THE EFFECTIVENESS OF NEURODYNAMIC TECHNIQUE (TENSIONING AND SLIDING) AND ULTRASOUND THERAPY TO REDUCE SYMPTOMS ON CARPAL TUNNEL SYNDROME PATIENTS: A CASE REPORT

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Abstract

Introduction: Carpal Tunnel Syndrome (CTS) is a peripheral neuropathy caused by entrapment on the median nerve in the carpal tunnel resulting in limited nerve mobility. The aim of this study is to find out the effectiveness of the neurodynamic technique (tensioning and sliding) and ultrasound therapy to reduce symptoms in CTS patients.
Case Presentation: The patient was a 47 years old woman with sensory impairment and decreased functional ability. Sensory impairment includes pain, paresthesias, and numbness in the palm and thumb to the ring finger.
Management and Outcome: Treatment given was a conservative treatment by physiotherapy in the form of neurodynamic technique (tensioning and sliding) and ultrasound therapy. The instruments used were the Numeric Pain Rating Scale to measure the pain and Boston Carpal Tunnel Questionnaire to measure the severity of symptoms and functional ability.
Discussion: The results obtained were the decrease of tenderness T1: 3 to T4: 2, motion pain T1: 3 to T4: 2, and increased functional ability of the patient.
Conclusion: The addition of hand splinting use during working with giving neurodynamic technique (tensioning and sliding) and ultrasound therapy can effectively reduce pain and increase functional ability.

Keyword: Carpal Tunnel Syndrome, Neurodynamic, Ultrasound Therapy

Introduction

Carpal tunnel syndrome (CTS) is the most common peripheral mononeuropathy, characterized by the occurrence of sensory and motor impairment. Carpal tunnel syndrome is caused by pressure on the median nerve in the carpal tunnel resulting in limited nerve mobility[1]. The prevalence of CTS cases ranges from 2.7-5.8% in the adult population. Women get this syndrome twice as often as men from 45-60 years old[2]. Sensory impairment and decreased conduction velocity on sensory nerve fiber is the initial manifestation of CTS. Sensory impairment on CTS includes the onset of pain, paresthesias, tingling, loss of sensation in the median nerve innervation. Based on the multicenter study conducted by Padua et al. [2] on 1,123 patients with carpal tunnel syndrome, the pain occurs in 52% of cases.

Treatments that can be given to CTS patients are operative and conservative treatments. Conservative treatment is claimed as a treatment with higher safety and lower costs[3]. Several CTS patients avoid surgical therapy and prefer conservative therapy. Conservative therapy can be given by physiotherapy, where the physiotherapy can give intervention using the modality of electrophysical agent or exercise, manual therapy, education, and splinting[4].

Manual therapy is a physiotherapy technique performed manually with specific techniques. The neurodynamic technique is one of the manual therapy techniques. The use of the neurodynamic technique can restore the dynamic balance between nerve relative motion and surrounding tissues and increase the shift of the median nerve[5]. Ultrasound is given on CTS patients, where ultrasound provides thermal and non-thermal effects, resulting in pain relief, anti-inflammatory effect, and tissue stimulation effect[6]. According to the study conducted by Mohamed et al. [7], the neurodynamic technique has a positive therapeutic effect.

Based on the background above, the writer would like to find out whether neurodynamic technique and ultrasound are effective in reducing pain in carpal tunnel syndrome patients.

Case Presentation

A 47 years old woman works as a cigarette factory employee. The patient complained of numbness and tingling in her right hand 2 months ago, which was initiated by pain in her wrist. The symptoms felt worse in the night. The patient does not have systemic disease, according to the examination performed by the doctor. In the examination, a sensory impairment was found. For the motor ability, there was no weakness, and the joint range of motion was still normal. Graphesthesia examination was performed to find out the sensory impairment by writing letters or symbols in the palm, then asked the patient to guess it. When performing the Phalen test and Tinel sign test,

a positive result was obtained, where the patient felt tingling in the area innervated by the median nerve. Based on the criteria of Chang et al.[8], the patient who has two or more symptoms (numbness and tingling in the median nerve area, paresthesias at night, positive Tinel sign test, positive Phalen test, pain in the wrist radiating to the shoulder) can be clinically diagnosed with carpal tunnel syndrome.

Management and Outcome

The instrument used for the patient was NPRS (Numeric Pain Rating Scale) to measure the pain. The assessment of pain used NPRS, where 0 = no pain, 10 = very pain. Boston Carpal Tunnel Questionnaire (BCTQ) was one of the questionnaires where there were two scales, symptom severity scale (SSS) with 11 questions and functional status scale (FSS) with 8 questions. The answers to the questions were a score of 1-5, where the higher the score indicates the severity/disturbed.

The physiotherapy interventions given to the patient were the Neurodynamic Technique in the form of tensioning and sliding, as well as ultrasound therapy. The sequences of neurodynamic technique were as follows: (1) initial supine position; (2) abduction arm to 90 °; (3) external rotation arm; (4) extension of wrist and fingers; (5) forearm supination; and (5) extension of the elbow. In this sequence, sliding and tensioning techniques were performed in proximal and distal direction: (1) mobilization of one-way proximal sliding (movement - elbow extension - large movement amplitude); mobilization of one-way distal sliding (movement - wrist extension, large movement amplitude); (3) mobilization of one-way proximal tension (movement - elbow extension - small movement amplitude at the end of the movement); (4) mobilization of one-way distal tension (movement - wrist extension - small movement amplitude at the end of the movement). The duration of therapy was around 20 minutes with 60x repetitions of sliding and tensioning technique, the interval of 15s/sequence was performed 3 times a week. Ultrasound therapy was given to the patient with an intensity of 1.0 w/cm^2 for 5 minutes of 3x a week. The application of US was over the carpal ligament transversely.

Results

The results of pain measurement with NPRS and functional ability with BCTQ

Table 1. The results of NPRS and BCTQ measurements

	T1	T2	T3	T4
NPRS				
Pain	0	0	0	0
Motion Pain	3	3	3	2
Tenderness	3	3	3	2
BCTQ	Pre	Pos		
SSS Symptom severity scale	23	20		
FSS Functional status scale	20	18		

Based on the pain measurement using NPRS, it was obtained results of silent pain T1: 0; motion pain: 3, tenderness: 3. After giving ultrasound and neurodynamic technique, the reduction of pain occurs on T4 to be motion pain: 2 and tenderness. 2. The results showed no reduction of pain on T2 and T3.

The results of functional ability using BCTQ obtained pre-treatment test for the SSS score of 23 to be 20, while the pre-treatment FSS score was 18 to be 15. Based on the BCTQ of SSS scale, the patient experienced pain reduction at night and reduction of tingling sensation in hand. Functional ability increase based on the FSS scale, where the increase occurs in writing ability and buttoning up the clothes.

Discussion

Based on the results above, the reduction of pain does not occur on T1, T2, T3, and reduction of pain occur on T4. This condition is caused by repetitive motion on the patient's wrist when cutting cigarettes. Repetitive motion that requires a lot of energy, fast movements, and the lack of recovery will worsen the CTS symptoms[9] because, at this time, the patient is still actively working. Because there is no pain reduction after 3 times of therapy, the patient is suggested to wear splinting during working. The use of splinting can maintain the wrist in the neutral position, reduce extreme wrist flexion and extension, resulting in the increase of pressure in the carpal tunnel[10]. The decrease of pressure in the carpal

tunnel can decrease the symptoms of CTS patients.

Based on the study conducted by[11], giving neurodynamic technique as the only therapy on CTS patients has therapeutic benefits, which are pain reduction and increased functional ability. The neurodynamic technique has 3 concepts, mechanical interface, neural structure, and innervated tissue. The neural structure concept is divided into two functions, physiological and mechanical functions. Tensioning, sliding, and compression are the mechanical functions of neural structure. Sliding technique in neurodynamic can increase blood circulation, axonal transport, increase nerve integrity, and decrease pressure caused by intraneural and extraneural fibrosis. Tensioning technique can improve the mechanical function of the nerve in its flexibility through tension technique so that it can improve the ability of the nervous structure to withstand tension load without resulting in tissue hypoxia[12]. The reduction of pain is caused by the multifactor effect and may be caused by the decreased pressure in the carpal tunnel and decreased tissue edema.

According to the study conducted by Ahmad et al. [13], which compared giving low-level laser therapy (904 nm Wavelength) and ultrasound (1.0w/cm^2), the results showed that both are effective for the moderate to the severe category of CTS patients. Ultrasound results in the changes of selective thermal coagulation on the small and controlled area. The surrounding tissue is left unaffected and does not affect the integrity of the dermis. The change of induced coagulative promotes collagen formation in the targeted anatomy and helps the tissue improvement process, which is then resulting in pain reduction.

The results of the study by Wolny[11] and Ahmed et al.[13] showed the pain reduction. However, this does not occur in this study because the study conducted does not include the type of work on the respondent. This becomes the possibility of different therapeutic effects in this study. Industrial workers with repetitive/prolonged hand movements, strong exertion, static posture, vibration, and local mechanical stress significantly increase the risk of CTS[14].

Conclusion

After performing 4 times of physiotherapy interventions in the form of manual therapy of neurodynamic technique and ultrasound with the addition of using had splinting during working obtained the results of pain reduction in 4th therapy and increased functional ability of the patient.

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