Original article / Оригинальная статья
DOI: https://doi.org/10.38025/2078-1962-2024-23-6-19-25

Check for updates

Effect of Ultrasound Combined with Dry Needling on Myofascial Pain in the Upper Trapezius : a Controlled Randomised Study

Rahmat Nugraha*, Rahmatika, Sudaryanto, Hasbiah, Tiar Erawan

Health Polytechnic Ministry of Health Makassar, Makassar, Indonesia

ABSTRACT

INTRODUCTION. Myofacscial Pain Syndrome (MPS) Upper trapezius is a condition of tightness in the upper trapezius characterized by the appearance of myofascial trigger points in the upper trapezius muscle fibers. This causes pain and decreased elastitrapezius muscle fibers, resulting in cervical motion limitations.

AIM. To determine the effect of the addition of ultrasound to Dry needling intervention on reducing pain and increasing cervical range in the condition of upper trapezius MPS.

MATERIALS AND METHODS. This type of research is a quasi-experiment with a randomized pre-test-post-test control group design that uses 2 sample groups, where the treatment group is given Ultrasound Therapy and Dry needling intervention, and the control group is given Dry needling intervention only. The sample obtained was 30 people according to the inclusion criteria, then randomized into 2 groups, namely 15 people in the treatment group and 15 people in the control group. Data collection was obtained through measurement of tenderness using Visual Analog Scale (VAS) and measurement of Range of Motion (ROM) using a goniometer.

RESULTS AND DISCUSSION. Based on the independent sample *t*-test for the VAS scale, the value of $p = 0.619$ (mean difference of 3.767 control > 3.553 treatment), and based on the Mann-Whitney test, the value of $p = 0.074$ for flexion ROM (mean difference of 17.00 control > 12.33 treatment), $p = 0.311$ for lateral flexion ROM (mean difference of 9.33 treatment > 8.00 control), and $p = 0.494$ for rotation ROM (mean difference of 13.33 treatment > 11.67 control), which means that there is no significant difference in effect between the treatment and control groups.

CONCLUSION. The addition of ultrasound to the dry needling intervention resulted in an increase of 9.33 in lateral flexion and 13.33 in rotation which means this number is greater when compared to dry needling alone with an increase of 8.00 in lateral flexion and 11.67 in rotation. However, the addition of ultrasound did not result in a decrease in tenderness and a greater improvement in cervical flexion where the value of 3.767 in dry needling alone > compared to the value of 3.553 in the addition of ultrasound and 17.00 > 12.33.

KEYWORDS: ultrasound therapy, dry needling, tenderness, myofascial pain syndrome, upper trapezius

For citation: Nugraha R., Rahmatika, Sudaryanto, Hasbiah, Erawan T. Effect of Ultrasound Combined with Dry Needling on Myofascial Pain in the Upper Trapezius: a Controlled Randomised Study. Bulletin of Rehabilitation Medicine. 2024; 23(6):19-25. https://doi.org/10.38025/2078-1962-2024-23-6-19-25.

*** For correspondence:** Rahmat Nugraha, E-mail: rahmatnugraha@poltekkes-mks.ac.id

Received: 04.07.2024
Accepted: 15.10.2024
Published: 16.12.2024

Влияние ультразвука в комплексе с сухим иглоукалыванием при миофасциальном болевом синдроме в верхней трапециевидной мышце: контролируемое рандомизированное исследование

Рахмат Нуграха*, Рахматика, Сударьянто, Хасбиах, Тиар Эраван

Политехнический институт Министерства здравоохранения Макассар, Макассар, Индонезия

РЕЗЮМЕ

ВВЕДЕНИЕ. Миофасциальный болевой синдром (МФБС) верхней части трапецевидной мышцы — это состояние сдавленности верхней части трапецевидной мышцы, характеризующееся появлением миофасциальных триггерных точек в волокнах верхней части трапециевидной мышцы. Это вызывает боль и снижение эластичности мышечных волокон трапециевидной мышцы, что приводит к ограничению подвижности шейного отдела позвоночника.

ЦЕЛЬ. Определить влияние дополнения ультразвуком процедуры сухого иглоукалывания на уменьшение боли и увеличение амплитуды движения шейного отдела позвоночника в условиях МФБС верхней трапециевидной мышцы.

МАТЕРИАЛЫ И МЕТОДЫ. Данный тип исследования представляет собой квазиэксперимент с использованием дизайна рандомизированного исследования контрольной группы «до проведения теста-после проведения теста», в рамках которого используются 2 группы выборки, причем группа лечения подвергается воздействию ультразвуковой терапии и сухого иглоукалывания, а контрольная группа — только воздействию сухого иглоукалывания. Полученная выборка составила 30 человек в соответствии с критериями включения, после чего была рандомизирована на 2 группы, а именно 15 человек в группе лечения и 15 человек в контрольной группе. Сбор данных осуществлялся путем измерения степени болезненности с помощью визуальной аналоговой шкалы (ВАШ) и измерения диапазона движения с помощью гониометра.

РЕЗУЛЬТАТЫ И ОБСУЖДЕНИЕ. По результатам независимого выборочного *t*-теста с использованием ВАШ, значение $p = 0{,}619$ (средняя разница — 3,767 контрольная группа > 3,553 группа лечения), а по результатам теста Манна — Уитни, значение $p = 0{,}074$ для диапазона движения (ROM) при сгибании (средняя разница — 17,00 контрольная группа > 12,33 группа лечения), $p = 0.311$ для ROM бокового сгибания (средняя разница — 9,33 группа лечения > 8,00 контрольная группа), и $p = 0{,}494$ для ROM при вращении (средняя разница — 13,33 группа лечения > 11,67 контрольная группа), что означает отсутствие значительной разницы в эффекте между группами лечения и контроля.

ВЫВОДЫ. Добавление ультразвука к процедуре сухого иглоукалывания привело к увеличению на 9,33 бокового сгибания и на 13,33 вращения, что означает, что это число больше по сравнению с одним только сухим иглоукалыванием с увеличением на 8,00 бокового сгибания и на 11,67 вращения. Однако добавление ультразвука не привело к уменьшению болезненности и значительному улучшению шейного сгибания, где значение 3,767 при сухом иглоукалывании больше по сравнению со значением 3,553 при добавлении ультразвука и 17,00 > 12,33.

КЛЮЧЕВЫЕ СЛОВА: ультразвуковая терапия, сухое иглоукалывание, болезненность, миофасциальный болевой синдром, верхняя трапециевидная мышца

Для цитирования: Nugraha R., Rahmatika, Sudaryanto, Hasbiah, Erawan T. Effect of Ultrasound Combined with Dry Needling on Myofascial Pain in the Upper Trapezius: a Controlled Randomised Study. Bulletin of Rehabilitation Medicine. 2024; 23(6):19-25. https://doi.org/10.38025/2078-1962-2024-23-6-19-25.

*** Для корреспонденции:** Rahmat Nugraha, E-mail: rahmatnugraha@poltekkes-mks.ac.id

Статья получена: 04.07.2024
Статья принята к печати: 15.10.2024
Статья опубликована: 16.12.2024

INTRODUCTION

Myofascial Pain Syndrome (MPS) is a prevalent chronic pain condition characterized by muscle tenderness and localized pain, often leading to persistent discomfort. MPS includes sensory, motor, and autonomic symptoms. Research indicates that most cases stem from trauma, muscle overuse, ergonomic and structural issues, and psychological stress [1].

Myofascial trigger points (MTrPs) are hypersensitive spots in taut bands of skeletal muscle or fascia, characterized by focal tenderness and electrical activity. Common in the trapezius muscles, they cause non-specific neck pain and are often treated by manual therapists. MTrPs are classified as active, causing referred pain and twitch response, or latent, causing pain only when palpated. According to Menses and Simons, MTrPs consistently cause pain patterns, result from muscle overload, contribute to motor dysfunction, muscle weakness, limited range of motion, and interfere with sensory and autonomic functions, with pain intensity linked to their irritability [2].

A study in Spain found that 30 patients with neck and shoulder pain were diagnosed with neck pain syndrome and shoulder pain syndrome. Upon examination, 66.6 % had MTrPs in the left upper trapezius and 70 % in the right. MPS affects 20–95 % of those with musculoskeletal pain, showing a similar distribution between genders (24.1 % women and 23.8 % men). Notably, 84 % of MPS cases occur in the upper trapezius muscle, making it the most commonly affected muscle [3].

Research by Irianto (2016) indicates that prolonged computer use (4–5 hours) among students can lead to MPS. Static work exceeding 2 hours daily with non-ergonomic postures causes neck pain due to muscle overload, potentially triggering MPS, as explained by Anggraeni [3, 4].

Dry needling application is able to decrease central nervous system excitability by decreasing peripheral nociceptive activity associated with trigger points, by decreasing cornu dorsalis neuron activity and modulating brainstem areas associated with modulating pain. Several studies have confirmed that trigger points (TrP) dry needling decreases the amplitude and frequency of end plate noise and end plate spikes, as well as decreases acetylcholine levels and neuromuscular junction responses. The localised twitch response can interrupt motor end-plate noise, thus inducing an analgesic effect, and when in conjunction with stretching, helps to relax the actin-myosin bonds that constrict tight bands [5].

Inserting the needle into the target soft tissue causes mechanical hyperstimulation and manipulation. Bruising, bleeding and pain are the three most frequent side effects of dry needling. In addition, these side effects are related to the dry needling technique, such as the number of needle insertions into TrPs [6].

Furthermore, UT is an effective intervention for various musculoskeletal problems. Continuous UT that produces thermal effects is utilised to treat symptoms of myofascial pain syndrome [7].

Ultrasound's thermal effects raise tissue temperature, increase local blood flow, enhance tissue flexibility, and reduce fluid viscosity. It accelerates tissue metabolism by improving cell permeability and ion transport. In myofascial pain syndrome, poor vascularity and low oxygen supply cause pain and disability. Ultrasound's thermal intervention dilates blood vessels, enhancing blood flow and reducing ischemia, which increases tissue oxygenation. Needling a trigger point induces a local twitch response (LTR), an involuntary muscle contraction due to improved electrical activity, seen in post-needling EMG changes. This needling also boosts local blood supply, seen as redness, and combined with ultrasound, enhances tissue repair and flexibility by improving inflammatory responses [8].

AIM

This study aimed to assess the impact of adding ultrasound to dry needling on pain reduction and Range of Motion (ROM) improvement in upper trapezius MPS. Using stratified sampling to consider age and activity, mixed results were found for ultrasound with dry needling versus dry needling alone, linked to varying age and activity levels in the groups.

MATERIALS AND METHODS

Types of research

The type of research used is quasi experimental with a quantitative approach. The sampling method used was stratified sampling with pre test-post test control group design.

Research Location and Time

This research was located at the Health Polytechnic Ministry of Health Makassar. The research was conducted in April–May 2024.

Population and Sample

The study population was all patients with myofascial pain syndrome upper trapezius D-IV regular physiotherapy Poltekkes Kemenkes Makassar. This research was conducted on the entire population.

Data Collection

Data collection used a questionnaire to assess MPS Upper Trapezius in regular D-IV physiotherapy students. The results showed that 75 % of students had symptoms. The researcher then selected the population based on specific criteria to obtain the sample and measured their ROM as pre-test data.

Processing and Analysis of Data

The researcher employed stratified sampling, assigning Level I samples to the treatment group and Levels II and III to the control group. The treatment group received ultrasound therapy (UT) and dry needling per protocol, while the control group received dry needling alone. Post-test measurements of cervical ROM were then taken. Analysis included within-group pre-test and post-test data and between-group comparisons to assess effectiveness. Findings were presented in tables and narratives, discussed, and conclusions and recommendations were drawn based on the results.

Research result

Sample Characteristic

Table 1. Gender Presentation and Mean Age of Sample

Sample Characteristic	Treatment Group		Control Group	
	n	%	*n*	%
Gender				
Man	4	26.7	3	20.0
Woman	11	73.3	12	80.0
	Mean	**SB**	**Mean**	**SB**
Age	18.73	0.594	19.67	0.724

Table 1 indicates that 26.7 % of the treatment group were men and 73.3 % were women, while in the control group, 20.0 % were men and 80.0 % were women. Overall, more women than men experience upper trapezius MPS.

Data Description

Table 2. Mean cervical range of motion and Visual Analog Scale by Value Pre Test, Post Test and Difference

Sample Group	Mean and Std. Deviation		
	Pre test	Post test	Difference
Treatment group			
Visual Analog Scale (VAS)	5.753 ± 0.9531	2.200 ± 0.7973	3.553 ± 0.9234
Flexion	64.67 ± 5.499	77.00 ± 3.684	12.33 ± 4.577
Lateral Flexion	33.67 ± 4.806	43.00 ± 2.535	9.33 ± 4.169
Rotation	60.67 ± 7.761	74.00 ± 2.803	13.33 ± 6.726
Control group			
VAS	6.333 ± 1.5444	2.567 ± 1.0761	3.767 ± 1.3605
Flexion	55.67 ± 8.837	72.67 ± 4.952	17.00 ± 7.746
Lateral Flexion	34.67 ± 5.164	42.67 ± 2.582	8.00 ± 4.140
Rotation	61.33 ± 6.673	73.00 ± 3.162	11.67 ± 6.172

Table 2 shows the mean values of VAS, ROM flexion, ROM lateral flexion, and ROM rotation in the treatment group and control group.

Hypotesis test

Table 3. Visual Analog Scale Mean Difference Test of Treatment and Control Groups

Data group	Before	After	*t*	*p*
Treatment group				
Mean	5.753	2.200	14.904	0.000
Std. Deviation	0.9531	0.7973		
Control group				
Mean	6.333	2.567	10.723	0.000
Std. Deviation	1.5444	1.0761		

The results of the paired sample *t*-test for the treatment group (Table 3) demonstrated a significant reduction in tenderness, with a *p*-value of 0.000 ($p < 0.05$). This indicates that the combination of ultrasound and dry needling effectively reduced tenderness in the upper trapezius muscles of patients with MPS. Similarly, the control group, which received dry needling alone, also showed a significant reduction in tenderness, with a *p*-value of 0.000 ($p < 0.05$).

Table 4. Mean Test of Flexion range of motion of Treatment Group

Data group	Mean	Std. Deviation	– rank	+ rank	*Z*	*p*
Before	64.67	5.499	–	–	–3.497	0.000
After	77.00	3.684	0	15		

The Wilcoxon test results (Table 4) showed a significant improvement in cervical flexion ROM, with $p = 0.000$ ($p < 0.05$). Rank analysis indicated a ± rank of 15, meaning that 15 participants experienced an increase in ROM following ultrasound and dry needling therapy.

Table 5. Mean Test of Flexion range of motion of Control Group

Data group	Before	After	*t*	*p*
Mean	55.67	72.67	–8.500	0.000
Std. Deviation	8.837	4.952		

The results of the Paired Sample *t*-test in the control group showed $p = 0.000$ ($p < 0.05$), indicating that the dry needling intervention produced a significant increase in cervical flexion ROM in upper trapezius myofascial pain syndrome. The rank analysis revealed a + rank of 15, meaning that 15 participants experienced an increase in cervical flexion ROM after receiving dry needling (Table 5).

Table 6. Mean Test of Lateral Flexion range of motion of Treatment and Control Groups

Data Group	Mean	Std. deviation	– rank	+ rank	Z	*p*
Treatment Group						
Before	33.67	4.806	–	–	–3.453	0.001
After	43.00	2.535	0	15		
Control group						
Before	34.67	5.164	–	–	–3.493	0.000
After	42.67	2.582				

The Wilcoxon test results indicated significant increases in cervical lateral flexion ROM for both the ultrasound and dry needling interventions in upper trapezius myofascial pain syndrome, with $p = 0.000$ ($p < 0.05$) and a + rank of 15 for both groups, indicating positive outcomes (Table 6).

Table 7. Mean Test of Rotation range of motion of Treatment and Control Groups

Data Group	Mean	Std. Deviation	– rank	+ rank	Z	*P*
Treatment group						
Before	60.67	7.761	–	–	–3.427	0.001
After	74.00	2.803	0	15		
Control group						
Before	61.33	6.673	–	–	–3.441	0.001
After	73.00	3.162	0	15		

The Wilcoxon test results indicate a significant increase in cervical rotational ROM in upper trapezius myofascial pain syndrome after ultrasound and dry needling interventions, with a *p*-value of 0.000 ($p < 0.05$). Specifically, 15 samples showed improved cervical rotation ROM after these treatments. Similarly, the control group demonstrated a significant increase in cervical rotational ROM from dry needling alone, also with a rank analysis of 15 samples showing improvement (Table 7).

Table 8. Differential Test of Mean Difference in Visual Analog Scale between Treatment and Control Groups

	Treatment group	Control group	*t*	*p*
Mean	3.553	3.767	–0.502	0.619
Std. Deviation	0.9234	1.3605		

The results of the Independent Sample *t*-test are $p = 0.619$ ($p > 0.05$), which means that there is no significant difference in the mean difference between the treatment and control groups. Then, judging from the mean difference, it shows that the value of 3.767 (control group) > the value of 3.553 (treatment group). This indicates that dry

needling alone can produce a greater decrease in tenderness than ultrasound and dry needling in patients with upper trapezius MPS (Table 8).

Table 9. Mean Difference Test of Flexion range of motion Difference between Treatment and Control Groups

	Treatment group	Control group	U	*p*
Mean	12.33	17.00	71.500	0.074
Std. Deviation	4.577	7.746		

The results of the Mann-Whitney test are $p = 0.074$ (p range of motion > 0.05) which means that there is no significant difference in the mean difference between the treatment and control groups. Then, judging from the mean difference, it shows that the value of 17.00 (control group) > the value of 12.33 (treatment group). This indicates that dry needling alone can produce greater cervical flexion ROM improvement than ultrasound and dry needling in patients with upper trapezius MPS (Table 9).

Table 10. Mean Difference Test of Lateral Flexion range of motion Difference between Treatment and Control Groups

	Treatment group	Control group	U	*p*
Mean	9.33	8.00	90.000	0.311
Std. Deviation	4.169	4.140		

The results of the Mann-Whitney test are $p = 0.311$ ($p > 0.05$) which means that there is no significant difference in the mean difference between the treatment and control groups. Then, the mean difference showed that the value of 9.33 (treatment group) > 8.00 (control group). This indicates that the administration of ultrasound and dry needling can produce greater cervical lateral flexion ROM improvement than dry needling alone in patients with upper trapezius MPS (Table 10).

Table 11. Mean Difference Test of Rotational ROM Difference between Treatment and Control Groups

	Treatment group	Control group	U	*p*
Mean	13.33	11.67	96.500	0.494
Std. Deviation	6.726	6.172		

The results of the Mann-Whitney test are $p = 0.494$ ($p > 0.05$) which means that there is no significant difference in the mean difference between the treatment and control groups. Then, the mean difference showed that the value of 13.33 (treatment group) > 11.67 (control group). This indicates that the administration of ultrasound and dry needling can produce greater improvement in cervical rotational ROM than dry needling alone in patients with upper trapezius MPS (Table 11).

RESULTS AND DISCUSSION

The effect of dry needling and ultrasound on reducing tenderness and increasing cervical ROM in upper trapezius myofascial pain syndrome

Based on hypothesis testing with the Paired sample *t*-test and Wilcoxon test, ultrasound and dry needling significantly reduce tenderness and increase cervical ROM in upper trapezius MPS. The study found that higher muscle tension correlates with more frequent LTR (> 5 times), while lower tension levels result in fewer local twitch responses (LTRs) (2–3 times). Samples showing reduced muscle tension after multiple dry needling sessions also exhibited fewer LTR. Dry needling techniques included pistoning and palpation (pincer and pull) on the upper trapezius, using a 0.25 x 40 mm needle in the superficial area to minimize tissue trauma and enhance patient comfort.

Research by Livandy V. and Setiadi T.H. indicates that maintaining a prolonged downward position can lead to muscle tension in the upper trapezius, triggering the development of MTrPs and resulting in neck pain. This condition can progressively limit cervical motion, thereby impairing neck functionality [9]. Additionally, a study by Yildirim M.A. et al. (2018) found that 25 students reported neck pain, particularly in the upper trapezius, due to the presence of MTrPs in the muscle. This caused limitations in cervical ROM, leading to soreness and restricted movement when looking down, looking up, or tilting the head left or right [10].

Research by Mejuto-Vázquez M.J. et al. showed that dry needling significantly increases cervical ROM in all directions, both 10 minutes and 1 week after the intervention. This improvement is due to the inactivation of TrP in the upper trapezius muscle, which reduces muscle tension. Patients with the highest initial VAS scores experienced the greatest reduction in pain and increase in ROM. The combination of ultrasound and dry needling also improved sleep quality by enhancing comfort during sleep. The thermal effect of ultrasound increases blood flow and metabolism, relaxing tight muscles [11].

The administration of ultrasound to the cervical will increase cervical ROM. This has been investigated with mixed results. Improvements in cervical ROM can be seen with all ultrasound models, but the degree of improvement and the constraints of the results vary. The use of high-intensity ultrasound has been shown to result in the fastest significant improvement in cervical ROM increase. Continuous ultrasound has also shown good improvement in cervical ROM although it often takes a frequency of 5 days a week for several weeks to see significant changes [12].

Dry needling intervention improves cervical ROM by reducing TrPs that cause muscle spasm and stiffness. Stimulating these points decreases muscle tension, increasing ROM. Puncturing trigger points induces LTR, an involuntary contraction linked to muscle electrical improvements, as evidenced by EMG changes in Santoso I. et al. This also boosts local blood supply, visible as redness, due to the inflammatory effect [8].

Research by Khandare S. et al. indicates that UT aids the healing of inflammation caused by dry needling. The thermal effect of ultrasound increases tissue temperature, causing vasodilation, which accelerates the removal of

metabolic waste and boosts oxygen and nutrient supply, reducing inflammation. Ultrasound-generated heat also alleviates muscle stiffness and spasm, reducing pain and enhancing cervical ROM. Additionally, ultrasound promotes fibroblast activity, speeding up tissue repair. Thus, combining ultrasound and dry needling accelerates cervical ROM improvement through their combined healing effects [13].

The effect of dry needling on reducing tenderness and increasing cervical ROM in upper trapezius myofascial pain syndrome conditions

Hypothesis testing using the Paired sample *t*-test and Wilcoxon test indicates that dry needling significantly reduces tenderness and increases cervical ROM in upper trapezius myofascial pain syndrome. Higher muscle tension levels corresponded to more LTRs, typically exceeding five, while lower tension resulted in fewer LTRs, around two to three.

Researchers also found that when muscle tension decreased, the pain felt during dry needling puncture would be more pronounced. Based on the researcher's observation, this happens because when muscle tension decreases, the LTR will decrease. As explained that LTR is a spinal cord reflex. This reflex occurs due to a diversion from the central nervous system which is the result of nociceptive stimulation that occurs due to harmful stimuli (chemical concentrations) with a high threshold. However, based on the information provided by the sample, the dry needling intervention alone experienced a longer post-puncture pain effect compared to the treatment group.

As explained in the treatment group, the dry needling intervention will inactivate the TrPs contained in the upper trapezius muscle through needle puncture which will provide a decrease in muscle tension through the local twitch response that occurs. Changes in ROM that occur can also be attributed to mechanical effects caused by dry needling such as disruption of contraction nodes, local stretching, and reduction of overlap between actin and myosin filaments.

Patients showing the greatest decrease in tenderness and increase in ROM initially had high VAS scores and limited ROM. The dry needling intervention significantly improved pain and ROM. After several interventions, LTRs decreased. The patient also limited strenuous activities, enhancing the dry needling effect. Sleep quality improved post-intervention, although soreness sometimes lasted over 24 hours; however, pain significantly reduced afterward.

The effect of adding ultrasound to dry needling intervention on reducing tenderness and improving cervical ROM in upper trapezius myofascial pain syndrome

Based on hypothesis testing using independent sample *t*-test and Mann-Whitney test, the value of $p = 0.619$ for pain, $p = 0.074$ for cervical flexion, $p = 0.311$ for cervical lateral flexion, and $p = 0.494$ for cervical rotation, which means there is no significant difference in the addition of ultrasound to Dry Needling intervention on decreasing tenderness and increasing cervical ROM. However, the mean difference showed a difference, namely the mean difference of control VAS was greater than the treatment, the mean difference of control cervical flexion ROM was greater than the treatment, the mean difference of cervical lateral flexion ROM treatment was greater than the control, the mean difference of cervical rotation ROM treatment was greater than the control.

Several factors explain why dry needling (the control group) results in a greater decrease in VAS compared to the combination of ultrasound and dry needling (the treatment group). Dry needling directly targets trigger points, reducing muscle tension and pain, while also stimulating the release of endorphins and neurotransmitters. In contrast, while ultrasound improves blood flow and tissue healing, its thermal effects may not directly address the primary pain source. Some studies suggest that dry needling is more effective in reducing pain in the short term, while ultrasound provides broader long-term healing effects.

The study found that cervical flexion ROM increased more in the control group than in the treatment group. While dry needling effectively deactivates trigger points, reducing muscle tension and enhancing cervical flexion ROM, the ultrasound intervention may mitigate some mild inflammation caused by dry needling. Although mild inflammation can support healing and increase ROM, the ultrasound's anti-inflammatory effects can limit the short-term benefits of dry needling. Conversely, the treatment group showed greater improvements in lateral flexion and cervical rotation ROM. The combination of dry needling and ultrasound is particularly beneficial for university students, who often experience muscle tension from prolonged static positions during lectures. This approach directly addresses trigger points formed from repetitive movements, improving overall muscle function.

CONCLUSION

Conclusions and Recommendations

Based on this study's findings, it can be concluded that ultrasound and dry needling significantly reduce tenderness and increase cervical ROM in upper trapezius myofascial pain syndrome ($p = 0.000$). Dry needling alone also shows significant benefits in tenderness and cervical ROM. Combining both treatments results in improved lateral flexion and cervical rotation compared to dry needling alone, although it does not lead to greater pain reduction or improvement in cervical flexion ROM. Physiotherapists are advised to use dry needling for treating trigger points, and students should stretch regularly to prevent myofascial pain syndrome. Further longitudinal studies are recommended for more accurate observations.

Recent findings

In this study, it was found that some samples with a greater level of muscle tension would produce a greater number of LTR, namely > 5 times. While in samples with lower levels of muscle tension will produce a smaller number of LTR, namely only 2–3 times when punctured. Likewise, samples that experience a decrease in muscle tension after being given several times dry needling will produce a smaller number of LTRs.

Researchers also found that when muscle tension decreases, the pain felt during dry needling puncture will be more pronounced. Based on the researcher's observation, this happens because when muscle tension decreases, LTR will decrease. As explained that LTR is a spinal cord reflex. This reflex occurs due to a diversion from the central nervous system which is the result of nociceptive stimulation

that occurs due to harmful stimuli (chemical concentrations) with a high threshold. However, based on the information provided by the sample, the dry needling intervention alone experienced a longer post-puncture pain effect compared to the treatment group.

Patients who experienced the greatest decrease in tenderness and increase in ROM initially had high VAS scores and limited ROM. The dry needling intervention showed a decrease in LTR, indicating tissue repair in the upper trapezius muscle. Ultrasound also effectively reduced pain and enhanced ROM, as well as improved the patient's sleep quality. The patient limited strenuous activities to optimize the results of both interventions.

Research Limitations

Differences in age and activity between the treatment and control groups may be a factor affecting the variation in research results. Age and activity will certainly affect the body's response to the intervention provided and will have an impact on the results of VAS and ROM measurements. In addition, the use of pain medication in patients will potentially produce bias in the study.

ADDITIONAL INFORMATION

Rahmat Nugraha, Bachelor of Physiotherapy, Magister of Sports Physiology Concentration in Physiotherapy, Lecture, Health Polytechnic Ministry of Health Makassar.
E-mail: rahmatnugraha@poltekkes-mks.ac.id;
ORCID: https://orcid.org/0009-0003-9342-8785
Rahmatika, Student, Health Polytechnic Ministry of Health Makassar.
Sudaryanto, Bachelor of Physiotherapy, Magister of Sports Physiology Concentration in Physiotherapy, Lecture, Health Polytechnic Ministry of Health Makassar.
Hasbiah, Applied Bachelor's Physiotherapy, Master of Health Sciences, Lecture, Health Polytechnic Ministry of Health Makassar.
Tiar Erawan, Doctor, Bachelor's Physiotherapy, Master of Health Sciences, Lecture, Health Polytechnic Ministry of Health Makassar.

Author Contributions. All authors confirm their authorship according to the international ICMJE criteria (all authors contributed significantly to the conception, study design and preparation of the article, read and approved the final version before publication). Special contributions: Nugraha R. — conceptualization, writing and editing; Rahmatika — writing — original draft; Sudaryanto — data analysis; Hasbiah — supervision; Erawan T. — supervision.
Funding. This clinical study did not receive any external funding.
Disclosure. The authors declare no apparent or potential conflicts of interest related to the publication of this article.
Ethical Approval. The authors declare that all procedures used in this article are in accordance with the ethical standards of the institutions that conducted the study and are consistent with the 2013 Declaration of Helsinki. The study was approved by the Local Ethics Committee of the Health Polytechnic Ministry of Health Makassar, Protocol No. 0287/M/KEPK-PTKMS/III/2024 dated 22.03.2024.
Data Access Statement. The data that support the findings of this study are available on reasonable request from the corresponding author.

References

1. Wang J., Zhang Y., Cui X., Shen L. Ultrasound-guided pulsed radiofrequency versus dry needling for pain management in chronic neck and shoulder myofascial pain syndrome patients at a tertiary hospital in China: A randomised controlled trial protocol. BMJ Open. 2023; 13(5): e071422. https://doi.org/10.1136/bmjopen-2022-071422
2. Gyer G., Michael J., Tolson B. Dry Needling for Manual Therapists: Points, Techniques and Treatments, Including Electroacupuncture and Advanced Tendon Techniques. Singing Dragon: London. 1st ed. 2016; 320 p.
3. Rahmanto S., Utami K.P., Sri Utami E.Y. Pengaruh Post Isometric Relaxation pada Kasus Myofascial Pain Syndrome Upper Trapezius terhadap Penurunan Nyeri di Ar – Rohmah Islamic Boarding School Malang. Jurnal Fisioterapi Dan Rehabilitasi. 2020; 4(1): 1–8. https://doi.org/10.33660/jfrwhs.v4i1.78
4. Afifa N.A.L., Yuliadarwati N.M. The Effect Of Combination Of Progressive Muscle Relaxation And Mckenzie Neck Exercise On Intensity Pain Cases Of Myofascial Pain Syndrome Upper Trapezius Muscle On Students. Jurnal Keperawatan Dan Fisioterapi (JKF). 2022; 5(1): 53–60. https://doi.org/10.35451/jkf.v5i1.1217
5. Stella, Sekeon S.A.S.,Tumboimbela M.J. Diagnosis And Treatment Of Myofascial Pain Syndrome Diagnosis Dan Tatalaksana Sindrom Nyeri Myofasial. In Jurnal Sinaps. 2021; 4(1): 1–12.
6. Takamjani I.E., Ezzati K., Khani S., et al. Review Study: The Effects of Ultrasound-guided Dry Needling on Patients With Myofascial Pain Syndrome. Iranian Rehabilitation Journal. 2020; 18(4): 369–376. http://dx.doi.org/10.32598/irj.18.4.133.3
7. Xia P., Wang X., Lin Q., et al. Effectiveness of ultrasound therapy for myofascial pain syndrome: A systematic review and meta-analysis. In Journal of Pain Research. 2017; 2017(10): 545–555. https://doi.org/10.2147/JPR.S131482
8. Santoso I., Satriyasa B.K., Munawaroh M., et al. Kombinasi ultrasound dan dry needling lebih menurunkan disabilitas leher daripada kombinasi ultrasound dan hold relax pada myofascial pain syndrome otot upper trapezius. Sport and Fitness Journal. 2018; 6(2): 11–22.
9. Livandy V., Setiadi T.H. Prevalensi gangguan muskuloskeletal pada pekerja konfeksi bagian penjahitan di Kecamatan Pademangan Jakarta Utara periode Januari 2016. Tarumanagara Medical Journal. 2018; 1(1): 183–191. https://doi.org/10.24912/tmj.v1i1.2543
10. Yildirim M.A., Öneş K., Gökşenoğlu G. Effectiveness of ultrasound therapy on myofascial pain syndrome of the upper trapezius: Randomized, single-blind, placebo-controlled study. Arch. Rheumatol. 2018; 33(4): 418–423. https://doi.org/10.5606/ArchRheumatol.2018.6538
11. Mejuto-Vázquez M.J., Salom-Moreno J., Ortega-Santiago R., et al. Short- Term changes in neck pain, widespread pressure pain sensitivity, and cervical range of motion after the application of trigger point dry needling in patients with acute mechanical neck pain: A randomized clinical trial. Journal of Orthopaedic and Sports Physical Therapy. 2014; 44(4): 252–260. https://doi.org/10.2519/jospt.2014.5108
12. Simons D.G., Travell J.G. Myofascial Pain and Dysfunction The Trigger Point Manual by Janet G. Travell David Simons. 3rd ed. 1999; 2169 p.
13. Khandare S., Smallcomb M., Klein B., et al. Comparison between dry needling and focused ultrasound on the mechanical properties of the rat Achilles tendon: A pilot study. Journal of biomechanics. 2021; 120: 110384. https://doi.org/10.1016/j.jbiomech.2021.110384