Outcomes of the Use of Hyaluronic Acid-Based Wound Dressings for the Treatment of Partial-Thickness Facial Burns

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The purpose of this study was to assess clinical, functional and cosmetic outcomes of the use of hyaluronic acid-based wound dressings for partial-thickness facial burns. Patients with partial-thickness facial burns hospitalized at the Burn Center between April 2014 and April 2017 were evaluated. Data pertaining to demographic characteristics, etiology, and degree of burn and percentage of burn to TBSA were collected. Pain, infection rates, reapplication rates, length of hospital stay, duration of healing, and presence of scar formation were analyzed. Median percentage of burn to TBSA was 15% (interquartile range [IQR]: 9–20). Fifteen patients had only facial burns, while 39 patients had burns on other parts of the body in addition to the face. Nine patients had deep partial-thickness burns, while 45 had superficial partial-thickness burns. Median length of hospital stay was 7 days (IQR: 3–15) for the entire study population and 4 days (IQR: 2–7.5) for patients who had only facial burns. Median healing time was 9 days (IQR: 7–12). Fifty-one (94%) patients had a Vancouver Scar Scale score of zero at 6 months. Use of hyaluronic acid-based wound dressings for facial burns is an effective and safe option.

Facial burns can result in a broad spectrum of functional disorders, from minor tissue damage to major loss of mobility.[1] Since the face is the most important part of the body in terms of communication with the outside world, cosmetic outcomes of treatment are as important as clinical and functional outcomes.[2] Therefore, it is important to consider all these criteria during treatment decision-making for facial burns.

Both conservative and surgical therapeutic options are available for facial burns. The choice of treatment depends on the depth and the degree of injury. Local care is generally sufficient for superficial burns, while a more aggressive approach may be required to achieve the best clinical and cosmetic outcomes in case of partial-thickness or deeper burns.[3,4] This may include various options such as local debridement, use of topical agents, wound dressings and skin substitutes. Topical preparations that include antimicrobial agents make a significant contribution to wound healing and scar formation by preventing wound infection.[5] Antibacterial dressings containing hydrocolloid or silver and various skin substitutes consisting of collagen or amnion membrane have been increasingly used over the last two decades.[6,7]

Hyaluronic acid (HA)-based wound dressings have also been introduced as a treatment option. High levels of HA in the human fetus play a key role in scar-less wound healing during fetal life. HA has been shown to support the structural integrity of the extracellular matrix owing to its water-retaining property, and contribute to wound healing via acceleration of epidermal cell migration and reepithelialization.[8] Additionally, due to its proven antibacterial properties, HA is a component of several topical and injectable cosmetic products and medications for dermatological diseases.

The purpose of this study was to assess the outcomes of HA-based wound dressings in patients with superficial and deep partial-thickness facial burns.

MATERIALS AND METHODS

Data pertaining to 885 burn patients hospitalized at the Karadeniz Technical University Medical Faculty Farabi Hospital Burn Center, Turkey, between April 2014 and April 2017, were retrospectively reviewed. Indications for hospitalization and depth of burn were determined on the basis of American Burn Association Burn Center referral criteria.[9,10] Burns that had a dry-red appearance (blanching on pressure) without blisters were classified as superficial burns, those with a dry-inelastic appearance (no blanching on pressure) and a white-gray to charred/black appearance were classified as full-thickness burns, while burns that did not qualify these criteria and burns associated with blisters were classified as partial-thickness burns.[10,11]

All patients with partial-thickness facial burns among hospitalized patients were evaluated. Patients with no facial burns, those with superficial burns (since these generally heal without

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scarring), or those with full-thickness facial burns (since surgical debridement is generally required), were excluded from the analysis. A total of 54 (6.1%) patients, all treated with HA-based wound dressing, qualified the patient-selection criteria and were included in the analysis. Data pertaining to demographic characteristics, depth of burn, cause of burn, percentage of the TBSA, and the results of the treatment were subjected to analysis. Approval for the study was granted by the Karadeniz Technical University Medical Faculty Scientific Research Ethical Committee.

All patients with partial-thickness facial burns were treated in the Burn Center. After appropriate superficial debridement, a commercially available HA-based wound dressing (Hyalosafe©; Anika Therapeutics, Padua, Italy) was used for all patients. The dressing was applied directly to the burn surface in such a way as to completely cover the burn surface. Hyalosafe© is manufactured using HYAFF technology and contains pure HA. The product is a sterile, flexible, transparent film (size: 15 × 10 cm) that is applied directly to the lesion and does not require subsequent fixation.[8]

The patients were followed-up according to a standardized protocol. Patients were evaluated daily during hospitalization and once every 2 days after discharge until complete epithelialization. After epithelialization, patients were invited for follow-up in the sixth month after burn. To assess the treatment efficacy, pain, presence of infection, frequency of reapplication of the product, and length of hospital stay were evaluated in the short-term period, and duration of wound healing and presence of scar formation were evaluated in the long-term period.

Pain evaluation was performed prior to application of the product, 6–12 hours after application, and on the day when epithelialization was first observed, using a Numeric Rating Scale (NRS) (range of scores: 0–10; 0, no pain; 10, maximum pain). Healing time was defined as the time elapsed to complete epithelialization in up to 95% of the facial burn area. Presence of scarring was evaluated using the Vancouver Scar Scale (VSS).[12] VSS allows for assessment of vascularity (0–3), pigmentation (0–2), pliability (0–5), and height (0–3) (minimum 0, maximum 3).[12] Parametric numerical data are presented as mean ± *SD*, and nonparametric numerical data as median (interquartile range [IQR]: 25th–75th percentile).

RESULTS

Forty-one (76%) of the 54 patients in the study were men and 13 (24%) were women. Median age of patients was 25 (IQR: 5–48) years. The cause of facial burns was fire (31 patients), scalding (20 patients), electrical burns (two patients), and chemical burn (one patient). Nine patients had deep partial-thickness burns, while 45 patients had superficial partial-thickness burns. Median percentage of burn to body area was 15% (IQR: 9–20). Burn was present in the face only in 15 patients, and in other areas of the body in addition to the face in 39. The demographic and clinical characteristics of patients are presented in Table 1.

Pain, presence of infection, frequency of reapplication of the product, and length of hospital stay were evaluated as short-term outcomes. The median NRS pain score was 6 (IQR: 3.25–7) before dressing application, 4 (IQR: 3–5) at 6–12 hours after application, and 2 (IQR: 1–2.75) on the day epithelialization was first observed. None of the patients developed wound infection. Reapplication of the product was only required in one patient, who had removed the original dressing. Median duration of hospitalization was 7 (IQR: 3–15) days. Median duration of hospital stay for the 15 patients who had only facial burns was 4 (IQR: 2–7.5) days. Time to healing and presence of scar (VSS score) were evaluated in the late treatment results period. Mean time to healing was 9 (IQR: 7–12) days. The scores for all parameters included in the VSS scores were normal in 51 (94%) patients, while scar formation was observed only in three patients. One patient with deep partial-thickness burn caused by scalding at the age of 1 year had a VSS score of 4 on account of pliability and scar height. One male patient with deep partial-thickness electric burn sustained at the age of 1 year had a VSS score of 6. A third patient with superficial partial-thickness burn caused by scalding had a VSS score of 1 on account of vascularity.

Images of two patients at different time points are shown in Figures 1 and 2.

DISCUSSION

This study evaluated the clinical and cosmetic outcomes of the use of HA-based wound dressings for the treatment of

Table 1. Patients' clinical and demographic data

Total Number of Hospitalized Burn Patients (*n*)		885
Number of Patients With Partial-Thickness Facial Burns (*n* (%))		54 (6.1%)
Age (Median (IQR))		25 (IQR: 5–48)
Sex (*n* (%))	Male	41 (76%)
	Female	13 (24%)
The Percentage of TBSA (Median (IQR))		15 (IQR: 9–20)
Burn Region (*n* (%))	Facial burn only	15 (27.8%)
	Face + upper extremity	16 (29.6%)
	Face + trunk	15 (27.8%)
	Face + trunk + extremity	5 (9.3%)
	Face + upper and lower extremity	3 (5.5%)

IQR, Interquartile range; *n*, number.

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Figure 1. Images of a male patient. (A) Time of admission. (B) After application of hyaluronic acid-based wound dressings. (C) Five days after the application of hyaluronic acid-based wound dressings. (D) Sixth month after the application.

superficial and deep partial-thickness facial burns. In addition to acceptable pain scores, the median duration of hospital stay in the study population was 7 days, whereas that in patients with only facial burns was 4 days. Infection was not observed in any of the patients. With respect to long-term outcomes, the median time to healing was 9 days (IQR: 7–12), and healing without scar formation was achieved in a vast majority of patients.

The pre-application median pain score in this study population was six, which decreased to four after 6–12 hours of application and to two at the time of first epithelialization. The fact that the product is generally applied only once and is spontaneously resorbed represents an advantage for both the patient and the physician since it eliminates the need for repeat application. Moreover, it also has a positive impact in terms of patient psychology and pain. Covering the entire burn surface with the product creates a protective barrier against infection. Since no dressing change is normally required, it also reduces the risk of infection by preventing contact with the wound area. Since the product is transparent, the development of infection can be easily detected by observation. The median length of hospital stay in the study population was 7 days (IQR: 3–15), whereas that among patients who had only facial burns was only 4 days (IQR: 2–7.5). We believe that shortening the hospital stay and lack of requirement for dressing may be considered advantageous in terms of costs.

In the long-term period, median time to first epithelialization was 4 days (IQR: 3–5), whereas the median healing time was 9 days (IQR: 7–12). Healing time in patients who received HA-based dressings was reasonably shorter than that reported previously for superficial partial-thickness burns (1–3 weeks), whereas healing times exceeded 3 weeks in case of deep partial-thickness burns.[12–14] Another parameter examined in the long term was the presence of scar formation. Scar formation according to the VSS was observed in only three patients, whereas 94% of the patients healed without scarring (zero point for VSS). Outcomes after treatment of facial burns are particularly important in terms of quality of life and patient psychology; our study shows that cosmetically acceptable results may be achieved with the use of HA-based wound dressings.

Increasing evidence shows that innovative biosynthetic wound dressings and skin substitutes are safe and provide satisfying outcomes. A membrane consisting of a synthetic copolymer was used for pediatric burns, which provided potential advantages in terms of length of hospital stay (median 10 days, ranging from 3 to 20), reepithelialization time (median 13 days, ranging from 7 to 29), and pain (median visual analog scale scores 3.2, ranging from 2 to 5).[15] Moreover, skin substitutes consisting of porcine collagen, HA, irradiated human amniotic membrane, and cadaveric skin allografts were investigated in patients with burns, all of which demonstrated effective results with acceptable outcomes and were comparable with those of our presented



Figure 2. Images of a female patient. (A) Time of admission. (B) After application of hyaluronic acid-based wound dressings. (C) Four days after the application of hyaluronic acid-based wound dressings. (D) Sixth month after the application.

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series.[6,13,16–19] However, since studies comprise various patient populations in terms of patients' age, burn location, and burn depth, it is difficult to argue that one is superior to the other in the absence of comparative studies on heterogeneous patient populations.

The main limitation of this study is the absence of a comparison group. However, due to the development of new therapeutic regimens, products that offer proven benefits with respect to wound healing have been routinely used at our burn center since years, and the conventional dressing approach is not employed for partial-thickness facial burns. It was therefore not possible to achieve a comparative study design using retrospective data. However, given the favorable outcomes that demonstrate the feasibility and safety of the product, further prospective comparative study is warranted. The single-application nature of the product, the absence of dressing requirements, and the suitability of treatment on an outpatient basis offer a considerable economic advantage; however, the lack of total cost analysis is another limitation of the study. Burn classification is based on the depth of the burn and generally relies on noninvasive observational experience. The use of subjective data for classification of patients' existing burns may therefore result in misclassification. However, all patients in this study were examined and classified by a single experienced surgeon at a high-volume burn center. We believe that, since there is no demonstrated superiority of the invasive/noninvasive methods for burn scoring over repeat evaluations by an experienced specialist, scoring by an experienced burn center surgeon is likely to be equally effective.[20]

CONCLUSION

Use of HA-based wound dressings for facial burns is an effective and safe option. They may provide acceptable pain scores and scar formation, need to be used only once, do not require repeat dressings, permit outpatient treatment, and require no specific tools for fixation. Further randomized, comparative studies are required to obtain more definitive evidence.

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