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Effects of pain Scrambler therapy for management of burn scar pruritus: A pilot study



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ABSTRACT

Purpose: Pain Scrambler therapy is a patient-specific electrocutaneous nerve stimulation device. Burn pruritus is a common form of chronic and disabling neuropathic pain that is often difficult to treat effectively. Pruritus is mediated by histamines, which are effector molecules stored in mast cells and released locally during injury or inflammation. Burn pruritus may be accompanied by peripheral neuropathic pain, which may result from injury to sensory nerves that hampers conductance of neuronal messages along the large A and small C afferent fibers to the spinal cord. In this study, we investigated the effect of pain Scrambler therapy on burn scar pruritus.

Methods: Sixteen subjects were recruited to participate in this study. The subjects complained of severe pruritus that was rated at least 5 on the visual analogue scale (VAS), despite treatments with antihistamines, gabapentin medication, and other physical modalities. Each Scrambler Therapy with the MC-5A Pain Scrambler Therapy[®] technology device was performed for 40min daily (Monday through Friday) for 10 consecutive days.

The stimulus was increased to the maximum intensity bearable by the individual patient without causing any additional pain or discomfort. The numerical rating scale (NRS), 5-D Itch Scale, and Leuven Itch Scale were administered and evaluated immediately before Scrambler therapy, and then immediately after 5 and 10 therapy sessions.

Results: For all 16 patients, NRS showed mean values of 6.75 ± 1.13 before therapy, 5.06 ± 1.53 after 5 sessions, and 4.13 ± 1.45 after 10 sessions. The NRS values before therapy and after 10 sessions were significantly different ($p < 0.05$). Pruritus frequency, severity, and consequences scores on the Leuven Itch Scale after Scrambler therapy were also significantly different ($p < 0.05$). Duration, degree, direction, and disability scores on the 5-D Itch Scale were also significantly different ($p < 0.05$).

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Conclusions: Scrambler therapy is a non-invasive, non-medicinal modality that significantly reduced burn-associated pruritus. Scrambler therapy should be considered as a treatment option for burn survivors with severe pruritus.

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1. Introduction

It is difficult to define burn pruritus, because its pathophysiology and mechanisms of progression are not well understood. Burn pruritus is the desire to scratch a burn wound mainly during the healing process. After discharge, 87% of patients with burn complain of pruritus [1]. Pruritus complaints begin within several days of the burn and, in some cases, continue for up to 2 years after healing; this causes significant suffering for burn patients. Antihistamines have been used as the primary treatment for pruritus in burn patients at most burn centers. However, a study assessing the efficacy of antihistamines in patients with burn pruritus showed that these treatments produced complete relief of burn pruritus in only 20% of patients, partial relief in 60% of patients, and no relief in 20% of patients [1]. Goutos [2] described refractory burn pruritus as a mechanism of, and process similarities of, neuropathic pain. Refractory chronic pruritus, which is unresponsive to histamines, can be explained by neuropathic mechanisms based on its response to gabapentins. Gabapentins are able to control pruritus by virtue of their ability to inhibit hypersensitivity reactions after nerve injury and secretion of inhibitory neurotransmitters, and have been shown to be more effective than histamines in treating peripheral pruritus [3,4].

The existing treatment modalities for management of pruritus, such as pharmacological or physical therapies, have shown limited benefits. In reality, standard treatment protocols for pruritus are not established at most burn centers, and new treatment approaches are being attempted. For example, Electrical stimulation therapy using Transcutaneous Electrical Nerve Stimulation (TENS) [5] has shown improvements in patients with burn pruritus. In another study, electrical stimulation causing pain was found to control pruritus [6].

Scrambler therapy is a treatment method that blocks pain through non-invasive electro-stimulation, and has recently proven effective for the treatment of chemotherapy-induced neuropathic pain [7] and intractable back pain syndrome. Scrambler therapy [8] is designed to produce 16 different electric currents that provide non-invasive electro-stimulations of the area surrounding the pain site, and serves to block pain signals.

The purpose of this study was to determine the efficacy of Scrambler therapy for the treatment of refractory burn-scar pruritus with hypersensitivity, by cutaneous desensitization of the burn areas.

2. Subjects and methods

Sixteen (15 male and 1 female) patients from The Department of Rehabilitation Medicine at Hangang Sacred Heart Hospital in

Korea were recruited to participate in this study. Their burn scars had re-epithelialized after aseptic care or skin graft. The patients complained of severe pruritus rated at least 5 on the 10-point numerical rating scale (NRS), despite being treated with drugs and physical therapy for more than 1 week after being admitted to the Department of Rehabilitation Medicine. Patients were excluded if they had a pacemaker, a history of severe mental illness, an uncontrolled seizure disorder, a metal medical device, or if there was potential for additional damage to the skin due to the use of Scrambler patches. The mean age of participants was $38.38 \pm$ standard deviation of 11.52 years, and the average burn surface area was $34.88 \pm$ standard deviation of 17.98%. There were 9 patients with flame burns, 3 with electrical burns, 2 with contact burns, 1 with a scalding burn, and 1 with a chemical burn (Table 1). Electrode patches were applied to a 20- to 25-mm area surrounding the most pruritic burn area using MC-5A Pain Scrambler Therapy[®] technology device. Scrambler therapy was performed in burn scar areas with pruritus and a visual analogue scale (VAS) score of 5 points or more. The applied stimulus was sequentially increased to the individual's maximum tolerated intensity that did not cause any additional pain or discomfort (within a range of 70U). Each treatment session lasted 40min. Patients participated in daily therapy sessions (Monday to Friday) for up to 10 consecutive days. If a patient did not exhibit any decrease in pruritus during treatment, the device was turned off, the electrodes were repositioned, and further treatment was attempted (Fig. 1).

To assess the effect of treatment, NRS was used to rate the degree of subjective pruritus immediately before Scrambler therapy, immediately after one week of treatment (i.e., after 5 sessions), and immediately after 2 weeks of treatment (i.e., after 10 sessions). Zero ("0") points were assigned when no pruritus was noted, and unbearable pruritus was assigned 10 points. The 5-D Itch Scale [9], a subjective and multi-dimensional measure of the degree, duration, direction of improvement, disability, and distribution area of pruritus, was

Table 1 – Demographic and clinical characteristics of subjects.

Variables	
Male:female, n	15:1
Age (years)	38.38 ± 11.52
TBSA (%)	34.88 ± 17.98
Duration (days) between burn and therapy	155.94 ± 92.34
Type of burn, n	
FB:EB:CoB:SB:ChB	9:3:2:1:1

TBSA=total burn surface area; FB=flame burn; SB=scalding burn; EB=electrical burn; CoB=contact burn; ChB=chemical burn. Values are presented as mean \pm standard deviation.

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