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ORIGINAL ARTICLE

Dry needling reduces pain in Sanglah General Hospital Denpasar workers with myofascial pain syndrome in the upper trapezius muscle

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BACKGROUND

Myalgia is a common complaint in the general population, but it is underappreciated and often undertreated. Myofascial pain syndrome is a form of myalgia that is characterized by local regions of muscle hardness. The main components of this syndrome are the trigger points that are composed of taut bands. Various invasive and non-invasive procedures are available to inactivate myofascial trigger points. Dry needling involves inserting a filiform needle directly into a trigger point without injection of material. Dry needling is a treatment modality that is minimally invasive, cheap, easy to learn, and carries a low risk for reducing pain.

OBJECTIVE

The aim of this study was to test the hypothesis that dry needling could reduce pain in subjects with myofascial pain syndrome in the upper trapezius muscle on Sanglah Hospital's workers.

METHOD

Twenty-six subjects with myofascial pain syndrome in the upper trapezius muscle were randomly divided into two groups: 13 subjects in the control group received acetaminophen, and 13 subjects in the dry needling group received dry needling and acetaminophen. The numeric rating scale was assessed before, 1 hour, 24 hours, and 7 days after the treatment. Side effects of dry needling were evaluated every day for 7 days follow-up. The total amount of acetaminophen was assessed at last day follow up.

RESULTS

At baseline, the numeric rating scale was same in control versus dry needling group. Reduction in all numeric rating scale at 1 hour, 24 hours, and 7 days after dry needling was significant (p<0.05).

CONCLUSION

Dry needling could reduce pain and oral analgesic consumption in subjects with myofascial pain syndrome in the upper trapezius muscle. There were no side effects of dry needling reported on this study.

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BACKGROUND

Myalgia is a common widespread problem, but is often ignored and therapy,when applied is often inadequate. Myofascial Pain Syndrome (MPS) is a form of myalgia with local muscle stiffness. The main component in MPS is the presence of trigger points that cause pain and the appearance of band links. In addition to medical therapy, MPS therapy is focused on inactivating trigger points. Inactivation of trigger points can be in the form of non-invasive mechanical stimulation and invasive actions. Dry needling (DN) is one way to inactivate trigger points. DN is an invasive procedure using filiform needles without using drugs.[1-7]

MPS often causes acute and chronic muscle pain with diverse manifestations such as tension-type headache, shoulder pain, low back pain, and other symptoms. Pain in MPS is usually blunt and difficult to localize.[1-2]

Trigger points are hyper-irritative points within the band link of skeletal muscle fibers, that produce local ischemia and hypoxia with central and peripheral sensitization. There are two types of trigger points, active trigger points that cause pain even though the muscles are resting and latent trigger points which are not spontaneous triggers of pain.[2-3,6]

Epidemiological studies of MPS are still difficult because there is no consensus which regulates the diagnostic criteria of this syndrome by default. The highest prevalence of musculoskeletal pain in the neck area in workers is 60-76% with the highest intensity of 77.3% occurring in the upper trapezius muscle. This is due to the high involvement of the hands (e.g. typing, raising arms, transporting goods), thus increasing muscle demands in the surrounding anatomical area. In Indonesia, MPS is more prevalent in women at 58.8%, work as employees ranks highest at 41.2%, with the highest average age of 20-40 years.[4,9-11]

The mechanism for the formation of band links is due to muscle trauma as a result of excessive use. This triggers the production and release of acetylcholine from the motor terminal of the neuron, even at rest. Persistent release of acetylcholine generates postjunctional membrane depolarization of muscle fibers. Increased muscle work and demand maintains the muscle in a prolonged contraction state. This in turn may compromise the vascular supply of oxygen and nutrients due to a compression effect. This condition, when inadequately treated will lead to hypoxia and subsequent impairment of the calcium channel pump responsible for returning calcium ion into the sarcoplasmic reticulum.

This mechanism then continually triggers both the release of Calcium and causes its inadequate intake from the sarcoplasmic reticulum. This results in shortening of the sarcomere. If this phenomenon is prolonged, muscle tissue hypoxia will occur followed by the release of vasoactive and allogeneic substances such as CGRP, Substance P, bradykinin, cytokines, and protons. Local pain, peripheral and central sensitization will occur as a consequence of the release of these substances. This cycle will continue if not corrected.[1,2,12-15]

The principle of managing MPS is to deactivate trigger points and maintain normal body biomechanics. Therapy modalities focus on trigger points, both through pharmacological and non-pharmacological therapy aimed at reducing inflammation and sensitization which are the sources of the onset of pain. Giving analgesics can reduce pain significantly, but does not restore function. Trigger point

manipulation is needed. This can be in the form of both invasive and non-invasive action. Examples of the latter are massage, electrical stimulation, and magnetic therapy. Invasive therapy is often done as an injection of local trigger points with certain substances; it can also be done using DN. [2-4,6,7]

DN is an attempt to activate trigger points using thin filiform needles to penetrate the skin and stimulate the areas that underlie the trigger points, viz., muscles, and connective tissue. It is done for the management of pain and the disruption of muscle spasm. Other advantages of DN are that it is cheap and easy to carry out with minimal side effects.

METHODS

This study used an experimental pre-test and post-test control group design with research subjects divided into two groups, namely the treatment group (analgesic and DN) and the control group (analgesic). The study was conducted on workers in the Sanglah General Hospital in Denpasar from September to October 2018. This study was declared ethically feasible by the Research Ethics Commission of the Faculty of Medicine, Udayana University/Sanglah Hospital Denpasar with no: 1602/UN14.2.2/PD/KEP/2018

The inclusion criteria in this study were workers aged 20-50 years who experienced pain in the upper trapezius muscle with a numeric rating scale (NRS) ≥ 4 together with trigger points located on examination in the upper trapezius muscle. The subjects were cooperative and willing to be included in the study and signed a document confirming informed consent. Exclusion criteria in this study were subjects with a history of immunodeficiency (malignancy, HIV infection, and diabetes mellitus), a history of blood clotting disorders, the use of drugs that interfere with blood hemostasis, infection and insertion wounds, needle phobia, allergy to acetaminophen and the ingestion of analgesics and muscle relaxants in the previous 24 hours. Subjects who met the eligibility criteria were divided into two groups using a coin toss as a simple randomization technique. The drop out criteria in this study were subjects who did not collect the questionnaires, consumed analgesics other than acetaminophen and muscle relaxants during the observation period, underwent non-invasive and other invasive therapies, together with those who were unwilling to continue therapy.

Calculation of sample size used the Pocock formula with an alpha of 0.05 obtained by the 18 total samples needed. To avoid a dropout of 15%, a sample size of at least 22 subjects was necessary.

Trigger points were obtained by palpation of the upper trapezius muscle and the location of a band link and pain response from the subject. DN procedures were carried out by one person who was competent in carrying them out. This study used a Huanqiu brand needle with a diameter of 0.25 mm and a length of 40 mm, the needle was inserted into the trigger point of the upper trapezius muscle until a local twitch response appeared. It was then withdrawn when there were no more visible twitch responses from the muscle. The procedure was repeated on any other existing trigger points. The DN procedure was stopped when there was a reduction in the frequency of appearance of a local twitch response and reduced resistance on palpation. The DN procedure was only performed once, i.e. at the beginning of the study period for each patient. Subjects in both groups were given an analgesic (1g of acetaminophen) at the start of

the procedure and were then were allowed to take it again with a maximum dose of 4 grams/day. The pain scale was assessed using NRS. NRS is a pain measuring system using numbers 0-10. NRS was assessed before DN was performed, then reassessed 1 hour, 24 hours, and 7 days after the DN. Subjects were followed for 7 days and during the observation period were evaluated for the presence of DN side effects in the form of bruising, swelling and bleeding, together with an assessment of the use of acetaminophen. If during the observation period, the subjects consumed other analgesics and muscle relaxants, underwent other non-invasive or invasive therapies, or refused to continue therapy, they were excluded from the study.

Data was analyzed using SPSS version 20.0. Descriptive data analysis was performed to study the distribution of age, gender, type of work, and initial NRS value. Normality test was based on numerical data using the Shapiro-Wilk test. Comparison of the mean reduction in NRS values before and after treatment in both groups was done using the ANOVA test if the data was spread normally or the Mann-Whitney test if the data was spread abnormally with a significance level of $p<0.05$. If drop out >15%, the intention to treat analysis was done.

Results

There were 26 subjects who met the eligibility criteria in this study. The subjects of the study were randomized by simple randomization and divided into 13 subjects as the treatment group (acetaminophen and DN therapy) and 13 subjects as the control group (acetaminophen therapy). The basic criteria of the research subject and statistical analysis in the form of age, sex, and type of work are presented in table 1. Statistically, no variable results were found for age, sex, and type of work.

The effect of acetaminophen and DN administration on NRS improvement in labor in Sanglah Hospital Denpasar was assessed by comparing the difference in NRS reduction between the control group and the treatment group at 1 hour, 24 hours, and 7 days after treatment. The normality test of NRS reduction difference data using the Shapiro Wilk test showed that the distribution of data was not normal, the hypothesis test used was the Mann-Whitney test, the level of significance was measured by the value $p<0.05$. The difference in NRS at 1 hour, 24 hours, and 7 days was found to be statistically significant. The analysis results are presented in table 2.

There were significant differences in the total and duration of analgesic use during the 7-day observation period in both groups. The results of the total analysis and duration of analgesic use are presented in table 3.

In the treatment group, evaluation of DN side effects, viz., bruising, swelling and bleeding was carried out over a 7-day period. No side effects were found in any subject in the treatment group.

Table 1 Basic characteristics

Variables	Treatment (*n*=13)	Control (*n*=13)	*P*
Age (year)	48 (23-50)	35 (23-50)	0.054
Sex			
Men	5 (38.5%)	4 (30.8%)	0.500
Women	8 (61.5%)	9 (69.2%)	
Occupation			
Nurse	6 (46.2%)	4 (30.8%)	
Student	4 (30.8%)	6 (46.2%)	0.670
Others	3 (23.1%)	3 (23.1%)	

Table 2 Analysis of NRS reduction differences at 1 hour, 24 hours, and 7 days after treatment

	Treatment (*n*=13)	**Control (*n*=13)**	***P***
1 hour	2 (0-4)	0 (0-1)	0.003*
24 hour	3 (0-5)	1 (0-4)	0.014*
7 days	4 (3-7)	3 (1-7)	0.001*

*statistically significant

Table 3 Total and duration of analgesic use

	Treatment (*n*=13)	Control (*n*=13)	*P*
Total analgesic (gram)	2 (0-3)	4 (1.5-21)	0.008*
Duration (days)	2 (0-5)	5 (2-7)	0.004*

*statistically significant

Discussion

The median age of this study is 48 (23-50) in the treatment group and 35 (23-50) in the control group. This result is not much different from the study conducted by Tsai et al. who quote an average age of 41.5±10.4 in the control group and 46.4±12.2 in the treatment group. [17] Research conducted by Tekin et al (2013) also found similar results regarding the mean ages of that study's participants; these were 42±12 and 42.9±10.9 years in the control and treatment groups, respectively.[18] Research conducted by Cerezo-Tellez et al. obtained a mean age of 46±16.2 in the control group and 40.1±13.1 in the treatment group.[19] This result is in accordance with previous studies which stated that the productive age range contains the highest percentage of those who experience MPS. This is due to individuals who are more active in using their muscles being in the productive age.

Based on the gender category, this study contains 17 female subjects and 9 male subjects. This is similar to the research conducted by Gerber et al (2015) who quotes 10 female subjects more than male subjects.[20]

Research conducted by Tekin et al (2013) with a total sample of 39 subjects also quotes 31 more female than male subjects.[18] Research conducted by Tsai et al (2010) also found that there were 21 more female than male subjects.[17] The results of this study support the view that women make more use their hands and shoulders in doing work and have lower pain thresholds when compared to men.

The subjects of this study were 10 nurses, 10 students, and 6 employees in other occupations (3 cleaning service employees, 2 administrative employees, 1 nutrition officer). Until this study there have been no studies that specify the types of work carried out by the subjects. Research conducted by Cerezo-Tellez et al. looking at the prevalence of MPS, divided occupations based on job characteristics. Their results showed that most MPS sufferers were subjects who worked by hand and often raised their hands higher than their shoulders by 76.6 %, followed by 72.3% of subjects who did repetitive work.[9] Research conducted by Meulemeester et al. also states that someone with long repetitive and static work such as employees who work at a computer can trigger MPS.[21] This is caused by a motor unit that works excessively and causes changes in muscle morphology, muscle pain, and fatigue.

The effect of DN administration on NRS improvement was assessed by comparing the median difference in NRS reduction between the control and treatment groups at 1 hour, 24 hours, and 7 days after treatment. In this study, the effectiveness of DN addition to NRS reduction was statistically significant (p<0.05) compared to the use of acetaminophen alone at 1 hour, 24 hours, and 7 days after treatment. A similar study carried out by Tsai et al. compared NRS decrease before and immediately after DN and obtained significant results.[17] Abbaszadeh-Amirdehi et al. also conducted a similar study and obtained significantly different results when compared to the control group (subjects without MPS).[22] Gerber et al. assessed the scale of pain using VAS before DN performed 3 times in 3 weeks in subjects with bilateral or unilateral upper trapezius chronic MPS. There was a significant decrease in VAS (p<0.01) after 3 weeks both in subjects with bilateral and unilateral MPS. [20] Longer observations were carried out by Cerezo-Tellez et al. by assessing VAS at 30 and 45 days after DN with results that were significant in both observations (p<0.01) compared to the control group (which only underwent muscle stretching therapy.[19]

During the observation period, there were no subjects in the treatment group who reported any side effects of DN actions in the form of bruising, swelling and bleeding. Very little data was obtained regarding the side effects of DN actions in similar studies. Research conducted by Martin-Pintado-Zugasti et al. reported a side effect of bleeding in 4 of the total 26 subjects studied. The absence of side effects in this study was due to the fact that the operators who carried out DN actions were properly trained and competent in their field.[23] This proves that DN is a minimally invasive procedure that is easy to perform and has minimal side effects.

The total amount and duration of use of analgesic drugs (acetaminophen) during the 7-day observation period were found to be statistically significant (p<0.05). Until now, researchers have not found any studies that directly compare the addition of DN with the use of analgesic drugs. The results of this study support that DN actions can reduce the total and duration of analgesic use.

Conclusion

The results of this study prove that DN is effective in reducing the scale of pain in upper trapezius muscle MPS; these results are consistent with previous similar studies. The analgesic effect caused by DN is related to the modulation of central and peripheral pain. This includes segmental inhibition and release of biochemical cascades such as endogenous opioids. In addition, this study also shows that DN can reduce the use of analgesic drugs in upper trapezius muscle MPS without significant side effects.

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