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Enzymatic debridement of deeply burned faces: Healing and early scarring based on tissue preservation compared to traditional surgical debridement

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Highlights

- Scarred healing may cause permanent functional, cosmetic and psychosocial sequelae.
- Enzymatic debridement assists in burn depth evaluation and tissue preservation.
- Enzymatic is associated with higher spontaneous epithelialization.
- Better scar quality after three months with enzymatic debridement.

Abstract

Introduction

Facial burns occur frequently and depending on the injured skin layers often heal with scars which may cause permanent functional and cosmetic sequelae. Preservation of the sensitive facial skin layers, especially of the dermis is essential for scarless epithelialisation. Enzymatic debridement of deep thermal burns has already been shown to assist with preserving viable dermis. However, up to date, there are no published reports on wound healing and in the long term aesthetic outcome after enzymatic debridement of facial burns.

Methods

Therefore we performed a—single centre clinical trial that included 26 subjects aged 18–78 years with facial burns clinically evaluated as deep dermal or deeper. Burns were treated either with enzymatic debridement or excisional surgical debridement. Then we compared both groups regarding debridement selectivity, wound closure and scar quality after more than 12 months.

Results

Enzymatic debridement significantly reduced time to complete wound closure after admission (19.85 days versus 42.23 days, p=0.002), and after enzymatic eschar removal (18.92 days versus 35.62 days, p=0.042). The number of procedures to complete debridement were significantly lower in the enzymatic debridement group (1.00 versus 1.77, p=0.003). 77% of facial burns that had been debrided enzymatically were found to be more superficially burned than initially estimated. Wounds undergoing autografting of any size were significantly reduced by enzymatic debridement (15% versus 77%, p=0.002). Scar quality after enzymatic debridement was superior compared to surgical debridement after 12 months regarding pigmentation (p=0.016), thickness (p=0.16), relief (p=0.10), pliability (p=0.01), surface area (p=0.004), stiffness (p=0.023), thickness (0.011) and scar irregularity (p=0.011). Regarding erythema and melanin, viscoelasticity and pliability, trans-epidermal water loss or laser tissue oxygen saturation, haemoglobin level and microcirculation we found no significant differences for treated and untreated skin in the EDNX group.

Conclusion

In our current study we found Bromelain based enzymatic debridement better in some aspects of tissue preservation in deep dermal facial burn.

Introduction

A systemic review of literature revealed that nearly 43% of all burn patients and 14% of patients with minor burns suffered in the long term under changes in their appearance due to scarring [1]. Up to 5.3% of all burn patients sustain facial burns [2]. Patients with facial burn scars often suffer from psychosocial maladjustment post burn as the appearance of our face is a central part of human personal identity and essential for normal social functioning [3]. The face is primarily defined by harmonious proportion and skin texture [4]. Especially facial burn scars are recognized to lead to lifelong social stigma and isolation [5].

The human face is composed of a multitude of filigree structures including nerves, vessels and muscles, all densely packed and covered by a thin and sensitive skin layer. If the fine texture of the skin is irreversibly damaged, facial symmetry and harmony are lost [4]. It has been shown that early debridement prevents complications and reduces late scarring [6], [7], [8], [9], [10]. It is widely accepted that preservation of viable skin in early debridement is essential in order to receive optimal long term outcome after deep facial burn [11]. Today early excision followed by autografting is still known as the gold standard in burn surgery [12]. However, precise depth diagnosis is difficult and preservation of viable tissue remains a great challenge for burn surgeons.

The unmet need to enhance aesthetic long term results in facial burn wound treatment led to various intensive research efforts. Various non-surgical chemical and enzymatic debriding agents have been evaluated in order to establish an effective and selective debridement procedure. Unfortunately none of the products was effective enough to complete debridement early enough to have an impact on wound-healing and infection rates [7], [13], [14], [15]. Since 2013 the Bromelain based enzymatic debriding agent NexoBrid® has rapidly established in the European burn surgery treatment repertoire. Previous animal and human burn studies indicate that Bromelain based enzymatic debridement may improve aesthetic outcome mainly due to its rapid wound bed preparation, effective action and the preservation of viable tissue [13], [16], [17], [18].

Until today there were no reports on Bromelain based enzymatic debridement with NexoBrid® in deep facial burns. We hope to close this gap by comparing enzymatic debridement with NexoBrid® (EDNX) and traditional excisional debridement (SD) in deep facial burn with special respect to debridement efficacy, acute healing phase, objective and subjective scar evaluation after 12 months in a controlled clinical study design.

Section snippets

Patient selection

The facial burn data (as well as others) were prospectively created since 2011 with all patients signing informed consent. As soon as the study begun we enrolled 13 patients between September 2014 and September 2015 with partial thickness and deep dermal facial burns which we treated with EDNX. These patients were compared to the last 13 SD patients from our database (Fig. 1, Fig. 2). The depth of all facial burns was evaluated by our senior burn specialist at the time of admission following …

Results

26 subjects aged 18–78 years (5 women, 21 men, almost equal distributed in both groups) met the inclusion and exclusion criteria and were enrolled in our study (Fig. 3, Fig. 6). 10 in both groups took part in the follow-up examination after 12 months. Data was found to be complete for all enrolled patients (Fig. 2). The EDNX and the SD group were similar regarding gender and age. The groups differed with respect to TBSA (EDNX 16%, SD 34%, p=0.038), however both groups were similar regarding …

Discussion

The best possible functional and aesthetic result of scar appearance is the main interest in facial burn treatment. Up to date, there are no reports in literature dealing with EDNX of facial burns. In the current study we compared EDNX and SD according to safety and selectivity, time to debridement and complete wound closure, healing time and scar quality after 12 months. …

Conclusion

This is the first report on results of enzymatic debridement of facial burns with NexoBrid®. The current study led us to the conclusion that EDNX was superior to SD regarding selectivity of debridement and preservation of vital tissue allowing an accurate, visual post EDNX burn depth evaluation without the need for any further devices. Surprisingly and aesthetic outcome of resulting scar tissue was superior in the EDNX group compared to traditional surgical debridement regarding pigmentation, …

Study limitations

Our study has some important limitations. First, blinding between enzymatic and surgical debridement was not possible. Additionally both groups differed regarding TBSA. Nevertheless comparison of facial BSA revealed no significant statistical difference. In order to improve data quality a greater number of patients with facial burns has to be enrolled within a prospective randomized study design. Since our group was convinced of the new method, which preserves a lot of viable tissue which is …

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> important to point out that the safe application of Enzymatic Debridement in the face requires special preparations of the sensory organs to protect them from contact with the enzyme.…

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