

Physiotherapy Management with Infrared, Transcutaneous Electrical Nerve Stimulation, and Nerve Tendon Gliding Exercise in Dextra Carpal Tunnel Syndrome Cases

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KEYWORDS	ABSTRACT
Carpal Tunnel Syndrome Dextra; Infrared; Transcutaneous Electrical Nerve Stimulation; Nerve Tendon Gliding Exercise	Carpal tunnel syndrome (CTS) is a peripheral nerve disease caused by compression of the median nerve in the carpal canal, where the canal is limited by the carpal bone and transverse ligament. Carpal tunnel syndrome arises when the median nerve is compressed within the channel of the wrist. Symptoms caused by CTS can lead to functional impairment of the hand, while most human work involves using the hands, resulting in disruption of daily activities. Therefore, managing CTS patients—one of which is through physiotherapy treatment—is important. Providing physiotherapy interventions using Infrared aims to improve blood circulation, reduce pain, and increase muscle relaxation; Transcutaneous Electrical Nerve Stimulation (TENS) aims to reduce pain, increase muscle strength, and improve hand function. This scientific paper is a case study, presenting patient cases and collecting data through the physiotherapy process. The modalities administered are Infrared, TENS, and Nerve Tendon Gliding Exercise. After physiotherapy was performed four times, the results showed a decrease in pain, a decrease in paraesthesia/tingling, an increase in the range of joint motion, an increase in muscle strength, and an improvement in functional activity ability as measured by the WHDI index. Physiotherapy management with Infrared, Transcutaneous Electrical Nerve Stimulation, and Exercise modalities performed over four therapy sessions in cases of Carpal Tunnel Syndrome Dextra can reduce pain and paraesthesia/tingling, increase the range of joint motion, enhance muscle strength, and improve functional activity as indicated by the WHDI index.

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INTRODUCTION

The hands have complex functions because they are very important limbs for work (Lee & Jung, 2015). Viewed in terms of anatomy, the hand has a structure of joints, bones, muscles, ligaments, and nerves that allow one or two hands to perform coordinated and automatic smooth movements. The wrist consists of the joint of the distal end of the radius with a proximal row of carpal bones (Eschweiler et al., 2022). The stability of the wrist is caused by the strong ligaments that hold the bones together. The duct below the ligament is the carpal tunnel, which is passed by the median nerve and all the flexors of the wrist. The median nerve is susceptible or at high risk to palm and wrist injury, where the median nerve is limited by the wrist bone and transverse carpal ligament, which can cause several symptoms. Most humans depend on their productivity on reliable hand function, so if the hand experiences a disorder such as Carpal Tunnel Syndrome, it will be felt to be very disruptive to activity and productivity (Nurullita et al., 2023).

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Carpal Tunnel Syndrome (CTS) is an entrapment neuropathy that occurs due to the compression of the median nerve when passing through the carpal tunnel in the wrist, precisely under the flexor retinaculum (Wahab et al., 2017). Factors that can affect the occurrence of carpal tunnel syndrome are repetitive movements of the wrist or fingers, strong contractions of the tendons, wrist movements that bend down and up, and grasp or pinch movements while working (Simson et al., 2024).

Carpal tunnel syndrome (CTS) is a peripheral nerve disease caused by the narrowing of the median nerve in the carpal canal, where the canal is limited by the carpal bone and transverse ligament. Carpal tunnel syndrome appears when the median nerve is compressed in the inner canal of the wrist. The median nerve is at high risk of stress in palm and wrist injuries, where the median nerve is restricted by the carpal os and transverse carpal ligament, which can cause several symptomatic signs. CTS is caused by occupational factors (due to work) such as repetitive movements, work posture, working time, length of work, and others. Meanwhile, non-occupational factors (individual characteristics) such as gender, age, obesity, smoking history, disease history, and pregnancy (Kefis & Ningsih, 2017).

The prevalence of Carpal Tunnel Syndrome in Indonesia is 1-5% in the general adult population with an incidence of 329 cases per 100,000 people per year and 5-21% in the working population. In Indonesia, the prevalence of Carpal Tunnel Syndrome due to work is not known for sure because there are still very few diagnoses of the disease reported as work-related. Research on high-risk occupations using the wrist was obtained with a prevalence of CTS ranging from 5.5% to 15% (Martini et al., 2023).

The symptoms caused by CTS can result in functional disorders in the hands, while most human work uses the hands, and this will cause disruption of daily activities. Therefore, the importance of handling CTS patients includes physiotherapy management. The role of the physiotherapist is to serve individuals and society to improve, develop, and maintain maximum movement and functional abilities throughout life (Maratis et al., 2022).

Physiotherapy health services for carpal tunnel syndrome can include providing tool modalities, exercise therapy, and manipulation therapy. In this case, the modalities that will be given are Infrared, Transcutaneous Electrical Nerve Stimulation, and Nerve Tendon Gliding Exercise. Infrared administration aims to reduce pain, inflammation, and improve blood circulation (Nur & Khansa, 2019). Transcutaneous Electrical Nerve Stimulation therapy aims to reduce pain, repair lost sensory function, and restore wrist muscle strength (Sari Dewi, 2024). Nerve Tendon Gliding Exercise aims to increase ligament glide space (LGS), increase muscle strength, and restore functional activity (Malau et al., 2021).

Based on the description above, the author is interested in taking the title of the scientific paper (KTI) "Management of Physiotherapy with Infrared Modality, Transcutaneous Electrical Nerve Stimulation, and Exercise in the Case of Carpal Tunnel Syndrome Dextra." This background underlies the formulation of the problem in this study, namely: How is the management process of physiotherapy with Infrared, Transcutaneous Electrical Nerve Stimulation, and Nerve Tendon Gliding Exercise in the case of Carpal Tunnel Syndrome Dextra? The purpose of this study is to determine the management of physiotherapy with

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Infrared, Transcutaneous Electrical Nerve Stimulation, and Nerve Tendon Gliding Exercise in cases of Carpal Tunnel Syndrome Dextra.

This study aims to fill this gap by evaluating a multimodal approach (Infrared, TENS, and NTGE) in the case of dextra CTS, especially in elderly patients. This study also uses the Wrist Hand Disability Index (WHDI) as a measuring tool to assess the recovery of hand function, which is still rarely used in previous studies. The purpose of this study is to analyze the physiotherapy management process with a combination of these three modalities and measure improvements in terms of pain, range of joint motion, muscle strength, and functional ability of the hands.

The benefits of this research include both clinical and research aspects. From a clinical perspective, this combination therapy protocol can be a guide for physiotherapists in handling cases of CTS, especially in elderly patients. For patients, this therapy is expected to reduce pain, restore hand function, and increase independence in daily activities. From the research side, this study provides empirical evidence on the effectiveness of multimodal therapy, as well as enriching the literature on the treatment of CTS in the elderly population. Thus, this research is expected to contribute to the development of a more comprehensive and effective CTS management strategy.

METHOD

This research method was a case study conducted on a 66-year-old patient, Mr. N, who experienced Carpal Tunnel Syndrome (CTS) Dextra. The research was carried out at Tidar Magelang Hospital with four physiotherapy intervention sessions from February 4 to 14, 2025. Data were collected through observation and interviews, as well as measurements of the patient's condition before and after the intervention. The modalities used included Infrared to reduce pain and improve blood circulation, Transcutaneous Electrical Nerve Stimulation (TENS) to reduce pain and improve muscle function, and Nerve Tendon Gliding Exercise to increase joint range of motion and muscle strength. Data analysis was conducted by comparing pain levels, range of motion, muscle strength, and functional activity ability using the Wrist Hand Disability Index (WHDI), with the expectation of providing insight into the effectiveness of physiotherapy management in CTS.

RESULTS AND DISCUSSIONS

Mr. N. N's patient with a diagnosis of Carpal Tunnel Syndrome came to Tidar Magelang Hospital with complaints of pain in the wrist up to fingers 1 and 2 and was diagnosed with physiotherapy problems in the form of pressure pain, motion pain, decreased range of joint motion, decreased muscle strength, and impairment of functional activities such as typing and helping his wife sweep. Based on the patient's problems, the modalities of InfraRed, Transcutaneous Electrical Nerve Stimulation and Exercise were given 4 times from February 4 to February 14, 2025, resulting in a decrease in pain, an increase in LGS, an increase in muscle strength, and an increase in functional activity. The discussion of physiotherapy management with the title "Management of Physiotherapy with Infrared Modality, Transcutaneous Electrical

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Nerve Stimulation and Exercise in Carpal Tunnel Syndrome Dextra" from T1 to the end of T4, is as follows.

Management of Physiotherapy in Carpal Tunnel Syndrome with InfraRed

Based on the patient's problems above, the Infrared modality was given which was carried out on February 3, 7, 10, 14, 2025 to reduce pressure and movement pain so that it can increase functional activities. Management process After receiving physiotherapy treatment using the InfraRed modality with management according to the SOP of preparing the patient in the supine sleeping position as comfortably as possible, then position the hand on the pillow and make sure it is free of clothes or accessories, the implementation is to position the InfraRed beam on the right hand, then position the InfraRed perpendicular with a distance of 35-45 cm with a time of 15 minutes. During therapy, it must be monitored by physiotherapist in case of unexpected events. InfraRed is also effective in reducing pain, giving InfraRed before exercise therapy is very beneficial. Infrared irradiation is given to the problem area, the heat that has entered the inside will affect the metabolism. Irradiation is carried out for 15 minutes, the administration of InfraRed light will provide a vasodilating effect so that it will improve blood flow in the patient's right wrist area. The therapeutic effect of InfraRed light will cause a reduction in pain due to the administration of mild heating or light heating of the superficial tissues so that counter irritation occurs which will cause pain reduction. According to the research of Baic et al (2018) with the title Physiotherapy Program on Carpal Tunnel Syndrome Condition at Cakra Husada Klaten Hospital. Providing the infrared modality, the heat rays produced by infrared will cause vasodilation of blood vessels which will result in an increase in blood volume to the tissues, then there will be a metabolic process of the body that will facilitate nutrients to the tissues then there will be the removal of the remnants of metabolic results through sweat, finally the pain will be reduced.

Below is a graph after physiotherapy actions related to reducing motion pain and pressure pain using Infra Red:

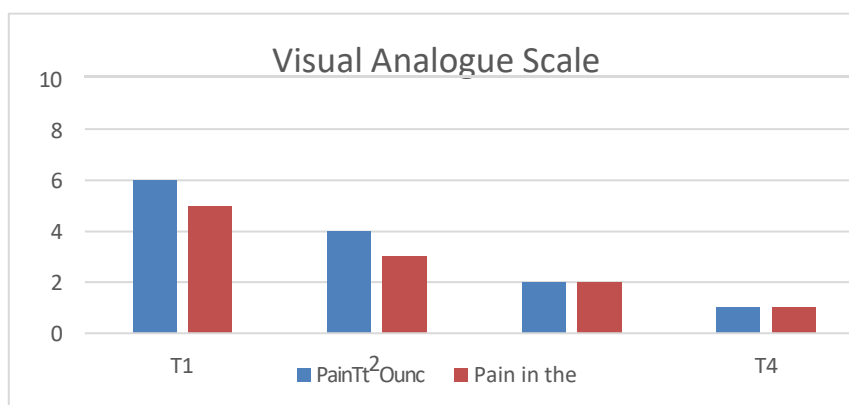


Figure 1. Graph of pain reduction using the Visual Analogue Scale (VAS) after physiotherapy intervention (Infrared and TENS) from T1 to T4 sessions.

Source: Researcher's personal documentation, 2025

Figure 1 shows a decrease in pain from T1 to T4. The use of Infra Red and TENS can reduce compressive pain and motion pain. With a value of compressive pain at T1: 6 to T4: 1 and motion pain T1: 5 to T4:1. From these results, in accordance with the case studies that have

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been carried out on Mr. N, the administration of infrared can also reduce pain because the therapeutic effect on infrared rays will cause a reduction in pain due to the administration of mild heating or light heating of the superficial tissues so that counter irritation occurs which will induce pain reduction.

This is supported by research conducted by Baic et al. (2018) with the title Physiotherapy Program on Carpal Tunnel Syndrome Condition at Cakra Husada Klaten Hospital, the provision of infrared modalities, heat rays produced by infrared will cause vasodilation of blood vessels which will result in an increase in blood volume to 74 tissues, then there will be a metabolic process of the body which will facilitate nutrients to the tissues then there will be the removal of the remaining results metabolism through sweat, eventually the pain decreases.

Management of Physiotherapy in Carpal Tunnel Syndrome with Transcutaneous Electrical Nerve Stimulation

Based on the patient's problems above, the TENS modality was given which was carried out on February 3, 7, 10, 14, 2025 in order to reduce pressure and movement pain so that it can increase functional activities. After receiving physiotherapy treatment using the TENS modality with management according to the SOP of preparing the patient in the most comfortable sleeping position possible, then position the hand on the bed and make sure it is free of clothes or accessories, install it on the right wrist, then set the frequency 100 Hz, set the time 15 minutes, and adjust the intensity of the electric current according to the patient's pain needs. As long as therapy must be monitored by physiotherapist if there is a decrease in intensity, then physiotherapy can add it. According to research by Rizky (2023) with the title "Counseling for Transcutaneous Electrical Nerve Stimulation (TENS) and Tendon and Nerve Gliding Exercise to Reduce Carpal Tunnel Syndrome Pain in Environmental Health Office Workers in Southeast Sulawesi," the mechanism of action is estimated to be through the 'closing of the gate' of pain transmission from small nerve fibers by stimulating large nerve fibers, then large nerve fibers will close the pain message pathway to the brain and increase blood flow to the painful area and TENS also stimulates the body's natural anti-pain production namely endorphins.

Below is a graph after physiotherapy actions related to reducing motion pain and pressure pain using TENS:

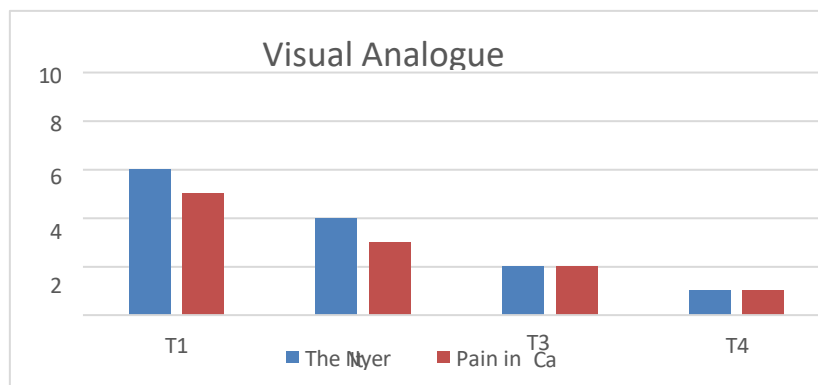


Figure 2. Evaluation of Dextra Wrist Pain

Source: Researcher's personal documentation, 2025

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Based on figure 2, there is a decrease in pain from T1 to T4. The use of Infra Red and TENS can reduce compressive pain and motion pain. With a value of compressive pain at T1: 6 to T4: 1 and motion pain T1: 5 to T4:1. From these results, according to a case study that has been carried out on Mr. N. N, the administration of TENS can help the body to produce endorphins that can block the perception of pain. TENS will activate large-diameter palpable fibers without activating smaller-diameter nociceptive fibers, which will produce segmental analgesic substances that are rapidly and localized in the brain in dermatoms that act on the central nervous system and peripheral nervous system to reduce pain.

Management of Physiotherapy in Carpal Tunnel Syndrome with Nerve Tendon Gliding Exercise

Based on the patient's problems above after being given the Infrared modality, TENS, then the patient is given an exercise which is carried out on 3, 7, 10, 14 February 2025 in the form of Nerve Tendon Gliding Exercise The patient is sitting as comfortably as possible, then physiotherapy stands in front of the patient to direct the movement of the nerve tendon gliding exercise The movement of the nerve gliding exercise consists of several stages. First, position the patient's palm in a light grasping state. Second, open the palm with your fingers tightly together. Third, perform the same movement as the second position, but add a dorsal flexion movement, which is to bend the wrist upwards. Next, in the fourth stage, do the third position and then add the thumb abduction movement, which is moving the thumb away from the palm. In the fifth stage, maintain the fourth position by holding the thumb abduction position for a few moments. The last stage, the sixth stage, still uses the fourth position but adds a wrist extension movement, then rotates the palm until it is facing forward. After that, continue with elbow and shoulder extensions, then hold it for approximately 5 seconds. This movement can be repeated several times according to the patient's ability.

The following is a graph after physiotherapy in the form of Exercise which is related to increasing the range of joint motion from T1-T4

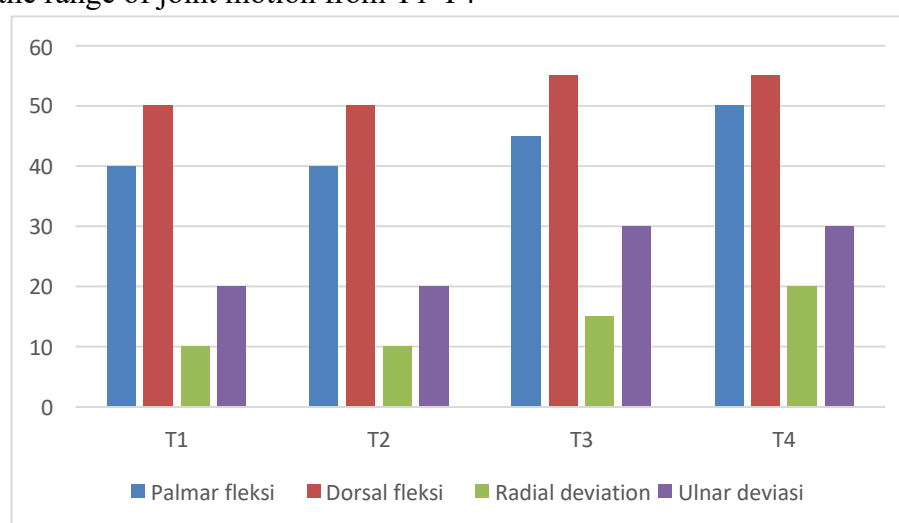


Figure 3. Evaluation of the Scope of Joint Motion (LGS) Wrist Dextra

Source: Researcher's personal documentation, 2025

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Based on figure 3, it was found that there was an increase in the range of joint motion after 4 times of physiotherapy, where the increase in LGS was caused by a decrease in the intensity of pain in the wrist so that the patient could follow the exercise program to the maximum. At T1 the patient's dorsal flexion and palmar flexion range of joint motion was S 40-0-50, then at T4 the patient's range of joint motion increased to S 50-0-55 and at T1 the range of joint motion Radial deviation and Ulnar deviation of the patient was F 10-0-20, then at T4 the patient's range of joint motion increased to F. 20-0-30. Physiotherapy provided Nerve tendon gliding exercise which is a hand and wrist movement treatment that is able to increase tendon flow through carpal tunnel. As with other parts of the body, the chances of injury are reduced when the area is stable and flexible due to a combination of exercise and stretching. The exercise therapy program carried out by the patient aims to increase LGS and maintain joint mobilization and minimize the occurrence of a decrease in muscle elasticity (Handalguna et al., 2022). Nerve and tendon gliding exercise can maximize the improvement of symptoms caused by compression of the median nerve in the carpal tunnel and flexor-related symptoms that occur in CTS patients. When the exercise is performed, there is remodelling and stretching of the tenosinovium around the carpal tunnel structure, this reduces adhesion and compression of the structure inside the carpal tunnel. With this exercise can restore the anatomical structure to its original position so that the compression adhesion in the tunnel is reduced and the symptoms also gradually disappear (Anggraini & Astari, 2021).

Below is a graph after physiotherapy in the form of exercise therapy related to increasing muscle strength from T1-T4.

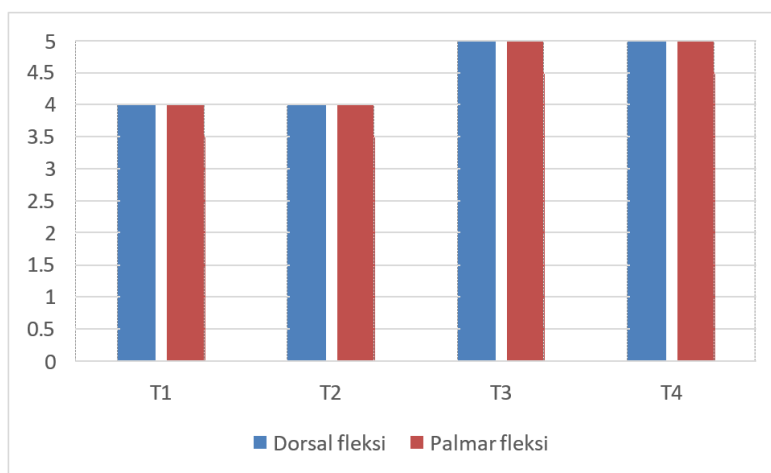


Figure 4. Muscle Strength Evaluation

Source: Researcher's personal documentation, 2025

Based on figure 4, it was found that there was an increase in muscle strength after 4 times of physiotherapy, from the data in the 4th therapy, the value of muscle strength was obtained from the palmar flexor muscle group with a result of 5 where the patient was able to perform movements in full ROM, against gravity, and was able to resist resistance to the maximum. The increase in muscle strength occurs due to the influence of nerve tendon gliding exercise which is able to reduce pain and also increase muscle strength. Nerve tendon gliding exercises involve

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stretching the nervous system and aim to help develop the movement of nerve tissue through joint movements, such as shoulders, elbows, hands, and wrists (Azizah et al., 2020).

Based on research conducted by Marryam et al. (2018) entitled "Neurodynamics Versus Nerve And Tendon Gliding Exercised Pak Armed Forces Med" shows that the action given is able to increase muscle strength. Muscle loss that occurs due to the manifestation of pain and a decrease in the range of joint motion so that the sufferer minimizes movement in his wrist for a long time. Nerve tendon gliding exercises can improve grip strength, muscle strength, and decrease the severity scale of pain and tingling symptoms (Marryam et al., 2018). Below is a graph after physiotherapy actions in the form of TENS and Exercise related to increasing functional activity from T1-T4.

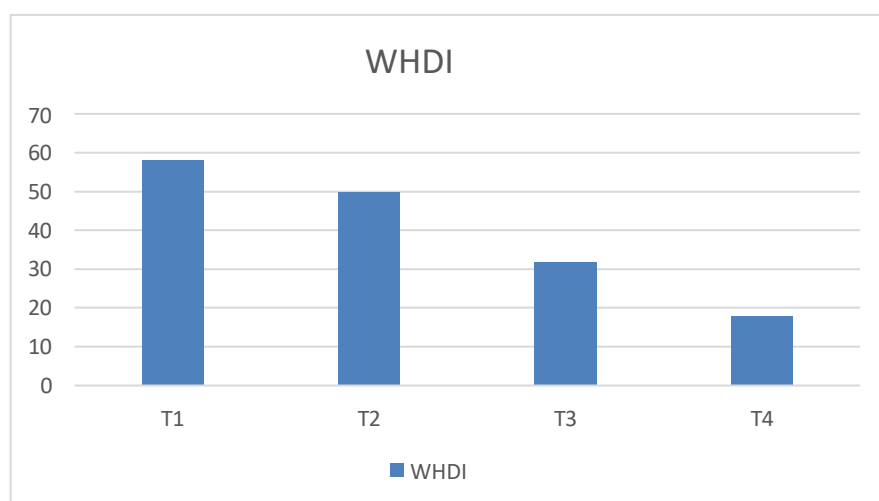


Figure 5. Muscle Strength Evaluation

Source: Researcher's personal documentation, 2025

Based on figure 5, the development of daily functional activity ability using the Wrist Hand Disability Index (WHDI) for 4 times of therapy obtained a T1 result of 58% and T4 obtained a score of 18% with the classification of the two therapies in the medium category. It can be said that there is an increase in the functional activity of the patient due to a decrease in pain, a decrease in paraesthesia, an increase in LGS, and also an increase in muscle strength value. Modalities that have an effect on improving the patient's functional activity are the use of infrared, tens and exercise.

The provision of Transcutaneous Electrical Nerve Stimulation (TENS) intervention is one of the physiotherapy interventions used in the treatment of acute and chronic pain conditions. It aims to control pain by activating complex tissues. A systematic review shows that TENS, if applied at an adequate intensity, it will be more effective for some acute pain conditions. The application of TENS uses stimulation intensity according to the patient's tolerance to remain comfortable so that hypoalgesia is formed which then reduces pain; Lower intensity is known to be ineffective for acute pain reduction (Qomariyah et al., 2023).

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Nerve Tendon Gliding Exercise is a type of exercise therapy that can be recommended for CTS sufferers. The basic principle of Median Nerve Mobilization itself is to focus on stretching the nerve network, namely the median nerve. Median Nerve Mobilization aims to reduce the intrinsic pressure on the median nerve in the carpal tunnel so that the symptoms felt by CTS sufferers due to compression of the median nerve in the carpal tunnel can gradually improve. Median Nerve Mobilization can also restore tissue balance, reduce the risk of surgery, reduce pain symptoms and restore nerve function in daily activities (Fannysah Zahwa & Widanti, 2024).

CONCLUSION

The management of physiotherapy conducted on Mr. N, a 66-year-old patient diagnosed with Carpal Tunnel Syndrome (CTS) dextra presenting pain, numbness, and tingling in the wrist extending to phalanges I and II, demonstrated that interventions using Infrared, Transcutaneous Electrical Nerve Stimulation (TENS), and Nerve Tendon Gliding Exercise (NTGE) according to Standard Operating Procedures effectively reduced symptoms such as pain and tingling, improved ligament glide space (LGS), increased muscle strength, and restored functional activity. These findings support the efficacy of a multimodal physiotherapy approach in managing CTS in elderly patients. For future research, studies should involve longer follow-up periods, larger and more diverse patient populations, and employ objective neurophysiological assessments. Additionally, comparative trials between multimodal and single-modality treatments would provide clearer insights into the relative benefits of each, ultimately helping to optimize and personalize physiotherapy protocols for CTS, especially in underserved groups like the elderly.

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