COMPARISON OF THE EFFECTIVENESS OF MUSCLE ENERGY TECHNIQUE AND ECCENTRIC EXERCISE IN REDUCING DISABILITY IN TENNIS ELBOW SUFFERERS

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Abstract. Tennis elbow is an injury that often occurs in athletes, and individuals who frequently use the muscles of the forearm and around the elbow joint. The pain felt will result in a decrease in the ability of the hand in the individual. Exercises that can be given to reduce disability are muscle energy technique (MET) and eccentric exercise. MET has an impact in accelerating tissue healing, reducing pain, increasing tissue elasticity and flexibility, and increasing joint scope of motion. Meanwhile, eccentric exercises help the tendon healing process and reduce pain. This study aimed to determine the difference in the effectiveness of muscle energy technique with eccentric exercise in reducing disability in tennis elbow sufferers. This type of research was quasi experimental research with pre- and post-test two group design. This research was carried out at the Siloam Hospital in July 2023. The sample of this study amounted to 18 people who were further divided into two groups, namely Group 1 (MET) and Group 2 (eccentric exercise). Tennis elbow disability was measured by a patient-rated tennis elbow evaluation (PRTEE) questionnaire. Based on the results of the paired sample t-test before and after in Groups 1 and 2, there was a significant change in reducing disability in tennis elbow sufferers after giving the exercise to each group (p<0.001). In the independent t-test, there was a significant difference between group 1 and group 2 in reducing disability in tennis elbow sufferers (p=0.016). It can be concluded that muscle energy techniques are more effective than eccentric exercise in reducing disability in tennis elbow sufferers.

Keywords: eccentric exercise, disability, muscle energy technique, tennis elbow

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INTRODUCTION

An individual in carrying out daily activities will involve all his limbs. One of the limbs that is often used when doing activities and work is the hand. Hands are limbs that have very complex functions. Jobs that rely a lot on hand skills in carrying out work activities are art workers, housewives, sportsmen, construction workers and chefs. Therefore, many of these workers experience musculoskeletal disorders in their arms and elbows. One musculoskeletal disorder that can occur is tennis elbow (Fauzi *et al*, 2014).

Tennis elbow (lateral epicondylitis) is inflammation that occurs in the lateral epicondylus of the elbow and also inflammation along the extensor tendons in the proximal part of the radioulna joint (Kisner and Colby, 2007). Tennis elbow is caused by repeated and heavy muscle contractions in the extensor carpi radialis muscles and also trauma caused by movements that occur in the extensor muscles of the wrist that suddenly and forcefully cause interference with the hands and elbows (Solomon *et al*, 2014). The prevalence of tennis elbow is around 1-3% in the general population and can increase to 23% among workers. The highest value of prevalence is estimated to increase by about 1.3% at the age of 45-54 years (Othman, 2014).

Tennis elbow sufferers in Indonesia generally occur at the age of 25-55 years with symptoms of pain in the lateral elbow, especially when the fingers squeeze or hold firmly (Rudianto and Sinuhaji, 2018).

Symptoms of pain usually arise gradually and can also be felt after activity or even while resting at night. This pain will cause a decrease in a person's ability to carry out activities such as taking care of themselves, taking care of themselves, and helping themselves to be able to carry out daily activities independently. In addition, tennis elbow sufferers will also experience a decrease in productivity in their work (Herliyana and Rahman, 2021).

Various treatment options have been recommended for tennis elbow, but non-operative treatment remains a priority for most tennis elbow sufferers. Non-operative treatment that can be given is physiotherapy. Physiotherapists as one of the implementers of health services play a role and are responsible for improving the degree of health, especially those related to the object of their discipline, namely motion and function. Efforts to improve health by physiotherapy include all elements related to efforts to improve the degree of health, namely improvement (promotive), prevention (preventive), healing (curative) and maintenance (rehabilitative) so that a healthy Indonesia can be realized (Rudianto and Sinuhaji, 2018). One of the efforts that can be done by physiotherapists in reducing disability in tennis elbow sufferers is to provide exercises in the form of muscle energy technique (MET) and eccentric exercise.

MET is a combination of isometric contraction and stretching will stimulate receptors that are responsible for extending (stretching) from the muscle spindle to move to adjust the maximum muscle length (Trivedi *et al*, 2019). Thomas *et al* (2019) stated that muscle energy technique is an osteopathic technique that manipulates soft tissues such as muscles, fascia, tendons, and ligaments that aim to improve musculoskeletal function and reduce pain. This technique can be applied to muscles that experience hypertonic, and muscle tightness. The administration of muscle energy technique is also very effective in joint dysfunction

and joint capsule adhesions. MET has the principle of manipulation in a gentle way, with a maximum resistance of 20% of muscle strength, coupled with breathing control, and optimal reps (Thomas *et al*, 2019). So, this MET exercise can have an impact in accelerating tissue healing, releasing adhesions, reducing pain, increasing tissue elasticity and flexibility, maximum muscle elongation and increasing the scope of motion of arm joints so that functional abilities will increase and disability in the arm will decrease (Saraswati *et al*, 2019).

Meanwhile, eccentric exercise is an action in which the muscles extend under pressure. During eccentric contractions, the load produced by the muscles is greater. Eccentric exercise is characterized by greater muscle microlesions, and mechanical tension compared to concentric/isometric contractions and can therefore result in greater muscle adaptation. Eccentric exercises aid tendon healing and pain reduction by being characterized by greater muscle microlesions and mechanical strain compared to concentric/isometric contractions and can therefore result in greater muscle adaptation. Reduced muscle pain and spasm will increase the ability of functional activity or disability due to tennis elbow will decrease (Parmar and Shukla, 2020).

Based on the above problems and seeing the impact of tennis elbow, researchers are very interested in conducting research to see the difference in the effectiveness of muscle energy technique with eccentric exercise in reducing disability in tennis elbow sufferers.

MATERIALS AND METHODS

This study is a quasi-experimental study with the research design used is pre- and post-test two group design where the sample will be

split into two groups, Group 1 receiving muscle energy technique (MET) and Group 2, receiving eccentric exercise. The research procedures can be seen in Fig 1.

This study used consecutive sampling techniques as its sampling method. Before the research was conducted, each respondents signed an informed consent. This study was carried out at Siloam Hospital Denpasar in July 2023, with exercise sessions occurring three times each week for a total of 12 meetings. The research instrument used was the Patient-Rated Tennis Elbow Evaluation (PRTEE) questionnaire (Vincent and MacDermid, 2014). The questionnaire consists of 15 items with three subscales: disability, usual activity, and specific activity. Total scores range from 0 to 100, where high scores indicate greater pain and disability. The data processing method employed Statistical Package for the Social Sciences (SPSS) software version 25.0 (IBM Corp, Armonk, NY), while the data analyses carried out were descriptive tests namely, the Saphiro-Wilk test normality test, Levene's test for homogeneity test, paired samples t-test for hypothesis testing and independent t-test for testing the difference in results in Groups 1 and 2.

This research has received permission from the Research Ethics

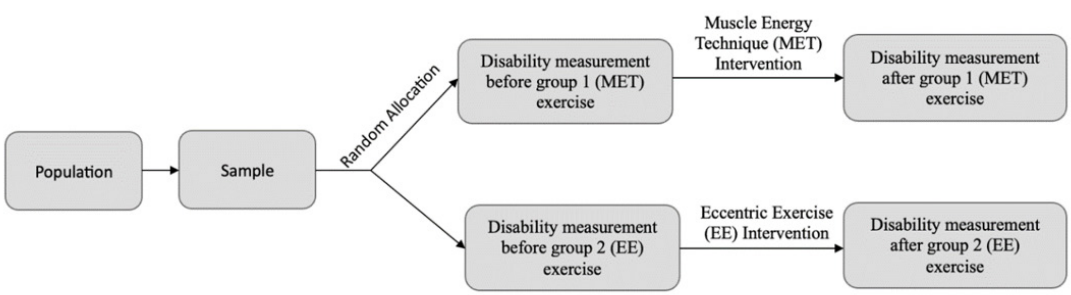

Fig 1 - Research design

Commission of the University of Bali International with number 01.046/UNBI/EC/VI/2023.

RESULTS

There were 18 tennis elbow sufferers participated in this study. Nine participants received muscle energy technique (Group 1) and the rest received eccentric exercise (Group 2). All participants received treatment for 4 weeks. Table 1 shows that most participants were female

Table 1
Participants' characteristics

Characteristic	Frequency, *n* (%)	
	Group 1 (N = 9)	Group 2 (N = 9)
Gender		
Male	3 (33.3)	3 (33.3)
Female	6 (66.7)	6 (66.7)
Age (years)		
25-30	3 (33.4)	2 (22.2)
31-35	4 (44.4)	6 (66.7)
35-40	2 (22.2)	1 (11.1)
Occupation		
Athlete	2 (22.2)	2 (22.2)
Housewife	3 (33.4)	2 (22.2)
Farmer	2 (22.2)	1 (11.2)
Private employees	2 (22.2)	4 (44.4)

Note: Group 1 comprises participants receiving muscle energy technique while Group 2 comprises participants receiving eccentric exercise.

(*n*=6, 66.7%); aged 31 to 35 years (*n*=6, 66.7%); and worked as private employees (*n*=4, 44.4%).

Normality and homogeneity test results (Table 2) reveal that the data in this study are normally distributed and homogeneous. Table 3 summarizes the comparison of mean disability reduction score in tennis elbow sufferers using the PRTEE questionnaire before and after treatment. Both groups showed significant differences in mean disability scores before and after MET and eccentric exercise treatments ($p<0.001$ in both groups). This shows that MET and eccentric exercise can reduce disability in tennis elbow sufferers. When the average values of disability reduction from MET and eccentric exercise were compared, a significant difference was obtained ($p=0.013$) meaning that MET is more effective than eccentric exercise in reducing disability in tennis elbow sufferers.

Table 2

Normality and homogeneity test results

PRTEE score	Normality test (Shapiro-Wilk test)				Homogeneity test (Levene's test)
	Group 1		Group 2		
	Mean ± SD	*p*-value	Mean ± SD	*p*-value	
PRTEE score before intervention	31.16 ± 6.56	0.209	32.16 ± 5.04	0.594	*p*=0.39*
PRTEE score after intervention	22.27 ± 5.58	0.323	27.11 ± 4.27	0.368	*p*=1.00*

*Homogeneous when $p> 0.05$

Note: Group 1 comprises participants receiving muscle energy technique while Group 2 comprises participants receiving eccentric exercise.

PRTEE: Patient-Rated Tennis Elbow Evaluation, SD: standard deviation

Table 3

Comparison of mean disability reduction score in tennis elbow sufferers using the PRTEE questionnaire in both groups before and after intervention

Group	PRTEE score before intervention (mean ± SD)	PRTEE score after intervention (mean ± SD)	*p*–value*
1	31.16 ± 6.56	22.27 ± 5.58	$p<0.001$
2	32.16 ± 5.04	27.11 ± 4.27	$p<0.001$
p-value†	0.722	0.013	

*Paired t-test; †Independent t-test

Note: Group 1 comprises participants receiving muscle energy technique while Group 2 comprises participants receiving eccentric exercise.

PRTEE: Patient-rated Tennis Elbow Evaluation; SD: standard deviation

DISCUSSION

Gender is a risk factor for tennis elbow. Tennis elbow injuries often occur in women compared to men (Wolf *et al*, 2010). This is because women carry out greater activities than men (Rudianto and Sinuhaji, 2018). In addition, during puberty, the hormone testosterone in males increases drastically and it will affect greater muscle mass than women. In men, the total muscle cross-sectional area is 80% while women have a total muscle cross-sectional area of 60% so that the maximum muscle strength between women and men is different (Nirschl and Pettrone, 1979).

Those who often experience tennis elbow injuries are in the middle age ranging from 20-50 years old. This is because with age, collagen structure decreases leading to a decrease in tendon flexibility making the tendon gets easier injured (Kinitz *et al*, 2021). Tennis elbow injuries often occur in sports that use rackets (such as badminton, tennis, golf,

and squash). In athletes, these injuries occur due to the top spin back hand, poor swing technique and heavy use of rackets. If continued, it will cause over strain, so that more and more it will cause microtrauma which eventually causes tennis elbow. In addition to athletes, these injuries are also common in individuals with jobs that use heavy equipment or perform repetitive gripping or lifting tasks such as housewives, farmers and private employees (Cutts *et al*, 2020). Tennis elbow can cause significant pain and functional impairment.

In this study, the exercises used to reduce disability in tennis elbow sufferers were muscle energy technique (MET) and eccentric exercise. MET in this study can reduce disability in tennis elbow sufferers because it improves musculoskeletal function, increase range of motion, and reduce pain (Thomas *et al*, 2019). MET exercises are performed by contracting the extensor carpi radialis brevis muscle isometrically and followed by stretching until the first pain barrier felt is then held for 30 seconds (Gibbons, 2022). Muscle lengthening will result in lengthening of fibers and components in the sarcomere and fascia in the myofibrils of the muscle lengthening due to stretching so as to have an impact on reducing the degree of overlapping of a link band, in the future it is expected to be able to trigger the release of optimal adhesion to muscle connective tissue (fascia and tendon) so that pain will be reduced and there will be an increase in grasping strength and functional disability will decrease (Hariharasudhan and Balamurugan, 2015). The results of this study are linear with research conducted by Saraswati *et al* (2019) where MET was proved effective in reducing disability in tennis elbow. Isometric contraction in the MET will affect the Golgi tendon organ that sends impulses to the posterior horn cell and has an inhibitory effect on increasing motor stimulation in the anterior horn cell which causes autogenic inhibitors after post isometric relaxation (Trivedi *et al*, 2019).

Eccentric exercise has a lengthening effect on muscles and tendons so that when the elbow moves the tension is reduced. Another effect is "loading" in muscles and tendons which increases tendon tensile muscle strength and hypertrophy in the belly muscle. Eccentric exercise is an exercise that produces the tension needed to form fibrous tissue in the musculoninous structure so that adaptation to increased tension (Upadhyay *et al*, 2017). This is in accordance with research conducted by Oya-Casero *et al* (2022) where the results of the study stated that eccentric exercise can reduce pain and disability in tennis elbow. Eccentric exercise results in increased collagen synthesis by activating mechanoreceptors in tenocytes (Oya-Casero *et al*, 2022). After doing eccentric exercise, there will be an increase in the main type of peri-tendinous type I collagen in normal tendons (Lee *et al*, 2018). Eccentric exercise can also inhibit the production of agents responsible for producing pain in tendinosis associated with neovascularization (Dimitrios, 2015). Eccentric exercises can stop blood vessel growth in tendinosis and subsequently relieve some of the associated pain and may increase tendon mass due to increased type I collagen deposition (Seo *et al*, 2018). Stimulation of type I collagen production may be particularly beneficial because fibroblasts from the area of tendinosis typically synthesize mechanically good type III collagen. Eccentric exercises can serve to strengthen tendons and protect them from subsequent overuse (Nowotny *et al*, 2018).

MET and eccentric exercise can both reduce disability in people with tennis elbow, but MET is more effective than eccentric exercise. This is because the application of MET can reduce peripheral nociceptor sensitivity and reduce proinflammatory cytokinin's. Decreased pain modulation could be the reason for disability reduction. When joint mechanoreceptors are activated, somatic afferent excitation occurs leading to sympathoexcitation and local activation of the periaqueductal. MET increases muscle flexibility due to viscoelastic changes in the

muscle. Stretching connective tissue components allows muscles to contract effectively thereby increasing strength. In addition, the increase in function is due to decreased pain and increased strength, which allows the muscles of the forearm to stabilize the hand and wrist so that precision and prehension functions are achieved to optimal levels (Stasinopoulos and Stasinopoulos, 2017).

The limitation of research in this study is the relatively small number of research participants. Further research should increase the number of samples so that the results of the study can represent a wider scope.

From the results and discussion above, it can be concluded that muscle energy technique is more effective than eccentric exercise in reducing disability in tennis elbow sufferers.

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CONFLICT OF INTEREST DISCLOSURE

The authors declare no conflict of interest.

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