The Use of Intact Fish Skin Grafts as a Novel Method of Management for Dermal Burns Following Enzymatic Debridement: A Controlled Retrospective Case Series

The Healing Power of Nature

Kerecis

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Presented at the 34th Annual Southern Regional Burn Conference, Nov. 4-7, 2021, New Orleans, Louisiana

Background

Optimal therapy for deep burn wounds is based on rapid necrotomy and coverage to avoid systemic inflammatory response achieving the best possible outcomes for scarring. Limited infrastructure and patients' underlying medical conditions present challenges in burn care. We aimed to determine optimal burn wound management using enzymatic debridement* and intact fish skin**.

Methods

In this retrospective case series, 12 patients with superficial or deep dermal burn wounds were treated with enzymatic debridement followed by treatment with fish skin, an alloplastic skin substitute dressing***, or a split-thickness skin graft. The patients were examined objectively and subjectively for healing and scar quality in a 12-month follow-up after burn injury.

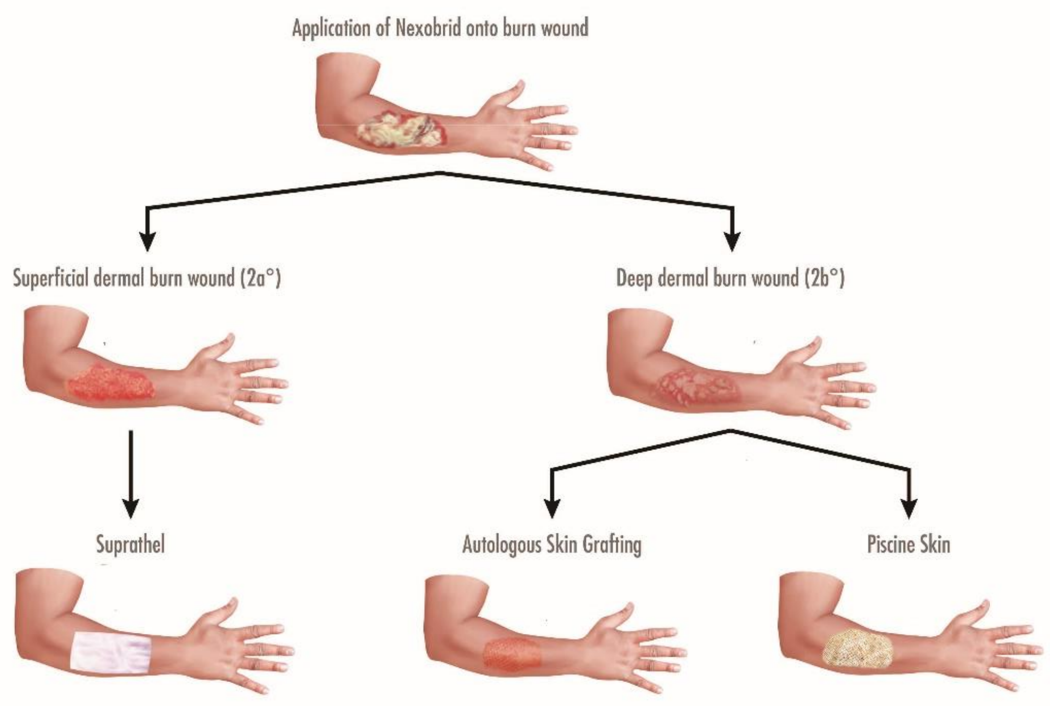
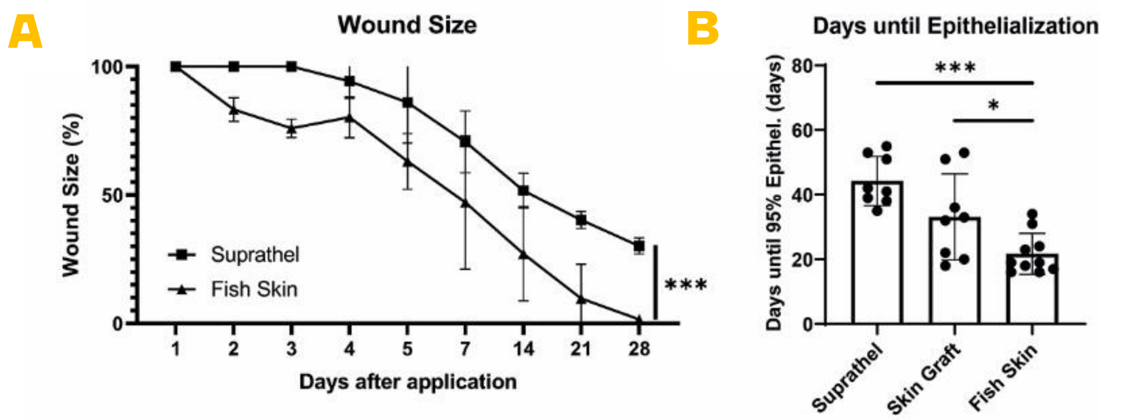


Figure 1: Treatment algorithm of dermal burn wounds in our facility regarding debridement and coverage. Burn wounds received enzymatic debridement by NexoBrid ™on the second day after admission. Subsequently, wound depth was determined. Superficial dermal burn wounds (2a°) were covered with Suprathel®, while deep dermal burn wounds (2b°) were treated with either autologous split-thickness skin graft or fish skin graft.



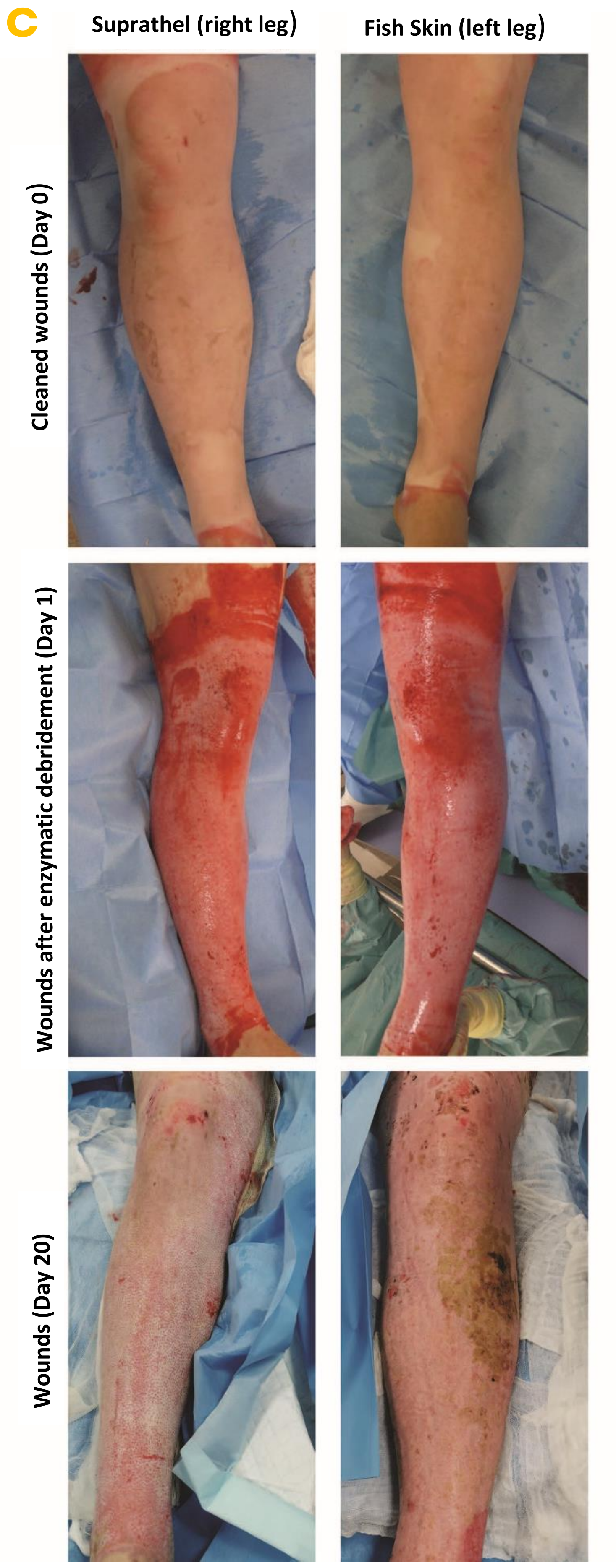


Figure 2: Total wound size over time. Based on daily and weekly measurements of the wound size by two independent assessors, wounds size was determined in Adobe Photoshop. (A) There was a significant reduction of wound size over time in fish skin treated wounds compared to Suprathel® ($p<0.001$). N of patients = 12. Results are shown as means ± SEM. P value: * < 0.05, ** < 0.01, *** < 0.001; Two-tailed unpaired t-test for pairwise analysis. (B) Comparing the period from the application of the definitive wound closure to the point of 95% epithelialization: Suprathel® (45.6 ± 6.6 days), STSG (34.7 ± 12.5 days), fish skin (22 ± 6.3 days). (C) Example of two deep dermal wounds in the same patient after enzymatic debridement treated with Suprathel® (left) and fisj skin (right). After 20 days, the Suprathel®-covered wound showed almost no epithelialization, while the fish skin wound was almost healed completely. As contralateral healthy skin was unavailable for control , this case was not included in the measurements and is for demonstrative purposes only.

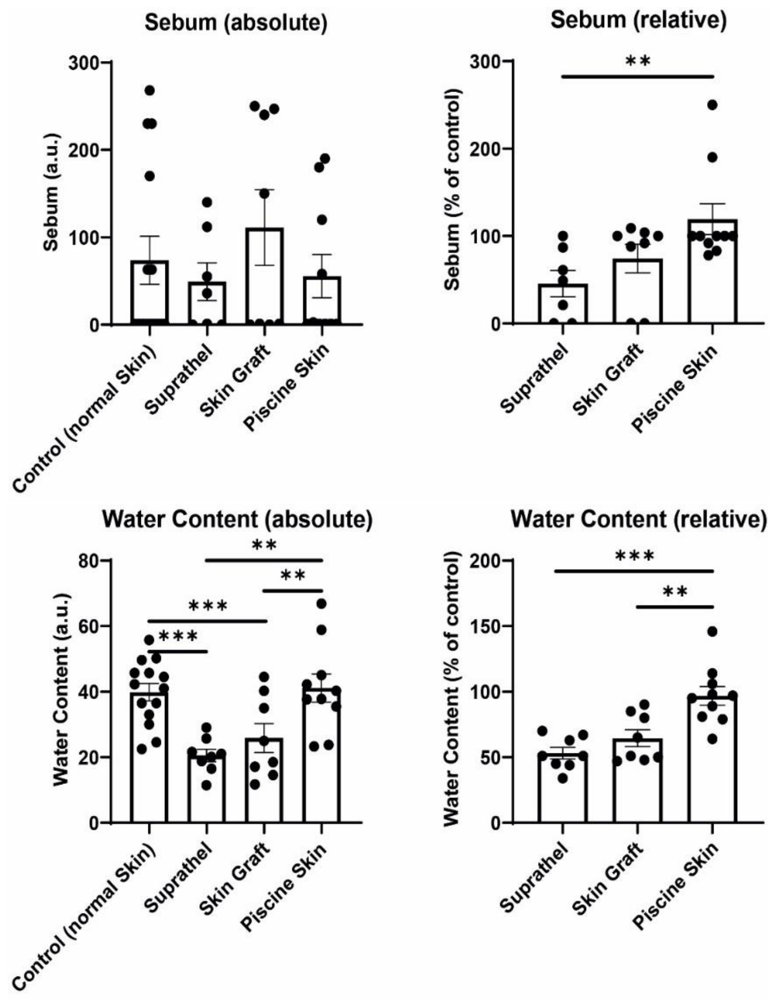


Figure 3: Sebum and water content of regenerated skin 12 months after injury. Using a Sebumeter® and Corneometer® sebum and hydration of the stratum corneum were measured. Left graphs display an unpaired comparison of absolute numbers between all different wounds. Right graphs show a paired comparison between wound and healthy reference skin. Relative Sebum content of wounds compared to healthy reference skin (top right): Suprathel® (45.4% ± 15.2%), STSG (74.1% ± 16.3%), fish skin (119.3% ± 17.6%). The relative water content of wounds compared to healthy reference skin (bottom right): Suprathel® (53.1% ± 4.4%), STSG(64.5% ± 6.4%),fish skin (96.9% ± 7.1%). N of patients = 12. Results are shown as means ± SEM. P value: * < 0.05, ** < 0.01, *** < 0.001; Two-tailed unpaired t-test for pairwise analysis.

Results

Wounds treated with the fish skin demonstrated accelerated wound healing and significantly higher water storage capacity in addition to functional and cosmetic outcomes such as improved elasticity, thickness, pigmentation, and pain relief. The decrease in pain and itch was expressed as modified POSAS score (Patient and Observer Scar Assessment Scale) compared to wounds treated with a split-thickness skin graft or alloplastic skin substitute. Furthermore, fish skin-treated wounds had significantly improved sebum production, and skin elasticity was significantly better than alloplastic skin substitute but not but reached no significant superiority compared to skin graft treated wounds.

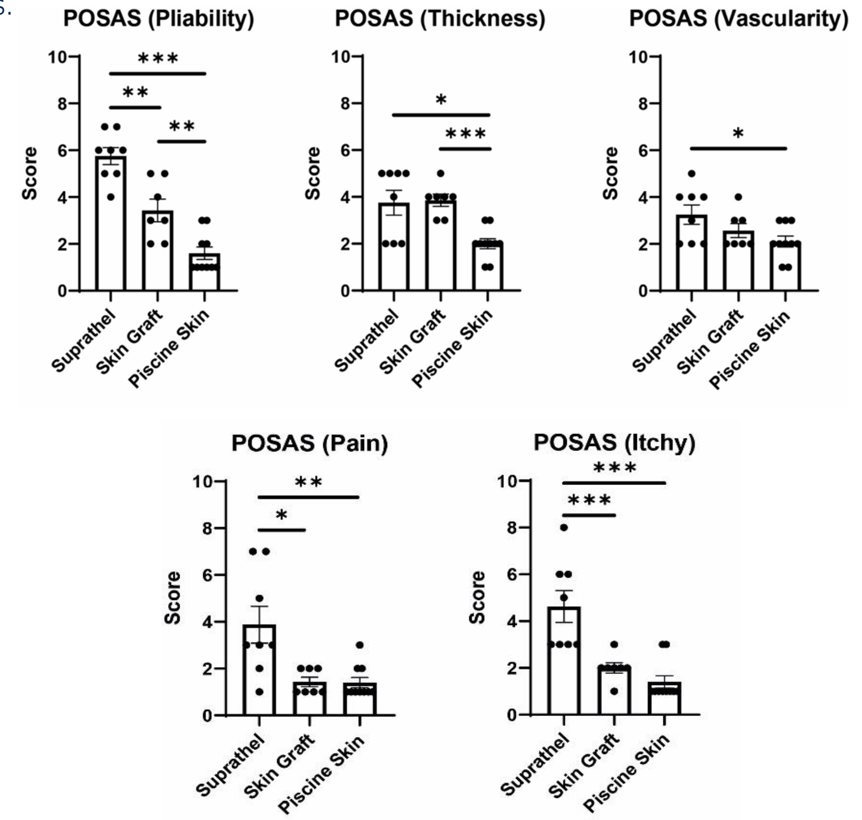


Figure 5: Patient and Observer Scar Assessment Scale (POSAS) 12 months after injury. Scoring the pliability wounds were assessed by two independent assessors: Suprathel® (5.75 ± 0.4), STSG(3.4 ± 0.5), fish skin (1.6 ± 0.3). Scoring the thickness wounds were assessed by two independent assessors: Suprathel® (3.75 ± 0.5), skin graft (3.9 ± 0.3), piscine skin (2 ± 0.2). Scoring the vascularity wounds were assessed by two independent assessors: Suprathel® (3.25 ± 0.4), STSG(2.6 ± 0.3), fish skin (2.1 ± 0.2). Scoring the relief wounds were assessed by two independent assessors: Suprathel® (4.9 ± 0.7), STSG(2.6 ± 0.3), fish skin (1.5 ± 0.2). Scoring the pain patients were asked for pain using a visual analogue scale: Suprathel® (3.9 ± 0.8), STSG(1.4 ± 0.2), fish skin (1.4 ± 0.2). Scoring the itchiness patients were asked for itchiness using a visual analog scale: Suprathel® (4.6 ± 0.7), STSG (2 ± 0.2), fish skin (1.4 ± 0.3). N of patients = 12. Results are shown as means ± SEM. P value: * < 0.05, ** < 0.01, *** < 0.001.

Conclusions

The combination of enzymatic debridement with intact fish skin graft resulted in faster healing of burn wounds with better functional and aesthetic outcomes than split-thickness skin graft or alloplastic skin substitute dressing. The results indicate that fish skin is an excellent skin substitute following enzymatic debridement of burn wounds and may further reduce the need for autografts.