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

Alexandra Schulz [a,*], *Paul Christian Fuchs* [a], *Irene Rothermundt* [a], *Alexandra Hoffmann* [a], *Lior Rosenberg* [b], *Yaron Shoham* [b], *Henrik Oberländer* [a], *Jennifer Schiefer* [a]

[a] *Department of Plastic Surgery, Hand Surgery, Burn Center, University of Witten/Herdecke, Cologne-Merheim Medical Center (CMMC), Cologne, Germany*

[b] *Department of Plastic and Reconstructive Surgery and Burn Unit, Soroka University Medical Center, Faculty of Health Sciences, Ben Gurion University of the Negev, Beer Sheba, Israel*

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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

* *Corresponding author at*: Department of Plastic Surgery, Hand Surgery, Burn Center, University of Witten/Herdecke, Cologne-Merheim Medical Center (CMMC), Ostmerheimer Strasse 200, 51109 Cologne, Germany. Fax: +49 211 8907 8314.
E-mail address: schulza@kliniken-koeln.de (A. Schulz).

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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.

1. 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 [6–10]. 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 [7,13–15]. 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 [13,16–18].

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.

2. Methods

2.1. 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 (Figs. 1 and 2). The depth of all facial burns was evaluated by our senior burn specialist at the time of admission following clinical characteristics (colour, capillary refill, skin pliability, sensation, presence of blisters, and presence of thrombosed vessels). To be included in the current study subjects had to fulfil the following inclusion criteria: (a) healthy adults over 18 years old, (b) suffering from deep facial

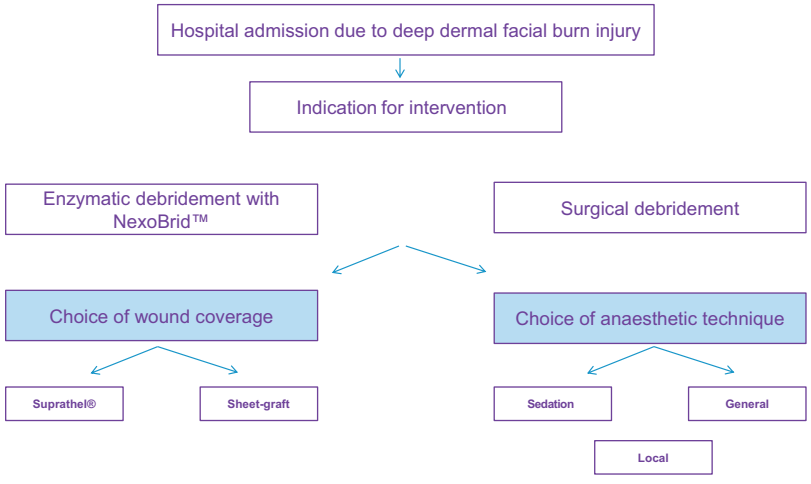

Fig. 1 – Treatment decision.