

Physiotherapy Management In Dupuytren's Contracture And Post-Burn Injury With TENS, Ultrasound, Scar Massage, And Exercise Modalities: A Case Study

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ABSTRACT

Intoduction: Dupuytren's Contracture et causa post burn injury is a condition characterized by fibrosis and contracture of the palmar fascia following burn trauma which causes pain, limited joint range of motion, decreased muscle strength, impaired skin integrity, and reduced functional activity. **Objective:** to determine the effectiveness of physiotherapy management using Transcutaneous Electrical Nerve Stimulation (TENS), ultrasound, scar massage, and exercise in patients with Dupuytren's Contracture et causa post burn injury. **Methods:** the research method used a case study conducted on one 56 year old male patient diagnosed with Dupuytren's Contracture et causa post burn injury. The measurement tools used included the Numeric Rating Scale (NRS) for pain assessment, goniometer for measuring joint range of motion, Manual Muscle Testing (MMT) for muscle strength, Vancouver Scar Scale (VSS) for scar evaluation, SWEAT for skin integrity assessment, and Wrist and Hand Disability Index (WHDI) for evaluating functional ability. **Results and Discussion:** after three sessions of physiotherapy intervention, the patient showed decreased pain intensity, increased joint range of motion, improved skin sensitivity, and slight improvement in functional activity, although muscle strength and scar characteristics showed no significant changes. **Conclusion:** physiotherapy interventions consisting of TENS, ultrasound, scar massage, and exercise were effective in reducing pain and improving functional ability in cases of Dupuytren's Contracture et causa post burn injury.

INTRODUCTION

Dupuytren's contracture is a progressive fibroproliferative disorder of the palmar fascia that causes flexion deformities of the fingers and impaired grip function. This condition often affects the ring and little fingers due to the formation of nodules and thickening of the palmar fascia. The incidence of Dupuytren's contracture is higher in men. In general, Dupuytren's contracture begins after the age of 40, and the incidence increases significantly with age; up to 20% of men over 60 are reported to experience the condition (1). Hand trauma, including burns, can trigger the fibroproliferative process, accelerating contracture formation in the palmar fascia. Research shows that approximately 22% of Dupuytren's contracture cases are associated with a history of hand trauma, including acute injuries and burns to the palmar area (2).

Burns to the hand can lead to scar tissue formation, which limits joint motion and interferes with functional hand activity. The post-burn inflammatory process increases fibroblast proliferation and collagen deposition, resulting in the formation of fibrotic tissue that triggers contracture (3). This condition can develop into Dupuytren's contracture if the palmar fascia progressively thickens and shortens. Patients generally experience pain when moving their fingers and difficulty performing activities such as gripping and writing (1). Physiotherapy treatment for post-burn scar tissue can be performed using scar massage, a rehabilitation technique that uses pressure and friction on the tissue to increase joint range of motion, reduce tissue stiffness due to scar tissue fibrosis, and help improve functional activity in areas affected by fibrosis and contracture (4).

A combination of physiotherapy treatments plays a crucial role in reducing musculoskeletal disorders in patients with Dupuytren's contracture due to burns. TENS delivers mild electrical impulses through the skin's surface to inhibit the transmission of pain impulses to the brain and stimulates the release of endorphins and enkephalins, the body's natural analgesics, allowing patients to perform stretching exercises more comfortably (5). Ultrasound helps increase soft tissue elasticity and improve local circulation in fibrotic tissue (6). Stretching exercises aim to increase tissue flexibility and maintain range of motion in the hand joints. This combination of physiotherapy modalities is expected to increase muscle strength and improve hand functional ability in patients with Dupuytren's contracture (7).

Based on the above background, Dupuytren's contracture and post-burn injury can cause pain, limited range of motion, decreased muscle strength, and impaired functional hand activity. This condition requires appropriate physiotherapy treatment to restore optimal hand function. The Hueston

Table Top Test can help evaluate the degree of contracture and the patient's condition during therapy. The provision of TENS, ultrasound, and stretching modalities is expected to improve the functional ability of the hand and reduce the limitations of movement in patients. The author is interested in compiling a case report regarding the management of physiotherapy in patients with Dupuytren's contracture et causa post-burn injury with TENS, ultrasound, and stretching modalities. The purpose of this study is to analyze the effectiveness of physiotherapy interventions on pain management, increasing joint range of motion, post-burn scar tissue management, and improving functional ability in patients with Dupuytren's Contracture et causa post-burn injury.

RESEARCH METHODS

The research design was conducted using a case study approach, or case study method, that aims to describe and evaluate the clinical conditions of the subject before and after being given physiotherapy intervention with one research subject. The measuring instruments used in this study were the Numeric Rating Scale (NRS) to evaluate pain felt by the patient or subject; a goniometer to measure the range of motion of the joints; Manual Muscle Testing (MMT) to measure muscle strength; the Vancouver Scar Scale to evaluate the condition of scar tissue; SWEAT to evaluate skin integrity; and a functional scale using the Wrist and Hand Disability Index to evaluate the functional ability of the patient or subject. Data collection was carried out at the beginning and end of the physiotherapy session program as material for evaluating the results of physiotherapy interventions in patients with Dupuytren's contracture et causa post-burn injury cases. The data obtained were then analyzed to determine the results of the evaluation of conditions before and after being given physiotherapy intervention.

Case Presentation

The study was conducted at Prof. Dr. I.G.N.G. Ngoerah General Hospital, Denpasar, from September 19 to October 3, 2025. The study involved a 56-year-old male patient diagnosed with Dupuytren's contracture et causa post-burn injury. The patient complained of pain and stiffness in his left wrist and fingers. His hand appeared claw-like and could not be positioned straight. A history of electrical burns in July 2023 contributed to this condition.

The patient underwent medical treatment for over a month after the electric shock. He was then referred to another hospital for intensive care and amputation of his right forearm, which lasted over a month. He also underwent physiotherapy for a year but discontinued therapy due to limited external factors. The persistent pain and stiffness prompted him to undergo an examination at Prof. I.G.N.G. Ngoerah General Hospital, Denpasar. This condition led to decreased functional activity, making it difficult for the patient to perform activities involving hand use.

Researchers conducted subjective and objective assessments at the initial meeting. Subjective examinations included patient identification, chief complaint, medical history, and medical treatment history through interviews and anamnesis. Objective examinations included observation, physical examination, and functional examinations using valid and reliable measuring instruments. Pain was assessed using the Numeric Rating Scale (NRS) at rest, pressure, and activity. Joint range of motion was assessed using a goniometer, and muscle strength was assessed using the Manual Muscle Test (MMT).

Researchers also examined the burn area around the wrist. Scar tissue was assessed using the Vancouver Scar Scale (VSS). Skin integrity was assessed using the SWEAT method, which includes sensibility, color, edema, area, and texture. Researchers assessed hand functional ability using the Wrist and Hand Disability Index (WHDI).

Table 1. Intervensi Fisioterapi

Intervention	Goals	Doses
TENS	Reduces pain sensation by transmitting electrical impulses through the surface of the skin to block or inhibit the transmission of pain impulses to the brain, and stimulates the release of endorphin and enkephalin hormones.	F: Once a week I: 30 mA T: 10 minutes T: Conventional
Ultrasound	Increases soft tissue elasticity and improves local circulation in fibrotic tissue.	F: 1x/week I: 0.8 W/cm ² Q: 5 minutes T: continuous, 1 MHz
Scar	Reduces stiffness due to tissue fibrosis and improves	F: 1x/week

Massage	elasticity and quality of scar tissue.	I: gentle Q: 10 minutes Q: Transverse friction
Exercise	Increase joint range of motion and increase muscle strength	F: 1x/week I: 10 repetitions x 3 sets Q: 15 minutes T: Active ROM exercise, stretching exercise, strengthening exercise, and hueston table top exercise

RESULTS

The results of a study on patients with Dupuytren's contracture et causa post-burn injury after three physiotherapy sessions showed changes, although not significant ones. The pre-intervention examination and the first physiotherapy session (T1) were conducted on September 19, 2025, to determine the patient's initial condition before receiving physiotherapy treatment. For evaluation, a repeat examination was conducted during the third physiotherapy session (T3), on October 3, 2026, after receiving physiotherapy intervention (post-intervention).

1) Pain Evaluation Results Using the Numeric Rating Scale (NRS)

Table 1 shows a decrease in pain sensation. For the stationary pain indicator, the score at T1 was 4, classified as moderate pain. At T3, the score decreased to 2, classified as mild pain. For the pressure pain indicator, the score at T1 was 6, classified as moderate pain. At T3, the results showed a decrease in pain to 5, classified as moderate pain. For the motion pain indicator, the score at T1 was 5, classified as moderate pain. Then, at T3, the results also showed a decrease in pain to 4, which is classified as moderate pain. This indicates that the application of TENS physiotherapy intervention is effective in reducing pain in cases of Dupuytren's contracture due to post-burn injury.

Table 2. Results of Pain Evaluation Using the Numeric Rating Scale (NRS)

Indicator	Pain Scale	
	T1 (pre-intervention)	T3 (post-intervention)
Silent pain	4	2
Tenderness	6	5
Motion pain	5	4

2) Results of Joint Range of Motion Evaluation Using a Goniometer

Table 2 shows an increase in joint range of motion in the wrist, metacarpophalangeal, proximal interphalangeal, and distal interphalangeal joints, although not significantly. This insignificant increase in this case may be due to multi-layer damage caused by the electric shock, which impacts the skin, fascia, muscle, and joint tissue, accompanied by active contraction of myofibroblasts, which can lead to chronic fibrosis (8). Furthermore, this condition may also be influenced by the irreversible nature of fibrosis due to the accumulation of permanent connective tissue. This suggests that physiotherapy interventions such as ultrasound, scar massage, and exercise, including active ROM exercises, stretching exercises, and the Hueston tabletop exercise, are effective in increasing joint range of motion.

Table 3. Results of Evaluation of Joint Range of Motion Using a Goniometer

Regio		T1	T3
Wrist		S : 10° — 0° — 5° F : 5° — 10° — 10°	S : 35° — 0° — 15° F : 5° — 10° — 13°
Phalang I	Metacarpophalangeal I	S : 20° — 20° — 14°	S : 23° — 20° — 10°
	Interphalang	S : 37° — 45° — 53°	S : 32° — 45° — 55°
Phalang II	Metacarpophalangeal II	S : 10° — 5° — 3°	S : 13° — 5° — 5°
	Proximal Interphalang II	S : 30° — 35° — 45°	S : 27° — 35° — 50°
	Distal Interphalang II	S : 20° — 25° — 33°	S : 17° — 25° — 38°
Phalang III	Metacarpophalangeal III	S : 15° — 10° — 0°	S : 20° — 10° — 5°
	Proximal Interphalang III	S : 40° — 45° — 53°	S : 45° — 45° — 58°

	Distal Interphalang III	S : 40° — 45° — 53°	S : 37° — 45° — 58°
Phalang IV	Metacarpophalangeal IV	S : 23° — 20° — 10°	S : 28° — 20° — 15°
	Proximal Interphalang IV	S : 65° — 65° — 72°	S : 65° — 65° — 75°
	Distal Interphalang IV	S : 10° — 10° — 15°	S : 10° — 10° — 18°
Phalang V	Metacarpophalangeal V	S : 27° — 27° — 20°	S : 30° — 27° — 25°
	Proximal Interphalang V	S : 75° — 80° — 85°	S : 75° — 80° — 87°
	Distal Interphalang V	S : 0° — 0° — 5°	S : 0° — 0° — 7°

3) Muscle Strength Evaluation Results Using a Manual Muscle Test

Table 3 shows that the results of the muscle strength evaluation using a manual muscle test after three physiotherapy sessions show that the muscle strength scores at T1 and T3 were 3. The patient was able to resist gravity but was unable to move the wrist and fingers through their full range of motion due to tissue contracture. These results indicate no changes in muscle strength, either in the form of an increase or decrease in the flexor and extensor muscle groups in the wrist and phalanges, or in the radial deviator and ulnar deviator muscle groups in the wrist region. This may be due to the short duration of the study and the fixed contracture, which resulted in insignificant increases in joint range of motion and made it difficult to increase muscle strength. However, physiotherapy interventions such as strengthening exercises can help maintain muscle strength.

Table 4. Results of Muscle Strength Assessment Evaluation Using the Manual Muscle Test (MMT)

Regio	Muscle Group	Value	
		T1	T3
Wrist	Flexor	3	3
	Extensor	3	3
	Radial deviator	3	3
	Ulnar deviator	3	3
Phalang I	Flexor	3	3
	Extensor	3	3
Phalang II	Flexor	3	3
	Extensor	3	3
Phalang III	Flexor	3	3
	Extensor	3	3
Phalang IV	Flexor	3	3
	Extensor	3	3
Phalang V	Flexor	3	3
	Extensor	3	3

4) Burn Scar Index Evaluation Results Using the Vancouver Scar Scale

Table 4 shows that the burn scar index evaluation results using the Vancouver Scar Scale after three physiotherapy sessions showed no changes in scar tissue structure. This may be due to the short study period and the lengthy scar remodeling phase (9). Furthermore, post-burn scar tissue in the fixed contracture phase progressively undergoes tissue fibrosis due to excessive collagen production in the wound area, resulting in permanent contracture (10).

Table 5. Results of the Burn Scar Index Evaluation Using the Vancouver Scar Scale

Indicator	Values and Interpretation	
	T1	T3
Vascularity	Pink (1)	Pink (1)
Pigmentation	Hypopigmentation (1)	Hypopigmentation (1)
Pliability	Contracture (5)	Contracture (5)
Height	Flat (0)	Flat (0)
Total	Medium scar	Medium scar

5) Results of Skin Integrity Evaluation Using Sensibility, Color, Edema, Area, and Texture (SWEAT) in Burn Wounds

Table 5 shows that the results of the skin integrity evaluation using Sensibility, Color, Edema, Area, and Texture (SWEAT) in burn wounds indicate changes after three physiotherapy sessions in the sensibility of the burnt skin, specifically in the wrist area. The results showed a decrease in pain and a slight increase in the skin's sensibility to sharp, dull, rough, and smooth sensations. There was no edema in the wrist area affected by the burn, either at T1 or T3. However, no changes were found in the color and texture of the burn wound. This indicates that physiotherapy intervention using TENS has been shown to reduce pain and improve skin sensibility after burns.

Table 6. Results of the Skin Integrity Examination Evaluation using Sensibility, Color, Edema, Area, and Texture (SWEAT)

Indicator	Value	
	T1	T3
Pain sensitivity	Pain in the scar area, the patient cannot feel sharp, dull, rough, and smooth sensations.	Pain is reduced in the scar area, the patient can feel a slight sharp, dull, rough, and smooth sensation.
Warna	Pale pink	Pale pink
Edema	-	-
Area	Wrist	Wrist
Tekstur	Rough at the edge of the scar, smooth at the hypopigmented area, stiff and dry	Rough at the edge of the scar, smooth at the hypopigmented area, stiff and dry

6) Functional Ability Evaluation Results Using the Wrist and Hand Disability Index Scale

Table 6 shows that the functional ability evaluation results using the Wrist and Hand Disability Index scale after three physiotherapy sessions indicate changes in numbness and tingling sensations and sleep. The numbness and tingling sensations in the hand and wrist at T1 were persistent but did not significantly interfere with hand activity. At T3, the numbness and tingling sensations were still persistent but did not significantly interfere with hand activity, indicating a change in the pain threshold from moderate to moderate. At T1, sleep quality was also slightly disturbed, with the patient waking up at least once due to hand and wrist pain. At T3, sleep quality improved, and there were no sleep problems indicating a change. The study indicates that the application of TENS physiotherapy interventions, ultrasound, scar massage, and exercise in the form of active ROM exercises, stretching, and Hueston tabletop exercises is effective in reducing pain intensity, increasing joint range of motion, and enhancing skin sensitivity. The physiotherapy intervention in the form of strengthening exercises, thus, influences the improvement of functional activity ability in cases of Dupuytren's contracture et causa post-burn injury.

Table 7. Results of Functional Ability Evaluation Using the Wrist and Hand Disability Index Scale

No.	Assessment Items	Value	
		T1	T3
1.	Pain Intensity	Pain in the wrist is constant and cannot use the hand for activities	Pain in the wrist is constant and cannot use the hand for activities
2.	Thick and Tingling Feeling	The feeling of thick and tingling is felt continuously but does not interfere with the activity of the hand within the limits of severity.	The thick and tingling sensation is felt continuously but does not interfere with the activities of the hands within moderate limits.
3.	Self Care	Unable to perform self-care activities using the affected hand	Unable to perform self-care activities using the affected hand
4.	Strength	Avoid lifting anything with the affected hand.	Avoid lifting anything with the affected hand.
5.	Writing or Typing Tolerance	Unable to write or type using the affected hand	Unable to write or type using the affected hand
6.	Work	Unable to do some work due to existing symptoms	Unable to do some work due to existing symptoms
7.	Driving	Unable to drive at all	Unable to drive at all

8	Sleep	Sleep is slightly disturbed or wakes up once every sleep	Have no problems sleeping
9	chore	Completely unable to do housework due to existing symptoms	Completely unable to do housework due to existing symptoms
10	Recreation/Sports	Unable to engage in recreational and sports activities due to symptoms	Unable to engage in recreational and sports activities due to symptoms

DISCUSSION

Post-burn contracture is caused by structural changes in the skin, muscles, tendons, and ligaments, resulting in limitations in the range of motion that depend on the depth and severity of the burn injury (11). Physiotherapy in the case of Dupuytren's contracture et causa post-burn injury aims to reduce pain, improve post-burn skin integrity, increase joint range of motion, maintain muscle strength, and enhance functional activity in the hand and wrist. The results of this case study indicate that physiotherapy interventions using TENS, ultrasound, scar massage, and exercises in the form of active ROM exercises, stretching, strengthening, and Hueston tabletop exercises have been proven effective and influential in reducing pain, healing tissue, increasing joint range of motion (LGS), maintaining muscle strength, and improving skin sensitivity in cases of Dupuytren's contracture et causa post-burn injury.

The TENS modality in this case works by modulating the nervous system using a gate control mechanism by stimulating brain areas, namely the periaqueductal gray (PAG) and rostral ventromedial medulla (RVM), sending signals to block pain input to the spinal cord. This involves neurotransmitters such as serotonin, noradrenaline, and adenosine to help suppress pain signals. In addition, TENS also helps release natural opioids from the hormones endorphins, enkephalins, and dynorphins, which work to reduce pain sensations. The effects of this modality can last for 8-24 hours after TENS application (12).

The TENS modality provides repeated stimulation, activating peripheral sensory receptors, which can increase sensory input to the central nervous system. Furthermore, TENS can modulate sensory processing in the central nervous system (CNS) (13). In cases of post-burn injury, allodynia, a condition in which pain sensations arise from stimuli or light contact with the skin that is usually not painful, often occurs. In cases of allodynia, TENS can provide a controlled stimulus to trigger nervous system adaptation by reducing hyperalgesia and increasing tolerance to stimuli, resulting in desensitization, a process aimed at reducing pain sensitivity to a stimulus (14).

The use of ultrasound helps reduce limitations in joint range of motion. Ultrasound works by providing thermal and non-thermal effects on tissue. The thermal effect generates heat to soften the inner tissue, particularly collagen, in the scar area, thereby increasing tissue elasticity and reducing adhesions (15). Softened collagen becomes more stretchable, thus increasing joint range of motion. Meanwhile, the non-thermal effects of ultrasound help increase blood vessel vasodilation, improving blood flow, aiding tissue metabolism, and accelerating the healing process.

In addition to the use of physiotherapy equipment, exercise therapy is also provided for cases of Dupuytren's contracture et causa post-burn injury. The exercise therapy provided includes active ROM exercises, stretching, strengthening, and Hueston table-top exercises. Active ROM exercises are given to maintain joint range of motion, joint mobility, slow the progression of tissue fibrosis, and prevent stiffness or even worsening joint contractures. Active ROM exercises can also maintain muscle strength to prevent further muscle atrophy. The stretching exercises given in this case aim to stretch joints or tissues experiencing stiffness and limited range of motion and increase joint flexibility (16). Furthermore, stretching exercises can also slow the progression of worsening contractures (17). Repeated strengthening exercises can activate motor skills and synchronize the motor unit system that works during exercise. Strengthening exercises also trigger the body's adaptive response to the load of the exercise given, as well as improve intramuscular and intermuscular coordination between agonist muscles, antagonist muscles, and accessory muscles. Meanwhile, the Hueston tabletop exercise, which is a combination of stretching and active ROM exercises, involves extension movements of the fingers and stretching of the palmar fascia. This exercise aims to reduce tissue contractures, increase fascial flexibility, and improve hand coordination.

Physiotherapy modalities in the form of manual therapy using scar massage are also carried out, especially in conditions where there is scar tissue after a burn or post-burn scar caused by Dupuytren's contracture et causa post-burn injury. Scar massage is performed using friction massage techniques that are given with pressure and friction that trigger stimulation of fibroblast activation and collagen remodeling to improve the quality of scar tissue and trigger vasodilation of blood vessels or local blood flow to increase the delivery of nutrients that can accelerate tissue healing so that the skin becomes more elastic and skin tissue integrity is increased (18). This technique can also influence the activation of gate control theory by reducing the sensitivity of nociceptors and reducing nerve irritation so that it can reduce pain and itching (19). Scar massage can reduce hypertrophy in scar tissue by controlling excessive fibroblast proliferation (20). Providing scar massage also aims to reduce adhesions and stiffness, as well as contractures in skin tissue. Reducing tissue stiffness and adhesions accompanied by increased flexibility and mobility of skin tissue can affect the increase in joint range of motion.

CONCLUSIONS AND RECOMMENDATIONS

Physiotherapy management with interventions including TENS, ultrasound, scar massage, and exercise modalities such as active ROM exercises, stretching, strengthening, and Hueston tabletop exercises plays a crucial role in cases of Dupuytren's contracture et causa post-burn injury. This reduces pain, increases joint range of motion, slows the progression of tissue contractures, maintains muscle strength, and improves the integrity and quality of post-burn scar tissue. The combination of physiotherapy modalities, along with appropriate education and home programs, creates a physiotherapy rehabilitation program that can accelerate the optimization of tissue recovery and improve functional ability and quality of life for patients. This study is expected to serve as a reference and benchmark for further research. It is recommended that future research utilize a larger sample size using a randomized controlled trial (RCT) with the use of other physiotherapy modalities to ensure generalizability.

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