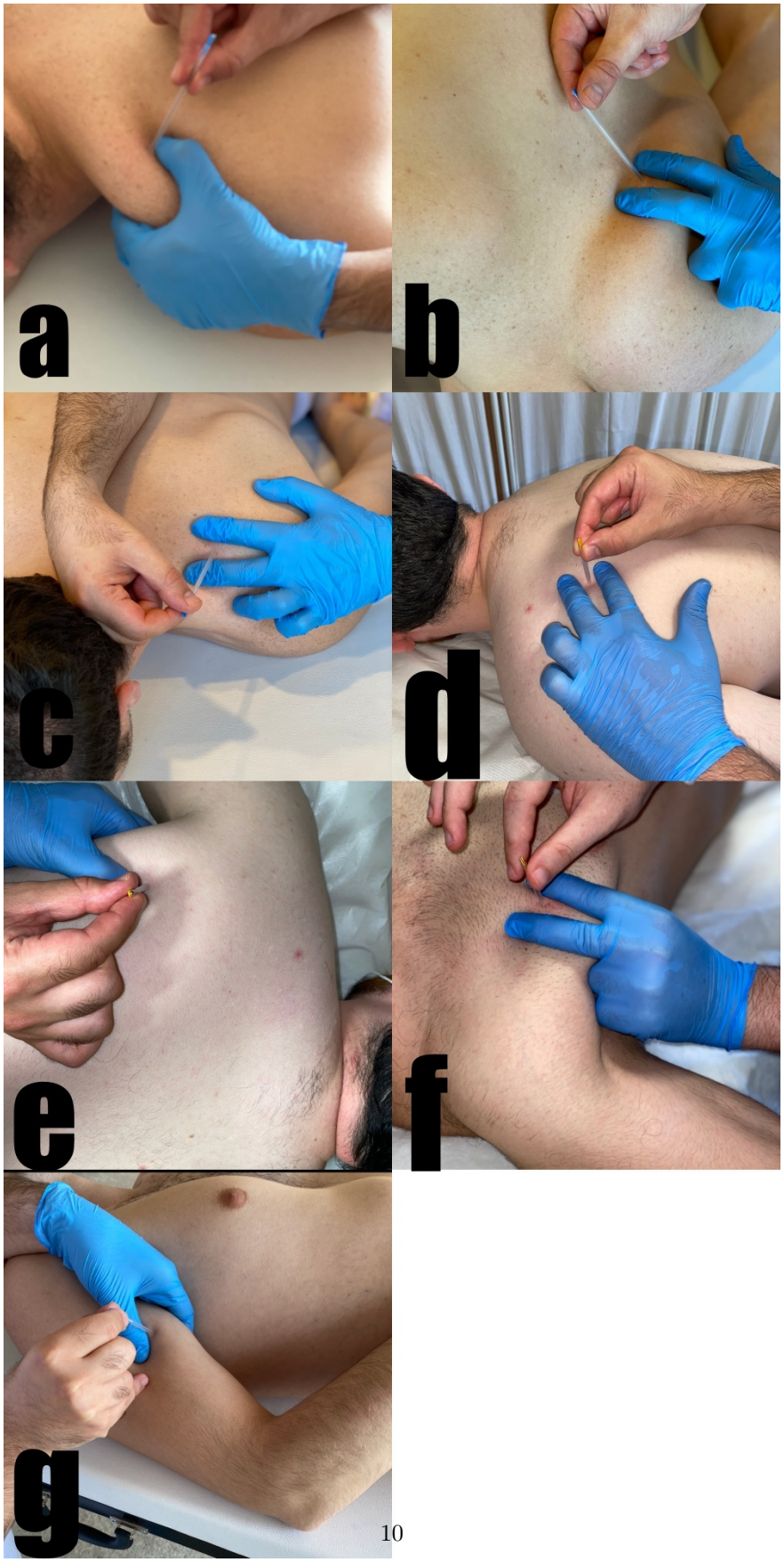
Figure 1. Flow chart of the study

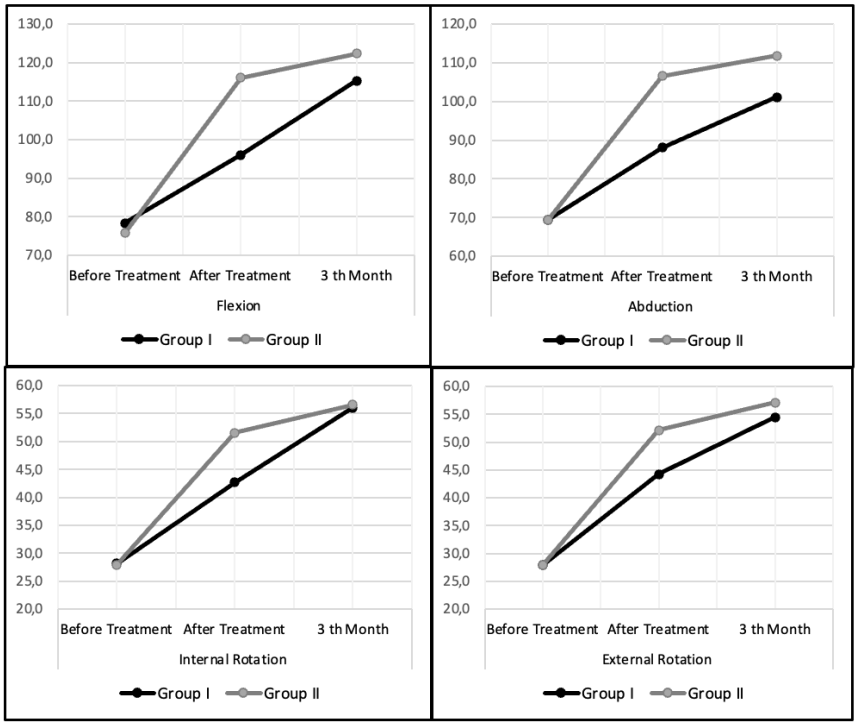
Figure 2. Dry needling treatment of the muscles

a. Upper trapezius muscle; b. Subscapularis muscle; c. Supraspinatus muscle; d. Infraspinatus muscle; e. Teres minor muscle; f. Pectoralis major muscle; g. Biceps brachii muscle

Figure 3. Comparison of joint range of motions within and between groups before, after, and at third month







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