Jurnal Keterapian Fisik
Vol. 7, No. 2, November 2022
https://doi.org/10.37341/jkf.v0i0.326

Original Research

The Effectiveness Of Dry Needling Versus Muscle Energy Technique Combined With Ultrasound Therapy In Reducing Disability Due To Tennis Elbow

Putu Ayu Sita Saraswati[1*], Sayu Aryantari Putri Thanaya[2], Made Hendra Satria Nugraha[3]

[1,2,3] Physiotherapy Department, Faculty of Medicine, Universitas Udayana, Indonesia

ABSTRACT

Background: *The tennis elbow is the most frequently diagnosed condition in the elbow and the most common cause of musculoskeletal pain in the elbow. Pain, limitation of joint motion, decreased muscle strength, and activity limitations as well as obstacles in participating in life are caused by tennis elbow. The aim of this study was to compare the effectiveness of ultrasound therapy and dry needling versus ultrasound therapy and MET in reducing disability due to tennis elbow.*

Methods: *This research was a randomized controlled trial using a pre and post-test control group design. The participants were 24 people who were divided into 2 groups. Group 1 (n = 12) was given the combined interventions of ultrasound therapy and dry needling, while group 2 (n = 12) was given the combined interventions of ultrasound therapy and MET. The interventions were given 12 times.*
Disability was measured using the Patient-Rated Tennis Elbow Evaluation Questionnaire (PRTEE). This study was conducted in the physiotherapy private practices in Denpasar and Badung Regency in Bali.

Results: *The result showed that the disability significantly decreased before and after the intervention in both groups ($p<0.05$). There was also a significant difference between the two groups.*

Conclusion: *It can be concluded that ultrasound therapy and dry needling are more effective than ultrasound therapy and MET in reducing disability due to tennis elbow.*

ARTICLE HISTORY
Received: January 20th, 2022
Accepted: November 21th, 2022

KEYWORDS
dry needling; muscle energy technique, PRTEE, tennis elbow, ultrasound therapy;

CONTACT
Putu Ayu Sita Saraswati
✉
sitasaraswati@unud.ac.id
Physiotherapy Department, Faculty of Medicine, Universitas Udayana. Bukit Campus, Jl. Raya Campus of Udayana University Jimbaran, Kec. Kuta Sel., Badung Regency, Bali, Indonesia 80361.

Cite this as:

INTRODUCTION

Tennis elbow, known as lateral epicondylitis, is a condition that commonly presents with tenderness along with pain at the elbow extensor. This case more commonly occurs in the dominant arm and is estimated to affect 1–3% of the adult population each year. It is caused by overuse activity involving repeated wrist extension against resistance, although it can occur as an acute injury caused by a traumatic

accident. It is found that up to 50% of all tennis players and laborers utilize heavy tools or engage in repetitive gripping or lifting tasks (Cutts et al., 2020).

Patients with tennis elbow usually report pain or tenderness at the lateral epicondyle of the humerus, decreased gripping strength, and weakness when turning their palms up and straightening their wrists. Tennis elbow is diagnosed by the symptoms and physical examination only (Keijsers et al., 2019). To further aid the diagnosis of tennis elbow, specific tests such as the Cozen test and Mill's test can be done, where provoked pain in the lateral epicondyle indicates that the tests are positive (Yalvaç et al., 2018).

Tennis elbow occurrence is affecting social and economic aspects since the patient will be less productive. There are 5% of tennis elbow patients who have taken sickness days. It was found that the median number of sickness days was 29 days a year in the United Kingdom.

The median of the estimated sickness absence period for workers due to a high physical strain at work caused by tennis elbow was one to three months in the Netherlands (Keijsers et al., 2019). To overcome this problem, appropriate physiotherapy interventions are needed. Physiotherapy interventions that can be given can be in the form of dry needling and manual therapy such as Muscle Energy Technque (MET) combined with electrotherapy modalities such as ultrasound therapy.

Ultrasound therapy is a modality used for physical therapy intervention that makes and transports sound waves to the internally injured site by utilizing a hand-held device. It delivered deep heating to soft tissues in the body (Luo et al., 2022). A study reported that therapeutic ultrasound was significantly effective in reducing the frequency and intensity of pain that persisted for at least 8 weeks, reducing the need for pain medication, and improving upper limb function (Kubot et al., 2017).

However, in one study, the administration of ultrasound therapy without being combined with interventions showed to be less effective than interventions with other electrotherapy modalities (Shaheen et al., 2019). Ultrasound therapy can be combined with exercise therapy or manual therapy to achieve more effective therapeutic results (Girgis & Duarte, 2020). Dry needling is a relatively new intervention and is rarely applied to treat tennis elbow cases.

Dry needling is an intervention that is given using a small needle that is penetrated into the skin. One study suggested a positive outcome of this intervention; there was a significant difference between giving dry needling intervention and standard intervention in the form of oral anti-inflammatory drugs and the use of proximal forearm braces in patients with tennis elbow (Uygur et al., 2017). But, an updated study published in 2020 found that there is low to moderate evidence that suggests a positive effect of dry needling for pain, pain-related disability, pressure pain sensitivity, and strength in the short term in patients with tennis elbow (Navarro-Santana et al., 2020).

One of the most common physiotherapeutic treatments for tennis elbow is the manual technique. It has become widespread among physiotherapists in recent years. One of the most common interventions that is generally given is Muscle Energy Technique (MET). Based on a study, MET, when used in addition to home exercises, was effective in relieving pain and increasing grip strength, finger strength, and functionality in tennis elbow (Bagcaci et al., 2022). The beneficial effect of this intervention should result in decreased disability due to tennis elbow.

The combination of ultrasound with dry needling and MET is still rarely applied in clinical practice, and there is still a lack of studies investigating which combined

intervention is more effective for treating tennis elbow. Given these gaps, the aim of this study was to compare the effectiveness of ultrasound therapy and dry needling versus ultrasound therapy and MET in reducing disability due to tennis elbow.

MATERIALS AND METHOD

This study was a randomized controlled trial (RCT) using a pre- and post-test control group design. Ethical approval was obtained from the Faculty of Medicine, Universitas Udayana/Sanglah General Hospital, with ethical clearance number 2175lUN14.2.2.Vll.14lLP12419. The study was carried out in private physiotherapy practices in Denpasar and Badung Regency in Bali from May to August 2019.

The target population of this study was individuals who complained or were clinically diagnosed with tennis elbow or lateral epicondylitis. The accessible population in this study were individuals who complained about or were clinically diagnosed with tennis elbow or lateral epicondylitis. Implemented in private physiotherapy practices in Denpasar and Badung Regency in Bali.

The inclusion criteria of this study included: (1) patients diagnosed with tennis elbow based on a physiotherapy examination, (2) patients aged between 30-45 years, and (3) those who agreed to join this study by signing the informed consent form. Meanwhile, the exclusion criteria included: (1) patients who had a history of or were suffering from psychogenic stress, diabetes mellitus, acute inflammation, cellulitis, acute strain, fractures of the humerus, radius, and ulna, symptoms of a heart attack, hematoma, osteomyelitis, severe edema, infection, malignancy, unstable joints, neurological disorders, unstable joints, osteoporosis, using pacemakers, inflamed skin conditions, (2) patients who were treated with other therapies, and (3) patients receiving pain medications.

The sample size in this RCT was determined using the Pocock formulation. The value of α error probability was set to 0.05 and power (1- error probability) was set to 0.95. Based on the sample size calculation, the sample size needed was 11 in each group. The sample size was increased by 15% to anticipate dropout, giving 12 participants in each group. Therefore, a total sample of 24 participants was required. All participants who meet the criteria will be chosen randomly using a permutation block.

The independent variables in this study were the combination of ultrasound therapy and dry needling as well as the combination of ultrasound therapy and MET, while the dependent variable was the disability of the forearm measured using the Patient-Rated Tennis Elbow Evaluation Questionnaire (PRTEE). There are 15 items in this questionnaire, which are subdivided into 2 parts: the first part contains 5 items assessing pain, ranging from 0 to 10 according to pain intensity, whereas the second part has 10 items assessing elbow function in daily activities, in which 0 indicates the total capacity and 10 refers to total incapacity. The results from the second part are divided by two and added to the results from the first part; the total score ranges from 0, indicating no involvement, to 100 points, referring to the maximum degree of limb involvement by tennis elbow (Ikemoto et al., 2020).

PRTEE has demonstrated sufficient clinical measuring properties. It demonstrated excellent reliability (ICC 0.89, 0.83, and 0.89, respectively) in the pain, function, and total scores. The reliability was assessed by subgroups (chronic vs. acute; men vs. women; work-related vs. non-work-related), the ICCs showed good reliability, and the score was greater than 0.75 (Mansoori et al., 2019).

Group 1 was given ultrasound therapy and MET, while group 2 was given ultrasound therapy and dry needling. Ultrasound therapy was applied using a gel. The therapy frequency was set at 3 MHz with a duration of 2–3 minutes and used a 5 cm ERA. The transducer was moved longitudinally in the direction of the muscle fibers and rotated in the area of the tendon.

MET was applied with the therapist stabilizing the patient's arm with the patient's left hand and forearm in a slightly flexed position. The therapist's right-hand exerted resistance, and the patient was asked to resist at 75% of his or her ability (approximately 75% of maximal isometric contraction) for 7 seconds. The patient was then instructed to relax. Following this, the therapist slowly and gently stretched the extensor carpi radialis muscle for 30 seconds (Bagcaci et al., 2022).

Before applying dry needling, the area to be treated was cleansed using povidone-iodine. Dry needling was applied by inserting 5 dry needling needles measuring 0.25 x 25 mm on the trigger points, which is the most painful area on the lateral epicondyle. The needle was inserted directly into the skin and fascia to a depth of 3-5 mm. Then, the needle was rotated 3–4 times and left *in situ* for 10 minutes. The patients received dry needling three times per week (Uygur et al., 2017).

Data analyses were carried out, which included: (1) the Saphiro-Wilk test to determine the normality distribution of the data, and (2) a comparative analysis to examine the difference in disability before and after treatment in each group. Based on the normality test, the data were normally distributed, thus the dependent sample t-test was used for comparative analysis, and (3) differential analysis was performed to examine the difference in disability between the two groups, which was performed using the independent sample t-test.

RESULTS

Based on the data in Table 1, the average age in group 1 was 40.17 ± 3.61, and in group 2 was 39.75 ± 4.13. In this study, it is known that the participants were aged between 35 - 45 years old. Based on gender, group 1 consisted of 6 men (50%) and 6 women (50%), while group 2 consisted of 4 men (33.3%) and 8 women (66.7%). Based on occupation, most of the participants in Group 1 were working as housewives (25%), while in Group 2 they were office workers (33.3%).

Table 1. Characteristics of respondents

Characteristics	Group 1 (n=12)	Group 2 (n=12)
Age (years)	40.17±3.61	39.75 ±4.13
Gender *f* (%)		
Male	6 (50)	4 (33.3)
Female	6 (50)	8 (66.7)
Occupation *f* (%)		
Office worker	2 (16.7)	4 (33.3)
Housewife	3 (25)	2 (16.7)
Wood carver	2 (16.7)	1 (0.08)
Goldsmith	1 (0.08)	0 (0)
Self-Employment	2 (16.7)	2 (16.7)
Teacher	1 (0.08)	1 (0.08)
Babysitter	1 (0.08)	2 (16.7)

Based on the normality test result, the data of both groups were found to be normally distributed (p>0.05). We also found that the data variance between the two groups was homogeneous (p>0.05). Based on the results of the normality and homogeneity test, the test used for hypothesis testing was a parametric statistical test.

Table 2. Analysis Results of PRTEE in Each Group

Data Group	Pre-test	Post-test	p value
	Mean±SD	Mean±SD	
(PRTEE)			
Group 1	25.79±4.19	19.33±3.85	0.001
Group 2	27.33±3.83	22.79±3.32	0.001

Based on Table 2, the PRTEE score significantly decreased before and after the intervention in Group 1 and 2 (p<0.05), which means that there were significant differences in the reduction of disability before and after the intervention in both groups.

Table 3. Test Results of *Independent sample t-test*

Data	Group Data	Mean±SD	p value
Pre-Test (PRTEE)	Group 1	25.79±4.19	0.356
	Group 2	27.33±3.83	
Post-Test (PRTEE)	Group 1	19.33±3.85	0.028
	Group 2	22.79±3.32	

Based on Table 3, a significant difference was found in the PRTEE score after the intervention between group 1 and 2 (p<0.05). This means that the combination of ultrasound therapy and dry needling reduces disability more than ultrasound therapy and MET.

DISCUSSION

This study found that the combination of ultrasound therapy and dry needling was significantly effective in reducing disability in tennis elbow (p=0.000). A study conducted by Uygur et al., (2017) stated that dry needling would be as effective as first-line treatment. Based on the PRTEE scores (pain and functional) before and after treatment, the dry-needling intervention group showed a significant recovery at weeks three and six.

Ultrasonographic images of some patients have shown that radiological recovery of the tendon is possible with dry needling (Uygur et al., 2017). Dry needling application activates mechanical and neurophysiological mechanisms, explaining the positive effect on pressure pain sensitivity. The underlying mechanical effects of dry needling are the disruption of dysfunctional endplates and the reduction of actin and myosin filament overlap (Navarro-Santana et al., 2020).

In addition, preliminary evidence supports the hypothesis that trigger point dry needling reduces peripheral and central sensitization by modulating dorsal horn neuron activity and activating central inhibitory pathways. Despite the exact mechanism by which dry needling works, experts suggest that this technique is capable of reducing peripheral and central sensitization by removing the source of peripheral nociception (trigger point), which positively affects tendon healing because it stimulates increased blood flow through vasodilation and local collagen proliferation. Thus, this technique is

able to restore the range of motion and reduce pain in patients with tennis elbow both locally and widely (Uygur et al., 2017).

There was a decrease in disability before and after the combination of ultrasound therapy and MET (p = 0.000). MET has been shown to have an impact on releasing articular boundaries, lengthening muscle fibers, and increasing the range of motion through connective tissue repair. However, many studies have shown that passive joint mobilization in this technique activates several areas in the central nervous system to produce a multisystem response that triggers increased tolerance to stretching, which can also play a role in increasing flexibility so that disability is expected to decrease (Sarin et al., 2018).

In this study, the PRTEE score significantly decreased before and after the intervention in Groups 1 and 2, which means that there were significant differences in the reduction of disability before and after the intervention in both groups. However, when the groups were compared, a significant difference was found in the PRTEE score after the intervention between the two groups, which indicates that the combination of ultrasound therapy and dry needling reduces disability more than ultrasound therapy and MET. According to a study, the invasive nature of the dry needling procedure compared to MET, which is a non-invasive procedure, can affect the subjective pain measurement of patients using PRTEE. Thus, MET can be reported as subjectively less effective.

The invasive nature of dry needling which directly breaks down trigger points causes the human body's natural response to foreign bodies penetrating the skin and tissues. This natural response includes the migration of satellite cells from other areas of the muscle, which aids muscle regeneration. The sonographic images of a few patients with tennis elbow indicated that radiological recovery of the tendon possibly happened (Uygur et al., 2017).

CONCLUSION

It can be concluded that the combination of ultrasound therapy and dry needling is more effective than the combination of ultrasound therapy and MET in reducing disability due to tennis elbow. Based on the study, both interventions are able to be clinically applied in the physiotherapy field. Further research with a longer total duration of therapy and longer follow-up related to long-term measurements is needed.

ACKNOWLEDGEMENT

The authors would like to show their greatest gratitude to Lembaga Penelitian dan Pengabdian Masyarakat (LPPM) Universitas Udayana for funding this research.

REFERENCES

Bagcaci, S., Unuvar, B. S., Gercek, H., Ugurlu, I., Sert, O. A., & Yilmaz, K. (2022). A randomized controlled trial on pain, grip strength, and functionality in lateral elbow pain: Mulligan vs muscle energy techniques. *Journal of Back and Musculoskeletal Rehabilitation*, 1–9. https://doi.org/10.3233/BMR-220061

Cutts, S., Gangoo, S., Modi, N., & Pasapula, C. (2020). Tennis elbow: A clinical review article. *Journal of Orthopaedics*, *17*, 203–207. https://doi.org/10.1016/j.jor.2019.08.005

Girgis, B., & Duarte, J. A. (2020). Efficacy of physical therapy interventions for chronic lateral elbow tendinopathy: a systematic review. *Physical Therapy Reviews*, *25*(1), 42–59. https://doi.org/10.1080/10833196.2019.1695355

Ikemoto, R. Y., Almeida, L. H. O., Motta, G. G. B., Kim, A. S. M., Lial, C. V. N., & Claros, J. J. (2020). Estudo comparativo entre as escalas: "Subjective Elbow Value" e "Patient-rated Tennis Elbow Evaluation" aplicadas em pacientes com epicondilite lateral do cotovelo. *Revista Brasileira de Ortopedia*, *55*(05), 564–569. https://doi.org/10.1055/s-0039-3402465

Keijsers, R., de Vos, R.-J., Kuijer, P. P. F., van den Bekerom, M. P., van der Woude, H.-J., & Eygendaal, D. (2019). Tennis elbow. *Shoulder & Elbow*, *11*(5), 384–392. https://doi.org/10.1177/1758573218797973

Kubot, A., Grzegorzewski, A., Synder, M., Szymczak, W., & Kozłowski, P. (2017). Radial Extracorporeal Shockwave Therapy and Ultrasound Therapy in the Treatment of Tennis Elbow Syndrome. *Ortopedia Traumatologia Rehabilitacja*, *19*(5), 0–0. https://doi.org/10.5604/01.3001.0010.5821

Luo, D., Liu, B., Gao, L., & Fu, S. (2022). The effect of ultrasound therapy on lateral epicondylitis. *Medicine*, *101*(8), e28822. https://doi.org/10.1097/MD.0000000000028822

Mansoori, A., Noorizadeh Dehkordi, S., Mansour Sohani, S., & Nodehi Moghadam, A. (2019). Cross-Cultural Adaptation and Determination of the Validity and Reliability of the Persian Version of the Patient-Rated Tennis Elbow Evaluation (PRTEE) Questionnaire in Iranian Tennis Players. *Function and Disability Journal*, *1*(4), 17–26. https://doi.org/10.30699/fdisj.1.4.17

Navarro-Santana, M. J., Sanchez-Infante, J., Gómez-Chiguano, G. F., Cleland, J. A., López-de-Uralde-Villanueva, I., Fernández-de-las-Peñas, C., & Plaza-Manzano, G. (2020). Effects of trigger point dry needling on lateral epicondylalgia of musculoskeletal origin: a systematic review and meta-analysis. *Clinical Rehabilitation*, *34*(11), 1327–1340. https://doi.org/10.1177/0269215520937468

Sarin, A., s, J., & Michael. (2018). To Study the Effectiveness of Cyriax Manual Therapy Vs. Muscle Energy Technique in Subjects with Tennis Elbow on Pain, Grip Strength and Functional Disability. *Journal of Physiotherapy & Physical Rehabilitation*, *03*(03). https://doi.org/10.4172/2573-0312.1000159

Shaheen, H., Alarab, A., & S Ahmad, M. (2019). Effectiveness of therapeutic ultrasound and kinesio tape in treatment of tennis elbow. *Journal of Novel Physiotherapy and Rehabilitation*, *3*(1), 025–033. https://doi.org/10.29328/journal.jnpr.1001025

Uygur, E., AKTAŞ, B., ÖZKUT, A., ERİNÇ, S., & YILMAZOGLU, E. G. (2017). Dry needling in lateral epicondylitis: a prospective controlled study. *International Orthopaedics*, *41*(11), 2321–2325. https://doi.org/10.1007/s00264-017-3604-1

Yalvaç, B., Mesci, N., Geler Külcü, D., & Yurdakul, O. V. (2018). Comparison of ultrasound and extracorporeal shock wave therapy in lateral epicondylosis. *Acta Orthopaedica et Traumatologica Turcica*, *52*(5), 357–362. https://doi.org/10.1016/j.aott.2018.06.004