

Physiotherapy Management of a Hypertrophic Ankle Scar After Debridement: A Case Report

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Abstract

Background: Hypertrophic scars can restrict joint mobility and impair functional outcomes, particularly near highly mobile joints. Reports describing physiotherapy management of ankle hypertrophic scars after debridement are limited.

Objective: To describe the clinical response to physiotherapy in a patient with a right ankle hypertrophic scar following debridement.

Methods: This case involved a 44-year-old woman with a four-month history of a hypertrophic scar after right ankle debridement. She presented with edema, paresthesia, restricted ankle range of motion, reduced muscle strength, and functional limitations. Six sessions were provided over two weeks, including therapeutic ultrasound, scar mobilization, active and active-assisted range of motion exercises, ankle pumping, gastrocnemius stretching, strengthening exercises, and therapeutic communication. Outcomes included ankle range of motion, paresthesia, Vancouver Scar Scale, Hamilton Anxiety Rating Scale, Barthel Index, edema grade, girth circumference, and manual muscle testing.

Results: Dorsiflexion increased from 15° to 30°, plantarflexion from 35° to 40°, inversion from 10° to 30°, and eversion from 5° to 15°. Paresthesia decreased from 8 to 2, Vancouver Scar Scale score from 10 to 6, and Hamilton Anxiety Rating Scale score from 10 to 3. Barthel Index increased from 90 to 99 and manual muscle testing from 3 to 5, while girth circumference difference decreased from 5 cm to 1 cm. Pitting edema improved from grade II to grade I.

Conclusion: The multimodal physiotherapy program was associated with improvements in mobility, edema, sensory symptoms, functional status, muscle strength, anxiety, and scar characteristics. Long-term outcomes could not be evaluated because no post-treatment follow-up was available.

Keywords

Ankle; Cicatrix, Hypertrophic; Physical Therapy Modalities; Exercise Therapy.

Introduction

Hypertrophic scarring is a pathological response to cutaneous injury characterized by excessive collagen deposition during wound healing, resulting in a raised and thickened scar that remains within the boundaries of the original wound.¹ Hypertrophic scars may develop after trauma, burns, surgery, or deep dermal injury, particularly when the remodeling phase is disturbed.² Abnormal fibroblast activity, persistent inflammation, and dysregulated synthesis of type I and type III collagen contribute to excessive extracellular matrix accumulation.³ Wound healing normally progresses through hemostasis, inflammation, proliferation, and remodeling, with progressive reorganization of collagen during the final phase.⁴ In hypertrophic scarring, the balance between collagen synthesis and degradation becomes dysregulated, and transforming growth factor beta signaling, persistent inflammatory activity, and mechanical tension may contribute to pathological scar formation.¹

Debridement may increase the risk of pathological scarring when deeper dermal tissue is involved and the inflammatory response is prolonged.⁵ The ankle is particularly relevant because repeated dorsiflexion, plantarflexion, inversion, and eversion expose the healing tissue to recurrent mechanical loading.^{1,3} Scar tissue around a joint may adhere to fascia, tendons, or the joint capsule, reducing tissue pliability and contributing to stiffness, restricted range of motion, and impaired gait.^{1,6} These limitations may affect walking, stair negotiation, standing tolerance, and other daily activities.⁶ Consequently, hypertrophic scarring around the ankle can involve integumentary, musculoskeletal, sensory, and functional domains rather than representing an isolated cosmetic concern. The clinical burden of pathological scarring is substantial. Approximately 100 million people are estimated to develop scars each year after trauma or surgery, with reported hypertrophic scar rates ranging from 40% to 94% after surgical wounds and reaching 91% after burns.¹ Risk is influenced by age, sex, skin pigmentation, wound location, and mechanical tension, while wounds requiring more than 21 days to heal may have a higher risk of pathological scarring.^{1,7} Clinically, hypertrophic scars may present as raised and thickened tissue, erythema or hyperpigmentation, pruritus, tenderness, stiffness, and reduced tissue mobility.¹ When located around the ankle, these characteristics may restrict joint motion and alter functional movement.⁸ Comprehensive assessment of scar characteristics, joint range of motion, muscle strength, edema, sensory symptoms, and functional capacity is therefore relevant to physiotherapy planning.⁶

Conservative rehabilitation is commonly used when hypertrophic scarring is accompanied by movement and functional impairments.⁹ Physiotherapy may address scar pliability, tissue adhesions, joint mobility, muscle performance, and functional activity through interventions such as scar mobilization, soft tissue techniques, range of motion exercises, stretching, strengthening, gait training, pressure therapy, and silicone based management.^{7,9,10} Manual soft tissue mobilization has also been described as part of conservative management for hypertrophic burn scars.¹¹ In clinical practice, a multimodal approach may be particularly appropriate when several impairments coexist.⁶ Early restoration of mobility may help limit stiffness and functional restriction in anatomically mobile regions such as the ankle.¹¹

Despite growing evidence on scar rehabilitation, reports describing comprehensive physiotherapy management of hypertrophic scarring around the ankle after postoperative debridement remain limited. Existing literature has often focused on burn related scars or on individual scar management techniques rather than the concurrent management of scar characteristics, joint mobility, edema, sensory symptoms, muscle weakness, and functional limitations.^{7,9} This case report therefore aimed to describe the clinical response to a comprehensive physiotherapy program in a patient with a right ankle hypertrophic scar following debridement. It also sought to provide a detailed clinical account of physiotherapy assessment, intervention, progression, and short term outcomes in a patient with pathological scar related impairments.

From a rehabilitation perspective, the clinical relevance of scar management extends beyond visible scar characteristics. Restrictions in tissue mobility may interact with edema, muscle weakness, and altered sensory perception, potentially limiting movement practice and participation in daily activities.^{6,9} Exercise based rehabilitation can support restoration of lower limb function, while ankle pumping may influence venous and calf muscle pump activity.^{12,13} Therapeutic communication may also support patient participation and the therapeutic alliance during rehabilitation.^{14,15} These considerations support an integrated approach in which scar directed treatment is combined with movement and functional interventions according to the impairments identified during assessment. Because this report describes a single patient without a comparator and without long term follow up, the findings are intended to document clinical change rather than establish treatment efficacy or causality.

Methods

This report used a single case study approach to describe physiotherapy management of a patient with a hypertrophic scar of the right ankle following debridement. The report was prepared in accordance with the CARE Guideline and considered physiotherapy specific reporting components described in the Physiotherapy Case Report (PhyCARE) Guideline.^{16,17} The case was documented to provide a transparent account of the patient presentation, clinical timeline, physiotherapy assessment, intervention, progression, outcomes, patient perspective, adherence, and adverse events.

The patient was a 44-year-old woman who worked as a contractor. She had a medical diagnosis of a hypertrophic scar of the right ankle following postoperative debridement approximately four months before physiotherapy assessment. The patient presented to the physiotherapy outpatient service at RSUP Dr. Tadjuddin Chalid Makassar after referral from the orthopedic service. The initial physiotherapy assessment was conducted on 8 April 2026, and the intervention program was delivered from 8 to 22 April 2026. The patient reported swelling, restricted movement of the right ankle, and paresthesia extending toward the toes. These complaints affected daily activities, including walking and toileting, as well as work and recreational activities. Based on the available history, she had no reported systemic disease and no previous similar complaint.

The inclusion criteria were a patient with a hypertrophic scar associated with movement, functional, and aesthetic impairments who was willing to participate in the scheduled physiotherapy program. The exclusion criteria were refusal to participate and nonadherence to the planned treatment program. The case was selected from a patient receiving physiotherapy following medical referral. The source document did not specify a formal sampling procedure or a separate recruitment period, and no additional recruitment information was available. All physical examinations and outcome measurements were performed by the same author throughout the intervention period under the supervision of the physiotherapist responsible for the patient.

The clinical timeline is presented in Table 1. The patient underwent debridement of the right ankle on 25 December 2025. The first dressing change occurred on 27 December 2025, followed by discharge from inpatient care on 28 December 2025. A second dressing change was performed in the orthopedic outpatient clinic on 31 December 2025. From 5 January to 19 March 2026, the patient attended routine medical follow up with dressing changes every three days. On 30 March 2026, persistent hypertrophic scarring, edema, restricted ankle movement, and paresthesia were documented during orthopedic follow up. On 6 April 2026, the patient was reviewed by the physician and referred to physiotherapy. The initial physiotherapy examination and first treatment session took place on 8 April 2026. Six physiotherapy sessions were completed between 8 and 22 April 2026, with the final evaluation performed on 22 April 2026.

The initial assessment included vital signs, observation, palpation, movement examination, scar assessment, edema assessment, muscle strength testing, and functional assessment. Blood pressure was 127/80 mmHg, pulse rate was 88 beats/min, and peripheral oxygen saturation was 98%. Paresthesia was rated as 8 on the reported visual analogue scale. The Vancouver Scar Scale (VSS) score was 10, the Hamilton Anxiety Rating Scale (HARS) score was 10, and the Barthel Index score was 90. Pitting edema was graded as II, the difference in girth circumference was 5 cm, and ankle muscle strength was graded as 3 on manual muscle testing. Inspection showed a lesion extending from the lateral ankle toward the calcaneal region, swelling around the ankle and dorsum of the foot, dry and desquamating skin, and hyperpigmentation around the scar. Dynamic observation indicated stiffness during right ankle movement. Palpation showed normal local temperature, edema around the ankle and dorsum of the foot, an irregular and dry skin contour, and a hypertrophic postoperative scar. Gastrocnemius tightness was present, whereas tenderness was not reported. Active and passive movement were restricted in dorsiflexion, plantarflexion, inversion, and eversion without pain.

Ankle range of motion was measured before intervention. Dorsiflexion was 15° compared with a reported normal value of 30°, plantarflexion was 35° compared with 50°, inversion was 10° compared with 35°, and eversion was 5° compared with 15°. These findings established the baseline movement impairment documented in Table 3. The case report did not provide additional information on the measurement instrument, assessor blinding, or psychometric properties of the instruments used. These details were therefore not inferred.

The physiotherapy program consisted of six sessions over two weeks, with a frequency of two sessions per week. Therapeutic communication was provided to address patient anxiety during treatment. Therapeutic ultrasound was applied to the hypertrophic scar at an intensity of 1.2 W/cm² using a circular technique for 8 minutes. Scar mobilization was then performed using light pressure for 3 minutes to address tissue mobility and adhesions. Range of motion management consisted of active range of motion and active assisted range of motion exercises for dorsiflexion, plantarflexion, inversion, and eversion, performed for two sets of five repetitions. Edema management included ankle pumping exercise for three repetitions of eight counts. Gastrocnemius stretching was performed for three repetitions of eight counts. Strengthening exercises targeted the tibialis anterior, gastrocnemius, soleus, plantaris, and peroneus longus and brevis, with three repetitions of eight counts for each exercise during each treatment session.

Exercise progression was based on the patient's response and tolerance. During the early sessions, treatment emphasized joint mobility and edema management, with active assisted movement used when assistance was needed. As movement capacity improved, assistance during active assisted exercises was reduced so that the patient performed a greater proportion of the movement actively. Stretching and strengthening were continued with adjustments to intensity according to tolerance, without

provoking pain or discomfort. The intervention was directed toward movement restoration, edema reduction, reduction of paresthesia, improvement of muscle performance, and recovery of daily activity.

Outcome assessment was performed at baseline and at the end of the six session program. The principal clinical outcomes documented in the source material were ankle range of motion, paresthesia, VSS, HARS, Barthel Index, pitting edema, girth circumference difference, and manual muscle testing. The report also documented the patient's perspective, treatment adherence, and adverse events. The patient attended all six planned sessions without missed appointments. No adverse events or unwanted effects were reported, and all treatment modalities were tolerated. A post treatment long term follow up was not performed, so the durability of the observed changes could not be assessed.

Because this was a single case report, no inferential statistical analysis, hypothesis testing, or effect size calculation was performed. The results were therefore summarized descriptively by comparing baseline and final clinical measurements. No additional statistical software or significance threshold was applicable to the case report. The patient provided written informed consent for publication of clinical data and photographic documentation. According to the institutional policy reported in the source manuscript, a single case report did not require approval from a research ethics committee. No institutional approval number was provided in the source material.

Table 1. Clinical timeline of the patient's course

Date	Clinical course
25 December 2025	The patient underwent debridement of the right ankle.
27 December 2025	First dressing change.
28 December 2025	The patient was discharged from inpatient care.
31 December 2025	Second dressing change at the orthopedic outpatient clinic.
5 January to 19 March 2026	Routine medical follow-up and dressing changes every three days.
30 March 2026	Persistent hypertrophic scar, edema, restricted ankle movement, and paresthesia were reported during orthopedic follow-up.
6 April 2026	The patient was reviewed by the physician and referred to physiotherapy.
8 April 2026	Initial physiotherapy assessment and first intervention session.
8 to 22 April 2026	Six physiotherapy sessions with periodic evaluation.
22 April 2026	Final evaluation showed changes in range of motion, edema, paresthesia, muscle strength, VSS, and Barthel Index.

Table 1 summarizes the clinical course from debridement through the final physiotherapy assessment. The six-session intervention period occurred over two weeks after medical referral to the physiotherapy service.



Figure 1. Clinical wound course before physiotherapy. [A] First dressing change after debridement. [B] Second dressing change. [C] Wound condition after suture removal.

Table 2. Baseline clinical assessment

Parameter	Baseline value
Blood pressure	127/80 mmHg
Pulse rate	88 beats/min
SpO ₂	98%
Paresthesia VAS	8
Vancouver Scar Scale (VSS)	10
Hamilton Anxiety Rating Scale (HARS)	10
Barthel Index	90
Pitting edema	Grade II
Girth circumference difference	5 cm
Ankle manual muscle testing	3

Table 2 presents the baseline clinical measurements used to characterize the patient's impairments before treatment.

Table 3. Baseline ankle range of motion

Movement	Baseline	Reported normal value
Dorsiflexion	15°	30°
Plantarflexion	35°	50°
Inversion	10°	35°
Eversion	5°	15°

The baseline range of motion measurements in Table 3 confirmed restriction in all four assessed ankle movements.



Figure 2. Hypertrophic scar of the right ankle at the initial physiotherapy assessment.

Results

The patient completed all six planned physiotherapy sessions between 8 and 22 April 2026. Changes were observed across movement, sensory, scar, edema, muscle strength, anxiety, and functional measures. No session was missed, and no adverse event was reported during the treatment period. The baseline and final values are summarized in Table 4, while changes in ankle range of motion are presented in Table 5.

At baseline, the patient demonstrated a hypertrophic scar involving the lateral right ankle and calcaneal region, accompanied by swelling of the ankle and dorsum of the foot. The skin was dry and showed desquamation, with hyperpigmentation around the scar. The scar was clinically described as hypertrophic, with an irregular surface and reduced tissue mobility. Gastrocnemius tightness was identified, while tenderness and pain during ankle movement were not reported. Active and passive ankle movements were restricted in all four assessed directions. These findings were consistent with the movement and tissue impairments identified during the initial physiotherapy examination.

The initial physiologic measurements were within the values documented in the source case. Blood pressure was 127/80 mmHg, pulse rate was 88 beats/min, and peripheral oxygen saturation was 98%. Paresthesia was rated at 8, the VSS score was 10, the HARS score was 10, and the Barthel Index was 90. Pitting edema was grade II, with a 5 cm difference in girth circumference. Ankle muscle strength was graded as 3 on manual muscle testing. The initial range of motion measurements showed dorsiflexion of 15°, plantarflexion of 35°, inversion of 10°, and eversion of 5°. The corresponding reported normal values were 30°, 50°, 35°, and 15°, respectively.

After six physiotherapy sessions, paresthesia decreased from 8 to 2. The VSS score decreased from 10 to 6, indicating a lower score on the scar assessment used in this case. The HARS score decreased from 10 to 3. The Barthel Index increased from 90 to 99, and manual muscle testing increased from grade 3 to grade 5. Pitting edema improved from grade II to grade I, while the difference in girth circumference decreased from 5 cm to 1 cm. These endpoint values are shown together in Table 4 to provide a direct comparison between the initial and final assessments.

Ankle range of motion improved in all assessed directions. Dorsiflexion increased from 15° to 30°, reaching the normal value reported in the baseline assessment table. Plantarflexion increased from 35° to 40°, inversion increased from 10° to 30°, and eversion increased from 5° to 15°. The final values for inversion and eversion remained below the reported normal value for inversion, whereas eversion reached the reported normal value. Table 5 presents these changes and allows the direction specific response to be identified without relying on a single composite mobility score.

The serial graphical presentation also documented changes during the six treatment sessions. Figure 4 presents the course of ankle range of motion across the intervention period. Figure 5 presents the decline in VSS score during the six sessions, and Figure 6 presents the reduction in the difference in ankle girth circumference. These figures provide a visual description of the trajectory of change, whereas Tables 4 and 5 provide the baseline and final numerical values used for the final assessment.

The condition of the scar was also documented photographically. Figure 1 presents the clinical wound course before physiotherapy, including the first dressing change after debridement, the second dressing change, and the condition after suture removal. Figure 2 shows the hypertrophic scar at the initial physiotherapy assessment. Figure 3 shows the scar after completion of six physiotherapy sessions. The photographic sequence provides visual documentation of the clinical appearance before and after the rehabilitation program. Because the photographs were not scored independently, they were used as descriptive clinical documentation rather than as a separate quantitative outcome.

The patient reported subjective improvement during the treatment period. She expressed satisfaction with the therapy and stated that the swelling and paresthesia that had previously interfered with daily activities had decreased substantially. She also reported that the ankle was easier to move and that she was able to return to work without significant complaints. In addition, she perceived the scar to be more comfortable and visually improved compared with its condition before physiotherapy. These statements represent the patient's perspective and complement the clinician assessed outcomes.

Treatment adherence was complete. The patient attended all six sessions according to the planned schedule, and no treatment session was omitted. All treatment modalities were reported to be well tolerated. No adverse events or unexpected effects occurred during the intervention period. The case did not include a post treatment follow up after the final assessment on 22 April 2026. Consequently, the persistence of improvements in range of motion, edema, paresthesia, scar characteristics, muscle strength, anxiety, and functional status beyond the treatment period was not assessed.

Overall, the documented endpoint changes were consistent across several domains. Mobility improved in all four ankle directions, edema measures decreased, paresthesia and anxiety scores were lower, muscle strength increased, functional independence improved according to the Barthel Index, and the VSS score decreased. These findings describe the short term clinical

course observed in this single patient following six sessions of multimodal physiotherapy. They do not establish the independent effect of any specific treatment component or demonstrate that the observed changes would occur in other patients with hypertrophic ankle scars.

The changes in mobility were not uniform in magnitude across directions. Dorsiflexion showed a 15° absolute increase, plantarflexion a 5° increase, inversion a 20° increase, and eversion a 10° increase between the initial and final assessments. The greatest absolute changes were therefore observed in dorsiflexion and inversion. In parallel, the girth circumference difference changed by 4 cm from baseline to the final assessment. The combined presentation of these values in the tables and serial figures provides a quantitative description of the patient's short term response.

The scar related and functional measures also changed during the same treatment period. The VSS score decreased by four points, while the Barthel Index increased by nine points. The HARS score decreased by seven points, and the reported paresthesia score decreased by six points. Manual muscle testing increased by two grades. Because the case report did not include a comparator, repeated measurements before treatment, or a long term follow up, these changes are reported as observed clinical changes rather than as treatment effects attributable to individual modalities.

Table 4. Comparison of clinical outcomes before and after intervention

Parameter	Baseline	Final
Paresthesia VAS	8	2
Vancouver Scar Scale	10	6
Hamilton Anxiety Rating Scale	10	3
Barthel Index	90	99
Pitting edema	Grade II	Grade I
Girth circumference difference	5 cm	1 cm
Manual muscle testing	3	5

Table 4 shows improvement across sensory, scar, anxiety, functional, edema, and muscle strength measures between the initial and final assessments.

Table 5. Change in right ankle range of motion before and after intervention

Movement	Baseline	Final
Dorsiflexion	15°	30°
Plantarflexion	35°	40°
Inversion	10°	30°
Eversion	5°	15°

Table 5 shows that ankle range of motion improved in every assessed direction, with the largest absolute changes observed in dorsiflexion and inversion.



Figure 3. Hypertrophic scar of the right ankle after six physiotherapy sessions.

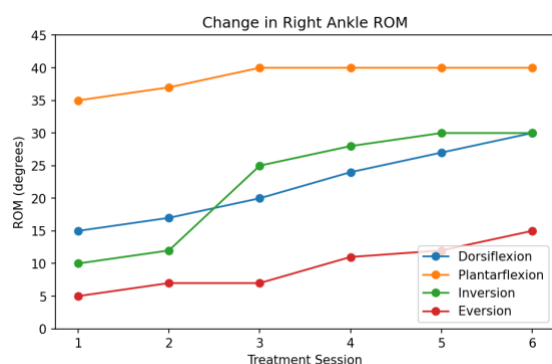


Figure 4. Change in right ankle range of motion across the six physiotherapy sessions.

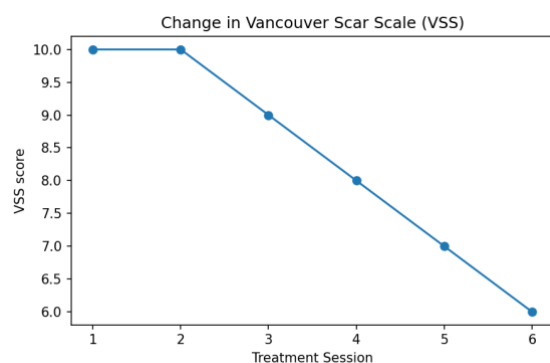


Figure 5. Change in Vancouver Scar Scale score across the six physiotherapy sessions.

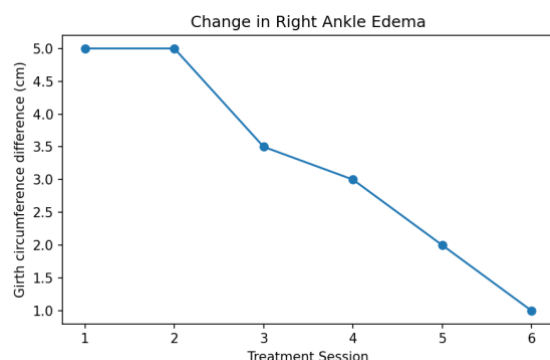


Figure 6. Change in ankle girth circumference difference across the intervention period.

Discussion

This case documented short term improvement across integumentary, musculoskeletal, sensory, functional, and psychological measures after six sessions of multimodal physiotherapy for a hypertrophic scar of the right ankle following debridement. The most notable changes were improved ankle range of motion, reduced edema and paresthesia, increased manual muscle testing grade, improved Barthel Index score, lower HARS score, and a lower VSS score. Because this was a single case without a comparator and without long term follow up, these observations should be interpreted as a clinical description rather than evidence of treatment efficacy or causality.

The reduction in VSS score from 10 to 6 was observed during a program that included therapeutic ultrasound and scar mobilization. Hypertrophic scarring is characterized by excessive extracellular matrix deposition and altered collagen remodeling, which can contribute to increased thickness and reduced tissue pliability.^{1,2} Physical scar management has been associated with improvements in several scar related outcomes, including pliability and thickness, although the certainty and magnitude of benefit vary among interventions and populations.⁹ Scar massage has also been investigated in hypertrophic burn scars, with reported improvements in selected scar characteristics and symptoms, but the available evidence remains limited by heterogeneity and methodological quality.¹⁸ The present case is consistent with the direction of these findings, although the contribution of scar mobilization cannot be separated from the other interventions delivered.

Therapeutic ultrasound was selected because the patient presented with a clinically stiff and less pliable hypertrophic scar. Evidence regarding ultrasound based scar treatment includes studies of therapeutic ultrasound and other ultrasound modalities, but the parameters and clinical populations differ.^{19,20} In particular, high intensity focused ultrasound thermotherapy is not equivalent to the conventional therapeutic ultrasound applied in this case, and its findings should not be directly generalized to the present intervention.¹⁹ A randomized study involving grafted skin after burns reported changes in biomechanical properties following therapeutic ultrasound based treatment, supporting the broader rationale for investigating ultrasound in scar rehabilitation.²⁰ However, the current case does not allow the specific contribution of ultrasound to the observed VSS improvement to be determined.

The improvement in ankle range of motion was observed in all four assessed directions. Dorsiflexion increased from 15° to 30°, plantarflexion from 35° to 40°, inversion from 10° to 30°, and eversion from 5° to 15°. These changes occurred in the context of scar mobilization, gastrocnemius stretching, active range of motion, and active assisted range of motion exercises. Scar adhesions and reduced tissue pliability may restrict movement around a joint, while repeated active movement and stretching provide opportunities to restore movement within the patient's tolerance.^{9,18} Exercise based rehabilitation is also relevant to lower limb functional recovery, although evidence from ankle sprain populations cannot be assumed to represent patients with hypertrophic scars.²¹ The present findings therefore support the clinical rationale for combining scar directed treatment with movement exercises while remaining insufficient to determine which component produced the greatest change.

Edema also decreased during the intervention period. Pitting edema changed from grade II to grade I, and the difference in girth circumference decreased from 5 cm to 1 cm. Ankle pumping was included to facilitate repeated ankle movement and muscle pump activity. Experimental work has demonstrated changes in calf vein deformation and femoral vein peak velocity during ankle pump exercise, providing a physiologic basis for incorporating ankle movement into edema management.¹³ Exercise has also been investigated as an adjunct in patients with venous leg ulcers, although the clinical context differs from the present case.¹² The reduction in edema may have coincided with improved ankle mobility and reduced tissue restriction, but the single case design does not establish the mechanism responsible for the change.

Paresthesia decreased from 8 to 2 during the same period. One possible clinical explanation is that reduced edema and improved soft tissue mobility may have reduced mechanical irritation around superficial neural structures. However, no formal neurological assessment or nerve conduction testing was reported, and the mechanism of sensory improvement cannot therefore be

confirmed. The reduction should be regarded as an observed patient reported change rather than evidence that the intervention directly treated a nerve lesion.

Functional status and muscle strength also improved. The Barthel Index increased from 90 to 99, while manual muscle testing increased from grade 3 to grade 5. The strengthening program targeted the tibialis anterior, gastrocnemius, soleus, plantaris, and peroneal muscles, while active ankle exercises provided repeated opportunities for movement practice. Improvements in ankle movement and muscle performance may have supported the patient's reported ability to walk more comfortably and return to work. Exercise based rehabilitation has been associated with functional benefits in lower limb conditions, but the evidence cited in this report is not specific to postoperative hypertrophic scarring.²¹ Therefore, the observed functional change should be interpreted within the context of this individual case.

The HARS score decreased from 10 to 3, and the patient reported less anxiety during treatment. Therapeutic communication was included throughout the program because anxiety was evident during the initial examination. Communication and the therapeutic alliance are recognized components of patient centered physiotherapy practice and may influence engagement with rehabilitation.^{14,15} Nevertheless, the reduction in HARS score may also reflect the patient's improving physical condition, repeated exposure to treatment, reassurance, or other factors unrelated to communication alone. The present case cannot distinguish among these possibilities.

The clinical reasoning for the multimodal approach was based on the coexistence of several impairments rather than on the scar appearance alone. The patient presented with a hypertrophic scar, tissue restriction, limited ankle movement, edema, paresthesia, reduced muscle strength, anxiety, and activity limitations. Addressing these findings through scar mobilization, therapeutic ultrasound, movement exercises, stretching, strengthening, edema focused exercise, and therapeutic communication allowed the intervention to target multiple domains within a short treatment period. This approach is consistent with the broader physiotherapy literature emphasizing physical scar management and individualized rehabilitation.^{6,9}

Several limitations should be considered when interpreting the findings. First, only one patient was included, which substantially limits generalizability. Second, there was no comparator, so the observed changes cannot be separated from natural recovery, changes in wound maturation, or other care received during the same period. Third, the intervention was multimodal, preventing attribution of any outcome to therapeutic ultrasound, scar mobilization, exercise, or communication individually. Fourth, no long term follow up was conducted after the final assessment on 22 April 2026, so the durability of the improvements remains unknown. Fifth, the source case did not report formal assessor blinding, detailed psychometric information for every outcome measure, or a predefined minimal clinically important difference. These limitations are important because the magnitude of numerical change does not by itself establish clinical effectiveness.

The case nevertheless provides clinically useful detail regarding the integration of scar management with movement and functional rehabilitation in a patient with a hypertrophic ankle scar after debridement. The findings suggest that monitoring scar characteristics alongside joint mobility, edema, sensory symptoms, muscle strength, anxiety, and functional independence may provide a broader picture of rehabilitation progress than scar appearance alone. Future studies should use larger samples, appropriate comparators, standardized outcome measures, longer follow up, and intervention specific designs to determine the effectiveness and relative contribution of individual physiotherapy modalities in patients with hypertrophic scars around the ankle.

Conclusion

This case report describes the short term clinical course of a 44 year old woman with a hypertrophic scar of the right ankle following debridement who completed six sessions of multimodal physiotherapy over two weeks. The program included therapeutic ultrasound, scar mobilization, active and active assisted range of motion exercises, ankle pumping, gastrocnemius stretching, strengthening exercises, and therapeutic communication. Improvements were documented in ankle mobility, edema, paresthesia, muscle strength, functional independence, anxiety, and scar assessment. Dorsiflexion increased from 15° to 30°, while plantarflexion, inversion, and eversion also improved. Paresthesia, VSS, and HARS scores decreased, whereas the Barthel Index and manual muscle testing grade increased. Edema improved from grade II to grade I and the girth circumference difference decreased from 5 cm to 1 cm.

These findings indicate an observed short term improvement across several clinical domains during a multimodal physiotherapy program. However, the single case design, absence of a comparator, multimodal intervention, and lack of long term follow up prevent conclusions about causal treatment effects or generalizability. The case therefore supports the clinical relevance of comprehensive assessment and individualized rehabilitation for hypertrophic scarring around the ankle rather than demonstrating the efficacy of any specific modality. Further research involving larger samples, standardized outcomes, appropriate comparators, and longer follow up is needed to determine whether similar improvements can be reproduced and maintained.

Author Contribution

Nisrina Athira: Conceptualization; Methodology; Investigation; Data curation; Writing, original draft.

Andi Rahamaniar SP.: Methodology; Validation; Writing, review and editing.

Masfufah: Formal analysis; Validation; Supervision; Writing, review and editing.

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Conflict of Interest Statement

The authors declare no conflict of interest.

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Ethics Statement

The patient provided written informed consent for publication of clinical data and photographic documentation. According to the institutional policy reported in the source manuscript, a single case report did not require approval from a research ethics committee. No ethical approval number was provided.

References

1. Mony MP, Harmon KA, Hess R, Dorafshar AH, Shafikhani SH. An updated review of hypertrophic scarring. *Cells*. 2023;12(5):678.
2. Frech FS, Hernandez L, Urbonas R, Zaken GA, Dreyfuss I, Nouri K. Hypertrophic scars and keloids: advances in treatment and review of established therapies. *Am J Clin Dermatol*. 2023;24(2):225-245.
3. Yuan B, Upton Z, Leavesley D, Fan C, Wang XQ. Vascular and collagen target: a rational approach to hypertrophic scar management. *Adv Wound Care (New Rochelle)*. 2023;12(1):38-55.
4. Jin C, Jin Y, Ding Z, Nuch KS, Han M, Shim JH, et al. Cellular and molecular mechanisms of wound repair: from biology to therapeutic innovation. *Cells*. 2025;14(23):1850.
5. Smith F, Donaldson J, Brown T. Debridement for surgical wounds. *Cochrane Database Syst Rev*. 2024;5(5):CD006214.
6. Di Serio S, Congiu M, Minnucci S, Scalise V, Mourad F. Current physical therapy for skin scar management: a scoping review. *J Clin Med*. 2025;14(17):5920.
7. Kazemeini S, Nadeem-Tariq A, Hajian P, Anil B, Easterly J, Sraa K, et al. Hypertrophic and keloid scar management: advances in diagnosis, perioperative care, and anesthetic modulation. *Cureus*. 2025;17(7):e88810.
8. Fang X, Wang Y, Chen H, Yan Z, Jin S, Wu Y, et al. Hypertrophic scarring and keloids: epidemiology, molecular pathogenesis, and therapeutic interventions. *MedComm (2020)*. 2025;6(10):e70381.
9. Deflorin C, Hohenauer E, Stoop R, van Daele U, Clijsen R, Taeymans J. Physical management of scar tissue: a systematic review and meta-analysis. *J Altern Complement Med*. 2020;26(10):854-865.
10. Barnes SP, Ma Y, Patel B, Muthayya P. Efficacy of massage techniques for hypertrophic burn scars: a systematic review of literature. *J Burn Care Res*. 2024;45(2):356-365.
11. Mathews J, Chauhan K, Samuel RJ. Manual soft-tissue mobilization in the management of hypertrophic burn scars: a systematic review. *INTI J*. 2025;2025(5):1-9.
12. Zhang Q, Lu L, Song JL, Wang L. Effects of exercise in treating patients with venous leg ulcers: a systematic review and meta-analysis. *Int Wound J*. 2023;20(5):1776-1783.
13. Zhuang Z, Ai D, Yao Y, Zheng L, Qin J, Chen D, et al. The changes of the calf-vein deformation and femoral vein peak velocity during ankle pump exercise with or without graduated compression stockings. *BMC Musculoskelet Disord*. 2022;23(1):1-10.
14. Rodríguez-Nogueira O, Leirós-Rodríguez R, Pinto-Carral A, Álvarez-Álvarez MJ, Morera-Balaguer J, Moreno-Poyato AR. The association between empathy and the physiotherapy-patient therapeutic alliance: a cross-sectional study. *Musculoskelet Sci Pract*. 2022;59:102557.
15. Ahlsen B, Nilsen AB. Getting in touch: communication in physical therapy practice and the multiple functions of language. *Front Rehabil Sci*. 2022;3:882099.
16. Gagnier JJ, Kienle G, Altman DG, Moher D, Sox H, Riley D, et al. The CARE guidelines: consensus-based clinical case report guideline development. *J Clin Epidemiol*. 2014;67(1):46-51.
17. Naqvi WM, Mishra GV, Shaikh SZ, Pashine AA, Sánchez Romero EA, Swaminathan N, et al. PhyCARE reporting guidelines for physiotherapy case reports: a consensus-based development. *BMJ Open*. 2026;16(1):e110765.
18. Ault P, Plaza A, Paratz J. Scar massage for hypertrophic burns scarring: a systematic review. *Burns*. 2018;44(1):24-38.
19. Anastasova VN, Georgiev AA, Zanzov EI, Velkova KG, Krasteva ES. High-intensity focused ultrasound thermotherapy for scar treatment. *Ann Burns Fire Disasters*. 2023;36(1):63-67.
20. da Costa Gonçalves A, de Jesus Guirro RR, Rossi LA, Farina Junior JA, de Carvalho CS, Ferro AP, et al. Effects of therapeutic ultrasound and paraffin with or without vacuum massage on biomechanical properties of grafted skin after burn: a randomized controlled trial. *Rev Assoc Med Bras (1992)*. 2022;68(12):1759-1764.
21. Wagemans J, Bleakley C, Taeymans J, Schurz AP, Kuppens K, Baur H, et al. Exercise-based rehabilitation reduces reinjury following acute lateral ankle sprain: a systematic review update with meta-analysis. *PLoS One*. 2022;17(2):e0262023.