



Case Report

Exploring the Impact of Radial Shock Wave Therapy on a Persistent Foot Ulcer in a Charcot-Marie-Tooth Disease Patient: A Detailed Case Study

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ABSTRACT

Background: Charcot-Marie-Tooth disease (CMTD) is a group of hereditary motor and sensory neuropathies with a prevalence of approximately 1 per 2,500 individuals. The most common feature of this disease is muscle weakness and impaired sensation in the extremities. However, this disease group, which includes various heterogeneous diseases, can present in different ways, such as foot infections and ulcers.

Case Presentation: In this case report study, we discuss an 18-year-old female patient who was referred to us with a non-healing ulcer on the plantar surface of her right foot. She was diagnosed with CMTD based on her history of sensory and motor symptoms, as well as the results of electromyography. After five sessions of extracorporeal shock wave therapy (ESWT), her ulcer healed successfully.

Conclusion: In addition to the importance of considering patient symptoms for the diagnosis of CMTD, this case demonstrates the effectiveness of ESWT in promoting wound healing for a non-healing ulcer within a CMTD context. Further research is necessary to validate this treatment as a standard of care for such patients.

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Introduction

Charcot-Marie-Tooth disease (CMTD) is the most common inherited neuromuscular disorder, with a prevalence of approximately 1 per 2,500 population [1]. Diagnostic tools for CMTD include sural nerve biopsy, electromyography (EMG), and nerve conduction velocity (NCV). Notably, NCV can distinguish between the two forms of the disease - the demyelinating and axonal forms - which may exhibit different clinical, genetic, pathological, and electrophysiological characteristics [2]. Most patients with CMTD experience progressive muscle weakness and atrophy, initially in the lower limbs and subsequently in the upper limbs. Sensory impairment is less common. In chronic cases, patients may develop neuropathic bony deformities, infections,

and ulcers, particularly in the foot [2]. Some CMTD subtypes have unique associated clinical features that may aid in diagnosis. For instance, poorly healing foot ulcers are common in CMTD type 2B, a peripheral ulcero-mutilating neuropathy. Frequent infections in these patients may also lead to amputations [3].

Extracorporeal shock wave therapy (ESWT) is a non-invasive technique that stimulates biological activities involving intra-cellular and cell-matrix interactions. It is suggested to be an effective and safe method for treating acute and chronic skin lesions [4], including pathological scars from burn injuries [5], as well as neuropathic foot ulcers, such as those seen in diabetic patients [6]. ESWT has been proposed as an alternative to surgery in musculoskeletal disorders of orthopedic pathologies [7], especially when conventional conservative therapies, including antibiotics, various topical treatments, and dressings, have failed to heal the wound. Consequently, we applied this method to a non-healing ulcer in a patient recently diagnosed with CMTD. The results of short-term

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follow-up confirmed its efficacy. A complete presentation of the case is provided in the following sections.

While foot ulcers can occur in CMTD, they are typically observed in patients with a confirmed diagnosis and are rarely the first symptom leading to diagnosis [8]. In this report, we present the case of an 18-year-old woman who came to us with a non-healing ulcer on the plantar surface of her right foot. A thorough history taking led to a suspicion of CMTD, which was later confirmed by EMG-NCV test results. A notable aspect of this case report is the therapeutic method used for the patient - ESWT, specifically radial shock wave therapy (RSWT). This approach resulted in complete wound closure after just five sessions.

Case Report

The patient, an 18-year-old woman, was referred to the Physical Medicine and Rehabilitation Clinic of Amin Hospital in Isfahan, Iran, in November 2020 due to an ulcer on her right foot accompanied by mild pruritus. The ulcer, which had appeared about three months prior, had not responded to conventional conservative treatment, including oral cephalexin capsules (500 mg, four times a day), various topical treatments, and dressings applied for over two months. The patient reported a history of a similar wound at the same site approximately one year earlier, which was treated with oral cephalexin capsules (500 mg twice a day). However, she did not follow up after the previous wound healed. The patient's medical history revealed sensory symptoms such as paresthesia originating from the soles of her feet since she was 13 years old. Despite these symptoms, she maintained normal pain, position, and vibration and experienced no walking or balance issues. The patient disclosed that her brother had similar sensory symptoms, which started earlier and progressed more rapidly, leading to a diagnosis of hereditary sensorimotor peripheral polyneuropathy. Although the patient's parents were cousins, they did not exhibit similar symptoms.

Upon physical examination, a 2-cm-long and 1-cm-deep ulcer with open edges was discovered on the plantar surface of her right foot, exhibiting mild to moderate oozing (Figure 1). The patient was not feverish. Her extremities were symmetrical, her muscles showed no signs of atrophy, and her plantar arch was mildly elevated. The results of the manual muscle testing, mental status examination, and muscle stretch reflexes were all normal. Sensory testing was performed on both legs using cotton wool, revealing impaired sensation in the distal third of both legs, while the sensation in the upper extremities was normal. The pinprick test was negative at the wound site and the heel of the right foot but normal in other regions and the other leg. The physician manipulated the patient's toe and asked her to identify its position, indicating normal proprioception. Temperature sensation was tested by immersing parts of the patient's foot in warm and cold water, and a vibration test was performed using a 128 Hz diapason (tuning fork); all tests yielded normal results. The pulses of the dorsalis pedis and posterior tibial arteries in both feet were examined and

found to be full and symmetrical. The cranial nerves were normal. The patient declined further investigations due to financial constraints.

Based on the patient's history and physical examination results, Charcot-Marie-Tooth Disease (CMTD) was suspected. The Electromyography-Nerve Conduction Velocity (EMG-NCV) test indicated chronic symmetric sensorimotor peripheral polyneuropathy, suggesting axonal CMTD. Radial Shockwave Therapy (RSWT) was initiated using the standard electromagnetic device DUOLITH SD1 (STORZ MEDICAL, Switzerland). The treatment parameters were set at Bar=3.5 and Hz=15, with 1500 radial shocks administered weekly for five sessions. The RSWT was performed in a scanning manner on the plantar surface of the right foot, specifically targeting the patient's ulcer.

Significant improvement was observed after three sessions of RSWT, with complete wound closure achieved after the final session (Figure 2). The patient exhibited complete wound healing three months post-treatment without any ulcer recurrence (Figure 3).

All procedures performed in this study adhered to the ethical standards of the 1964 Helsinki Declaration and its subsequent amendments. Informed consent was obtained from the patient.

Discussion

The case presented here underscores two significant



Figure 1: The wound characteristics in the initial presentation of the patient to our center.



Figure 2: The wound characteristics of the patient after five sessions of treatment with extracorporeal shock wave therapy.



Figure 3: The wound healed completely 3 months after completion of the treatment.

aspects. The first aspect is the use of RSWT, a therapeutic method not previously employed for wound healing in patients with CMTD. Given the absence of definitive treatment for CMTD, primarily due to extensive genetic variation across subtypes [9, 10], effective management of foot ulcers becomes crucial in preventing chronic infection and potential foot amputation [10]. Neuropathic foot ulcers, being recurrent and resistant to conservative therapies, often lead to amputation in these patients. Such an outcome can significantly impair the patient's quality of life [11]. Hence, the value of a non-invasive method to prevent amputation cannot be overstated.

For the first time, we implemented ESWT in such patients. The results of our short-term follow-up conducted three months after the completion of five sessions, demonstrated complete healing without any recurrence or complications. ESWT is a non-invasive therapeutic method that promotes tissue regeneration, alleviates pain, and improves the function of the injured tissue [12]. The neuroprotective effects of this method could further enhance the treatment of neuropathic foot ulcers and reduce the risk of recurrence [12], as previously observed in the case of diabetic foot ulcers [6].

Another crucial aspect of this case is the importance of an accurate diagnosis of CMTD, particularly in instances that do not exhibit severe motor deficits. The patient, in this case, had been experiencing sensory deficits for several years, which she overlooked. These sensory symptoms were not her primary complaint; instead, she sought treatment for her foot ulcer. While foot ulcers are common in CMTD due to the peripheral neuropathy associated with the disease, their occurrence in a patient not previously diagnosed with it is unusual. To the authors' knowledge, only a few cases of CMTD presenting with a foot ulcer have been diagnosed. Judhan et al. reported a case of a 26-year-old man with a five-year history of a non-healing ulcer on the plantar surface of his left leg. A thorough neurological examination revealed bilaterally weak ankle dorsiflexion, absent tendon reflexes in all four limbs, and sensory deficit in the lower limbs up to mid-calf [8]. Other reports have noted the concurrent presence of Diabetes Mellitus (DM), where CMTD was diagnosed upon the presentation of a chronic non-healing and/or recurrent foot ulcer [13, 14]. Therefore, it is crucial to pay attention to motor and sensory deficits in patients presenting with a non-healing ulcer, especially in those with underlying conditions like DM or sickle cell anemia, which can cause a similar neuropathic foot ulcer, to prevent misdiagnosis [15].

Conclusion

This case highlighted two significant aspects. First, it presented a non-healing foot ulcer in a patient not previously diagnosed with CMTD. The disease was suspected based on a comprehensive history and physical examination, which revealed a sensory deficit in the

patient. EMG-NCV confirmed this diagnosis. The second important aspect was the successful treatment of the foot ulcer using ESWT. This method, which has not been previously used in such patients, could be an alternative to amputation. Further studies are necessary to confirm the efficacy and safety of this treatment for foot ulcers in patients with CMTD.

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