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Ultrasound therapy and stretching of wrist extensors on pain, motion and functional impairment of the wrist in patients with carpal tunnel syndrome

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Abstract

Background: Carpal tunnel syndrome (CPT) is a medical situation when there is pressure on the median nerve, where the wrist is located, which makes parasthesias, numbness and weak hand muscles. Several interventions can be done to overcome patient problems, one of which is physiotherapy. This study is intended to identify in-depth information related to the effectiveness of ultrasound therapy along with wrist stretching to reduce pain and make functional improvements in the wrists of patients with CTS.
Purpose: To determine the benefits of ultrasound therapy also wrist stretching for patients with CTS.
Method: This quasi-experimental study employs a pre-test and post-test design with a control group of ten respondents who have had CTS. This study employs the DASH questionnaire, the VAS, and a goneometer to measure joint mobility area. Wilcoxon and Mann-Whitney tests used to analyze the data.
Results: It was found that, motion pain decreased, joint motion area increased, and increased functional potential after intervention. The impact varied between group 1 and group 2 ($p<0.05$). However, in compressive pain and silent pain, the value of $p>0.05$ was found, so there was no difference in effect between the 2 groups, but group 2 had more changes than group 1.
Conclusion: Ultrasound therapy and wrist stretching were shown to result in decreased pain, enhanced functional routine, also increased joint range of motion.

Keywords: Carpal Tunnel Syndrome; Motion and Functional Impairment; Stretching; Ultrasound Therapy; Wrist.

INTRODUCTION

In everyday life, humans frequently engage in normal actions that require the use of their hands. Excessive exercise can cause RSI (repetitive strain injury), which, if repeated, can progress to CTS (carpal tunnel syndrome) (Andayani, Wibawa, & Nugraha, 2020). If the position of the palm and forearm persists unphysiologically for a short time, the joints of the hand will experience excessive pressure or stretching, which causes thickening of the transverse carpi ligament. Due to the unergonomic positioning of the palms and forearms while working, this thickening can narrow the carpal tunnel and compress the nerves. This creates an increased risk of developing CTS later in life (Agustin, 2014; Utama, & Susanti, 2014; Akurke, 2018; Dhengre, Rajput, Patel, & Katarne, 2024).

Compression of the median nerve in the flexor retinaculum, also known as the carpal ligament tranversum, at the wrist causes a group of symptoms known as Carpal Tunnel Syndrome (Deniz, Ekinci, Köse, & Altay, 2019; Fariqhan, & Taufik, 2022; Montanari, Corzani, Luchetti, & Atzei, 2022). It requires management to reduce pain, increase range of joint movement to restore functional routines by interventions such as ultrasound therapy and wrist stretching (Draper, 2010; Roll & Hardison, 2017;

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Ionică, & Apostu, 2024).

Ultrasound Therapy is a treatment method that utilizes sound waves emitted by a tranducer. Ultrasound is a component of physiotherapy that provides mechanical energy (Ranganayakulu, Rao, & Gahane, 2016). The ultrasound method has a heat/thermal effect that reduces pain because ultrasound micromassage creates a thermal effect on the tissue. This heat effect can improve blood circulation, relax muscles, increase the potential to regrow tissue, reduce pain, and many more (Puspitasari, Amanati, & Abidin, 2017).

Stretching is a muscle-stretching technique used to prepare muscles for work and relax them as they work (Nohantiya, 2017). The physiological effects of stretching can be the reduction of muscle tension, improvement of blood circulation, reduction of anxiety, fatigue, and stress, reduction of injury risk, and shaping people better (Darmawijaya, Yani, & Permadi, 2019).

The Neuropathy PERDOSSI (Study Group of the Indonesian Neurologist Association) is running the "Fight Neuropathy" campaign. In Indonesia, the number of people affected by neuropathy is very high. 43% of 16,800 people surveyed have it. More than 50% of people engage in daily activities and lifestyles that can potentially cause neuropathy, such as typing on devices and computers, which can cause CTS. In 271 patients with CTS, the prevalence of neuropathy increased to 50%, or one in two patients. In Indonesia, 31.2% of musculoskeletal diseases were diagnosed in informal workers such as fishermen, farmers, and laborers. On the other hand, 11.9% of people in West Java Province were diagnosed by health workers and 11.9% had symptoms or diagnosis (Ministry of Health of the Republic of Indonesia, 2013). This study is intended to obtain information related to the effect of ultrasound therapy intervention and wrist stretching on CTS. Not only seeing changes in pain but also seeing an increase in joint range of motion and increased functional potential in CTS patients.

RESEARCH METHOD

This study was designed using physiotherapy interventions using Ultrasound Therapy and Wrist Stretching. This research design uses quantitative research methods that have a Quasy Experimental nature to obtain information on the effectiveness of Ultrasound Therapy and Wrist Stretching interventions to reduce pain, improve joint motion area and functional potential of the wrist in CTS patients.

A control group design was used along with a pre- and post-test approach, where respondents are divided into 2 qualifications (ultrasound therapy and ultrasound therapy + wrist stretching), respondents will carry out a physiotherapy examination and measurement process first before taking therapeutic action. And vice versa, a physiotherapy examination and measurement will be carried out after the therapy is carried out.

The study was conducted in February 2024 at the Proven Medika Utama Clinic, Muara Enim, South Sumatra. The sampling technique used a non-random technique with a purposive sampling method and obtained a total of 10 participants with a length of illness <6 months. With inclusion criteria; unilateral or bilateral carpal tunnel syndrome patients, aged 20 to 45 years with wrist pain> 3 using VAS, able to communicate well, willing to be respondents and not taking painkillers at the time of the study. and exclusion criteria; Carpal tunnel syndrome patients with a history of diabetes, with open wounds in the affected area, pregnant and breastfeeding, receiving other treatment and uncooperative.

Physiotherapy examination in the form of, pain examination using Visual Analoge Scale (VAS), Range Of Motion (ROM) examination using a goneometer and functional ability examination using DASH (Disabilities of the Arm, Shoulder and Hand). After the examination also physiotherapy intervention, the results then analyzed with Wilcoxon and Mann Whitney tests.

This research has been declared ethically acceptable by the Research Ethics Committee of Dr. Soedjono Level II Hospital with the number: 880/EC/IV/2024.

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RESEARCH RESULTS

Table 1. Characteristics of Participants (N=10)

Characteristics	Results
Age (n/%)	
(Mean±SD)(Range)(Years)	(37.19±7.386)(20-45)
< 30 years	3/30
> 30years	7/70
Gender (n/%)	
Female	9/90
Male	1/10
Occupation (n/%)	
Doctor	1/10
House Wife	5/50
Bank employee	1/10
Office employee	2/20
Civil Servant	1/10
Right/left (n/%)	
Right	8/80
Left	2/20

Based on the table, from 10 participants the average and standard deviation of age were 37.19±7.386 with an age range of 20-45 years. The majority were female namely 9 (90%), with occupation as housewives as many as 5 (50%), and the majority experienced pain on the right side as many as 8 (80%).

Table 2. Wilcoxon Test (N=10)

Type of Examination	Bifore (Mean±Rank Sum)	After (Mean±Rank Sum)	p-value
Motion pain	(5.50±55.00)	(0.00±0.00)	0.005
Tenderness	(5.50±55.00)	(0.00±0.00)	0.005
Silent Pain	(5.50±45.00)	(0.00±0.00)	0.005
DASH	(5.50±55.00)	(0.00±0.00)	0.005
Dorso Flexion	(0.00±0.00)	(5.50±55.00)	0.005
Palmar Flexion	(0.00±0.00)	(5.50±55.00)	0.005
Radial Deviation	(0.00±0.00)	(5.50±55.00)	0.004
Ulnar Deviation	(0.00±0.00)	(5.50±55.00)	0.004

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The effect of Ultrasound Therapy and Wrist Stretching interventions on reducing pain, increasing joint motion area and increasing functional potential in people suffering from Carpal Tunnel Syndrome (n = 10). The results showed that in patients with Carpal Tunnel Syndrome as many as 10 respondents there was a decrease in pain, increased joint motion area and increased functional potential. The results of statistical tests show p = <0.05, so the decision to reject H0 is made, it indicates that following the intervention, a notable difference has occurred for reducing pain, increasing joint motion area and increasing the functional potential of patients.

Table 3. Mann Whitney u test (Difference between pre and post test)

Category	Group 1 (n=5)	Group 2 (n=5)	p-value
Motion pain (Mean±Rank Sum)	(3.10±15.50)	(7.90±39.50)	0.008
Pressure pain (Mean±Rank Sum)	(4.00±20.00)	(7.00±35.00)	0.151
Silent Pain (Mean±Rank Sum)	(4.10±20.50)	(6.90±34.50)	0.151
ADL (Mean±Rank Sum)	(3.00±15.00)	(8.00±40.00)	0.008
Dorso Flexion (Mean±Rank Sum)	(3.00±15.00)	(8.00±40.00)	0.008
Palmar Flexion (Mean±Rank Sum)	(3.00±15.00)	(8.00±40.00)	0.008
Radial Deviation (Mean±Rank Sum)	(3.40±17.00)	(7.60±35.00)	0.032
Ulnar Deviation (Mean±Rank Sum)	(3.00±15.00)	(8.00±40.00)	0.008

The distinction in the impact of Ultrasound Therapy compared to Wrist Stretching interventions on pain reduction, increasing joint motion area and increasing functional potential in people suffering from Carpal Tunnel Syndrome. The findings showed that among 10 responders with Carpal Tunnel Syndrome, motion-related pain was lessened, joint mobility was improved, and an increase in functional ability, where the p value <0.05, so that group 1 and 2 differed from one other. However, in pressure pain and silent pain, the p value>0.05 was obtained, which means that both groups both received changes, but group 2 received more changes than group 1.

DISCUSSION

In this study, it was found that Ultrasound Therapy and Wrist Stretching resulted in decreased pain, increased joint range of motion and improved functional activity as measured using VAS, Goniometer and DASH. When compared between the two groups, it was found that the group receiving Ultrasound Therapy and Wrist Stretching intervention was able to reduce pain, increase joint motion area and improve functional activity more than the group receiving Ultrasound Therapy intervention only.

Several studies have shown that Ultrasound Threpay has an effect on pain reduction. The ultrasound method causes micromassage which causes heat (thermal) effects in the tissue, this can be a pain reducer. How much heat is generated differs for each tissue. The intensity and duration of the treatment determines the amount of heat generated. This heat effect can increase blood circulation, relax muscles, increase the potential to regenerate tissues, reduce pain, and other effects (Puspitasari et al., 2017). In previous studies, patients were given flexion and extension movements of their fingers. This occurs when the flexion movement from the median nerve extension position and the superficial digital flexor tendon stretch slightly when returning to the 30° position.

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These active and passive movements can reduce median nerve tension (Liu, Liu, Chen, Wang, Wu, & Horng, 2021).

Research at Wonosari Hospital using ultrasound therapy interventions, stretching exercises, strengthening exercises and manual therapy for 2 weeks with 4 interventions, can reduce pain, increase muscle strength and improve functional ability (Putri, Sudaryanto, & Ismadi, 2022). The use of ultrasound in cases of carpal tunnel syndrome at Banyumas Regional Hospital with therapy as many as 4 times therapy within a period of 2 weeks can reduce pressure pain, and pain of movement in both wrists. The use of exercise therapy in the form of ULTT 1 nerve mobilization can increase LGS and increase muscle strength in both wrists (Ghufroni, & Pertiwi, 2023).

Study in outpatient clinic of orthopedic departments at Cairo University hospitals showed that the longitudinal stretching of muscles and nerve in addition to Ultrasound therapy, strengthening exercise, and splinting is more effective than deep transverse friction massage in addition to Ultrasound therapy, strengthening exercise, and splinting in the treatment of patients with carpal tunnel syndrome (Hafez, Alenazi, Kachanathu, Alroumi, & Mohamed, 2014).

CONCLUSION

In this study, the results showed that Ultrasound Therapy and Wrist Stretching were proven to result in decreased pain, increased joint motion area and increased functional activity measured using VAS, Goniometer and DASH. The group that received Ultrasound Therapy and Wrist Stretching intervention was able to reduce pain, increase joint motion area and increase functional activity more than the group that only received Ultrasound Therapy intervention. Therefore, when performing therapy, it is required to add exercise therapy to be more effective and maximized.

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