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The clinical utility of extracorporeal shock wave therapy for burn pruritus: A prospective, randomized, single-blind study

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ABSTRACT

Purposes: To investigate the effect and mechanisms of extracorporeal shock wave therapy (ESWT) on burn scar pruritus.

Methods: Forty-six patients participated (experimental group, n=23; sham stimulation group, n=23). Patients had complaints of severe pruritus ranging from 5 to 10 on the visual analog scale. The experimental group received 1000-2000 shock waves for each treatment with 100 impulses/cm^2, each with low-energy flux density (0.05–0.20 mJ/mm^2) and a 1-week interval between treatments for 3 weeks. The numerical rating scale (NRS), 5D-Itch Scale, and Leuven Itch Scale were evaluated immediately before ESWT and after the third session. Laser Doppler blood perfusion imaging (LDI) was performed immediately before ESWT and after the first and third sessions.

Results: In the experimental group, mean NRS scores were 6.30 ± 1.29 before therapy and 3.57 ± 2.09 after the third session, and the difference was significant ($p < 0.001$). NRS scores in the experimental group after the third ESWT were significantly decreased compared to those of the sham stimulation group ($p=0.009$). The duration, severity, and consequences scores of pruritus on the Leuven Itch Scale after the third ESWT were significantly decreased in the experimental group compared with the sham stimulation group ($p=0.033$, $p=0.007$, and $p=0.009$, respectively). The direction score on the 5-D Itch Scale after the third ESWT was significantly decreased in the experimental group compared to the sham stimulation group ($p=0.033$). After the first ESWT session and after 3 sessions, the burn area had a significant increase in perfusion according to LDI, compared with the scores before treatment in the experimental group ($p=0.023$ and $p=0.013$, respectively).

Conclusion: ESWT is a non-invasive modality that significantly reduced burn-associated pruritus.

Abbreviations: ESWT, extracorporeal shock wave therapy; NRS, numerical rating scale; LDI, Laser Doppler blood perfusion imaging; SP, substance P; CNS, central nervous system; LIS, Leuven Itch Scale; CGRP, calcitonin gene-related peptide.

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1. Introduction

It is challenging to define burn pruritus because its mechanisms are not well defined. Burn scar pruritus can be defined as an urge to scratch a burn wound during the healing process. On discharge from the hospital, the incidence of pruritus is reported to be 87% [1]. Complaints of acute pruritus begin within several days of the burn injury, and chronic pruritus may continue for up to 2 years after healing. Pruritus is a quality of life problem for burn patients. It disrupts patients' sleeping and leisure activities. In most burn centers, antihistamines used as first-line treatment for pruritus in patients with burns. However, a study assessing the efficacy of several antihistamines in burn patients with pruritus showed that complete relief of pruritus was accomplished in only 20% of patients [1]. Histamine is one of the pruritogenic mediators. It is released in tissues with acute inflammation and in granulation tissue that has formed. These pruritogenic mediators activate C fibers, and the impulses of pruritus are transmitted to the spinal cord. Other mediators of pruritus are neuroinflammatory transmitters, including substance P (SP) released by mast cells. C fibers transmit impulses to the dorsal root ganglion and central nervous system (CNS) [2,3]. Some studies have reported that chronic pruritus, which is unresponsive to histamines, can be explained by neuropathic mechanisms based on its response to gabapentin. Gabapentin is able to control pruritus by virtue of its ability to inhibit hypersensitivity reactions after nerve injury and by its secretion of inhibitory neurotransmitters. Thus, it has been suggested that the CNS is involved in the development and maintenance of pruritus, and neuropathic mechanisms have similar patterns to sensitization in neuropathic pain models. Pruritus is considered a form of pain, and the current practices for management of pruritus, such as emollient cream and pharmacological or physical therapies, have shown limited benefits. Standard treatment protocols for pruritus have not been established, and new treatment approaches are being researched.

Extracorporeal shock wave therapy (ESWT) has been used to treat musculoskeletal diseases (plantar fasciitis, lateral epicondylitis of the elbow, etc.). Recent research has demonstrated the effectiveness of ESWT in stimulating biological activities that involve intra-cell and cell-matrix interactions [4]. These results suggest that ESWT can be used in tissue regeneration. The concept of tissue regeneration is associated with neoangiogenesis and anti-inflammation [5,6]. Recent mechanistic research studies of ESWT have demonstrated angiogenetic and anti-inflammatory effects in ischemic skin flaps and acute burn wounds.

The incidence of burn-associated pruritus indicates the need for another modality that can positively reduce pruritic symptoms. The purposes of this study were to determine the effect of ESWT for the management of refractory burn scar pruritus and to clarify its mechanisms of ESWT in burn scar pruritus via Laser Doppler blood perfusion imaging.

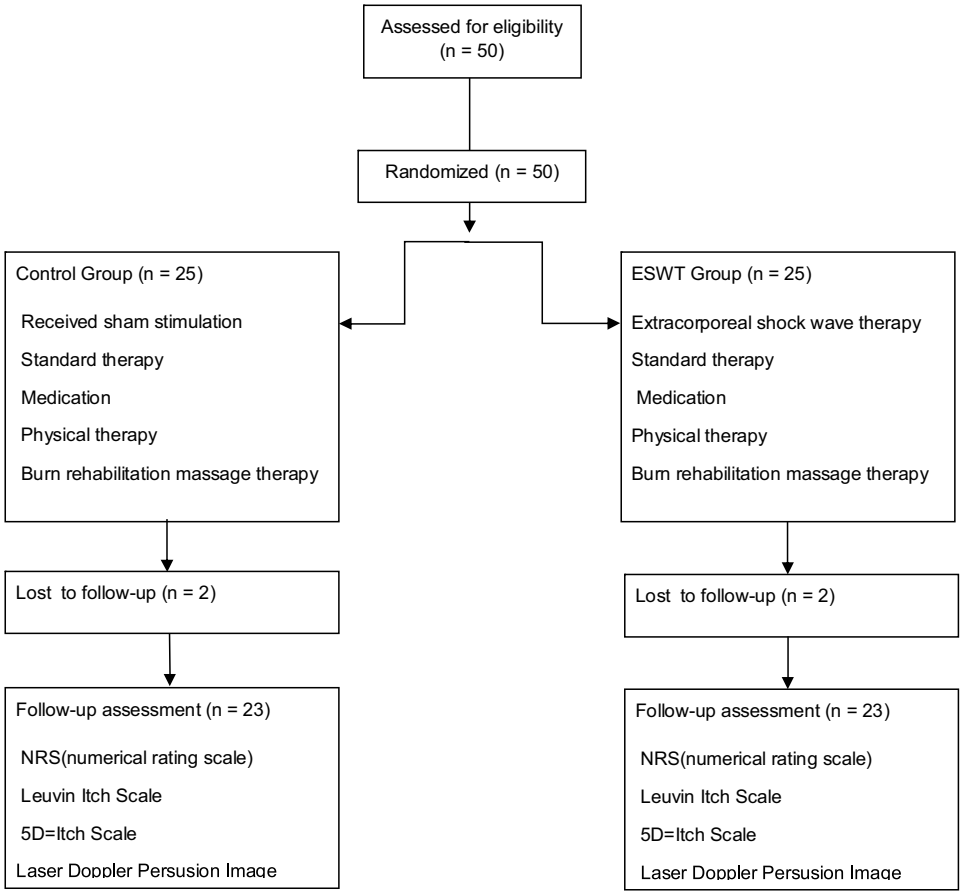

Fig. 1 – Diagram for subject enrollment, allocation and follow up.

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