COMPARATIVE STUDY BETWEEN SODIUM CARBOXYMETHYL-CELLULOSE SILVER, MOIST EXPOSED BURN OINTMENT, AND SALINE-SOAKED DRESSING FOR TREATMENT OF FACIAL BURNS

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SUMMARY. Facial burns vary from relatively minor insults to severe debilitating injuries. Sustaining a burn injury is often a psychological trauma for the victim and is especially menacing when the face and neck are involved. This study was carried out on 60 patients with superficial dermal burns to the face admitted to the Burn Unit of Tanta University Hospital, Egypt, from September 2007 to July 2008. The patients were allocated randomly to one of three groups, each of which was treated with one of the following: sodium carboxymethyl-cellulose silver (Aquacel Ag®), MEBO® (moist exposed burn ointment), or saline-soaked dressing. We found that patients managed with MEBO® had less pain and itching and easier movement than those managed with Aquacel Ag®, while the Aquacel Ag® group required a shorter duration of time for healing, without any bad odour, than the MEBO® group. Quality of healing and patient satisfaction were nearly equal as regards MEBO® and Aquacel Ag®. Saline-soaked dressings were least satisfactory - they caused the most pain and itching, limited the patients' movements the most, needed the longest time for healing, and gave patients the least satisfaction. It was concluded that MEBO® was an excellent choice for management of facial burns owing to its soothing effect, ease of patient movement, easy handling, and good healing properties. Aquacel Ag® was found to be comparable to MEBO® and is specially recommended when frequent dressings cause difficulties for the patients or when they cannot accept a bad odour; saline-soaked dressings are not recommended for the management of facial burns because of the pain they cause, itching, limitation of patient movement, and delayed healing.

Introduction

The head and neck area has been identified as the site most frequently affected by thermal injuries, and the very young, the elderly, and the physically handicapped have been found to be the most vulnerable categories.[1-3]

Facial burns vary from relatively minor insults to severe debilitating injuries. The objectives of reconstruction following a facial burn include restoration of function, comfort, and appearance.[2]

The high incidence of second-degree burns has led many researchers to explore more effective treatment protocols. A wide variety of agents are available for treatment of burn wounds, including ointments, creams, and biological and non-biological dressings.[4]

Wound healing is affected by patient-related factors, the wound itself, and cells in the wound, with overlapping problems of microcirculation, local immunity, and dressing methods. The desired result is healing with minimal scarring and no functional defects.[5]

A good dressing should be cheap, alleviate pain, prevent infection, be easy to handle, permit easy and early mobilization, have no toxicity, cause no allergic reactions, and lead to quick and solid healing with a cosmetically acceptable scar.[6]

Local pathological changes in facial burns do not differ from those in other areas of the body except as regards the importance of this region and the formation of oedema. Most tissue is lost from heat coagulation of the protein within the tissue. The final tissue loss, however, is progressive and results from the release of local mediators, changes in blood flow, tissue oedema, and infection,[7,8]

Sodium carboxymethyl-cellulose silver (Aquacel Ag®) is a moisture-retentive topical dressing available in hydrofibre sheets made of a material that has been demonstrated to be safe and efficacious in the management of partial-thickness burns, showing parity to cadaver skin for most dressing-related aspects for this condition. It is a non-woven dressing made of sodium carboxymethyl-cellulose. Recently, 1.2% w/w silver was added to Aquacel®, creating Aquacel Ag®, which releases ionic silver into the dressing for up to two weeks. This duration in time differentiates Aquacel Ag® from other sustained-release silver delivery products indicated for burn management.[9,10]

Moist exposed burn ointment (MEBO) was developed in the mid-1980s by Professor Rongxiang of the Beijing Guangming Chinese Medicine Institute for Burns, Wounds and Surface Ulcers. MEBO is an ointment consisting of

an oily base of sesame oil and beeswax with herbal components comprised of 18 amino acids, 4 fatty acids, 7 polysaccharides, vitamins, and trace elements, plus an active substance consisting of 0.25% , -sitosterol. This mixture enhances re-epithelialization and repair by providing required nutrients and low partial pressure of oxygen, as well as removing necrotic tissues.[11,12] It isolates the wound bed from invasive environmental factors and reduces body fluid loss.[13]

Saline solution as a burn wound dressing keeps the burn wound constantly wet until it heals. This method is said to reduce the duration of hospital stay and to minimize equipment and materials of dressing allowing partial-thickness burns to heal promptly and eschar to separate early.[14]

Patients and methods

This study was carried out on 60 patients with superficial dermal face burns admitted to the Burn Unit of Tanta University Hospitals, Egypt, from September 2007 to July 2008.

Patients with flame or scald burns in the face were included but not those with chemical or electrical burns. Total body surface area (TBSA) burns exceeding 25% in adults (>12 yr) and 15% in children (<12 yr) were not included. Patients with other serious injuries, e.g. spinal damage, those with systemic disease affecting wound healing, e.g. diabetes mellitus type I, and those taking immunosuppressant drugs, e.g. corticosteroids, were also excluded.

All patients received initial treatment in the form of a thorough face wash with sterile 0.9% saline and removal of debris and foreign bodies. The face was then dried with sterile gauze. Hair in the burned area was shaved off with electric clippers. Blister fluid was evacuated but the blister epithelium was left intact as a biological dressing.[15]

In ear burns, the ear was cleaned as above, after which gentamicin cream was applied, while for the lips cocoa butter was applied to promote soothing and movement.[16]

The patients were allocated randomly to one of three groups, as indicated below.

Group I: Twenty patients with facial burns treated with sodium carboxymethyl-cellulose silver (Aquacel Ag®).

When the burns had been washed with saline, sheets of Aquacel Ag® were applied directly to the wound, with an overlap of 2 cm extending over non-burned surrounding skin.

In order to permit eyelid movement, the eyelids were not covered with Aquacel Ag® sheets; instead, they were covered with MEBO® or Api-Care® cream (twice daily).

If the wound was dry and Aquacel Ag® sheets were not fixed to the wound, saline was added to transform the hydrofibre into a gel that attached easily to the wound (*Fig. 1*). Aquacel Ag® sheets were secured in place with an outer sterile dressing (two layers of gauze with a thin layer of cotton in between), while the outer dressing was secured with Surgi-net® (a cylindrical elastic net encircling the face and fixing the dressing in place) (*Fig. 2).*

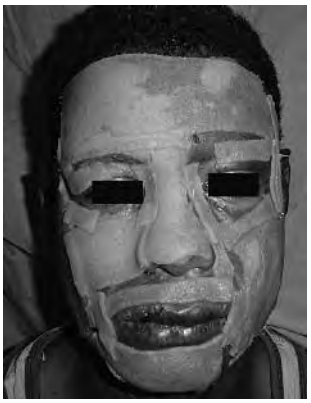

Fig. 1 - Aquacel Ag® sheets applied to facial burn wounds and saline added to transform sheets into gel.

Fig. 2 - Aquacel Ag® sheets secured in place using Surgi-net®.

The sheets were checked every third day for adherence of the Aquacel Ag® sheets and for the purpose of changing the outer dressing. In cases of non-adherence or slippage, the sheets were removed and replaced after thorough wound cleansing with saline.

When complete re-epithelialization occurred in part of the wound, the Aquacel Ag® sheet over it was spontaneously dried and separated from the wound. When complete healing occurred most of the sheet was separated and removed spontaneously (*Figs. 3a, 3b*).

Group II: Twenty patients with facial burns treated with MEBO®. The facial burn was washed with saline and a thin layer of MEBO® was applied over the burned areas of the face. The same was done three times per day

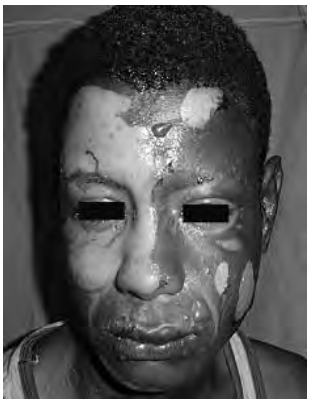

Fig. 3a - Group 1: 15-yr-old patient, day 1 post-burn.

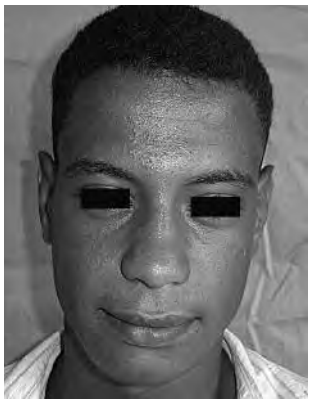

Fig. 3b - Group 1: same patient, 3 months post-burn.

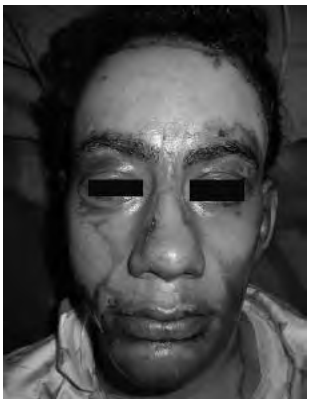

Fig. 4a - Group 2: 20-yr-old patient, day 1 post-burn.

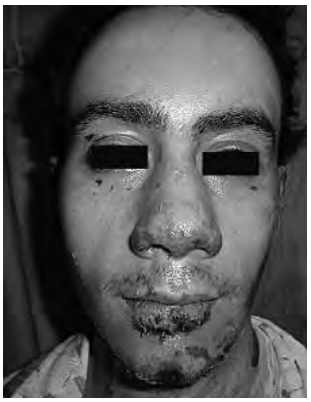

Fig. 4b - Group 2: same patient, day 10 post-burn.

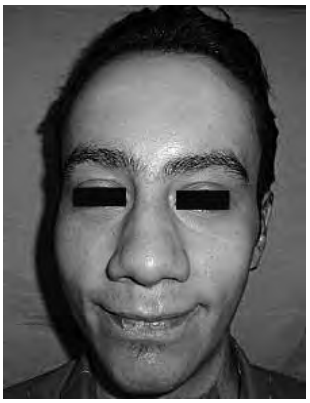

Fig. 4c - Group 2: same patient, 3 months post-burn.

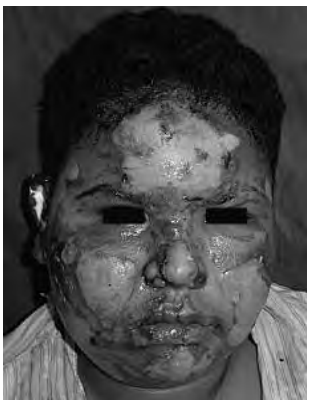

Fig. 5a - Group 3: 14-yr-old patient, day 1 post-burn.

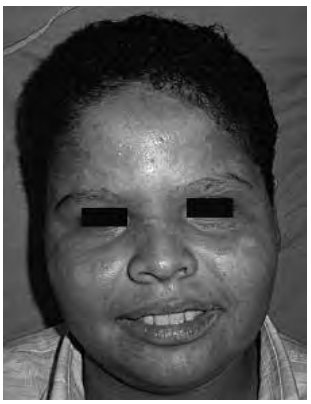

Fig. 5b - Group 3: same patient, day 17 post-burn.

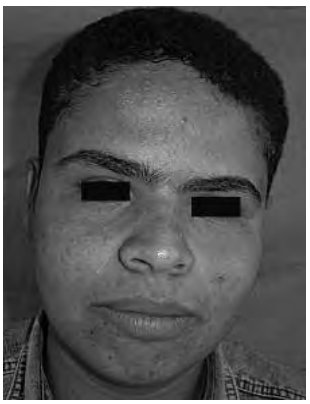

Fig. 5c - Group 3: same patient, 3 months post-burn.

at nearly equal intervals after cleansing of the wound with saline. Application of MEBO® was continued until complete healing occurred (*Figs. 4a, 4b, 4c)*.

Group III: Patients with facial burns treated with saline-soaked dressings. After the facial burn had been washed in saline, sterile dressings (two made of gauze with cotton in between) soaked with sterile saline 0.9% were placed over the burned area of the face. When the dressing became dry, a new soaked dressing was placed over the wound, and so on. This procedure continued until healing occurred (*Figs. 5a, 5b, 5c)*.

The patients were assessed as to pain, itching, ease of movement while the dressing was *in situ*, odour, time necessary for healing, quality of healing, cost of the dressing, and patient satisfaction.

Results

There were no significant differences between the three groups as regards age, sex, TBSA, and burn cause. Pain was scored on a visual analogue scale. On the first two days post-burn, the pain rated by the patients was more severe than that rated by the same patients from day 3 post-burn onwards. Group II patients felt the least pain both on the first two days (mean score = 3.1 ± 1.9) and on day 3 post-burn onwards (mean score = 1.3 ± 1.5) (*Figs.* 6, 7).

The difference between the groups was significant both on days 1 and 2 ($p < 0.05$) and from day 3 onwards ($p < 0.05$).

There was no itching in 25% of cases in group I, 65% of cases in group II, and 10% of cases in group III. Itching was rated mild in 45% of cases in group I, 20% in group II, and 50% in group III. Itching was rated moderate in 20% of cases in group I, 15% in group II, and 25% in group III. There was severe itching in two cases (10%) in group I and three cases (15%) in group III. The difference between groups was significant ($p < 0.05$) (*Fig. 8*).

Ease of movement with the dressing was rated by the patients excellent in 70% of cases in group II but poor in 75% of cases in group III (*Table I)*. The difference between groups was highly significant ($p < 0.001$).

Nearly all cases (95%) in group I and 75% of cases

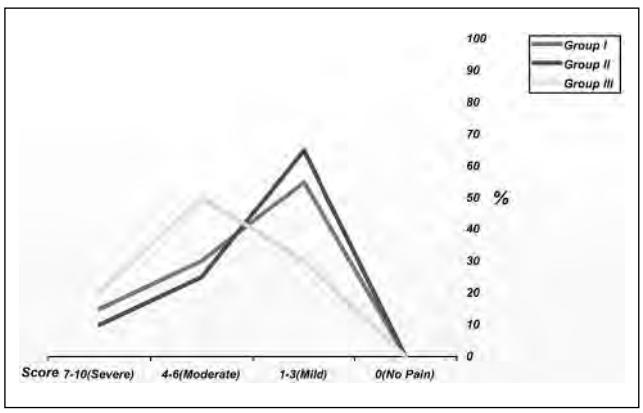

Fig. 6 - Pain scores, days 1 and 2 post-burn (visual analogue scale).

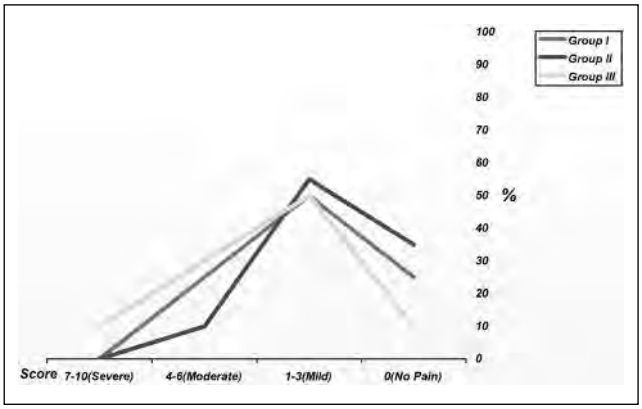

Fig. 7 - Pain scores from day 3 onwards (visual analogue scale).

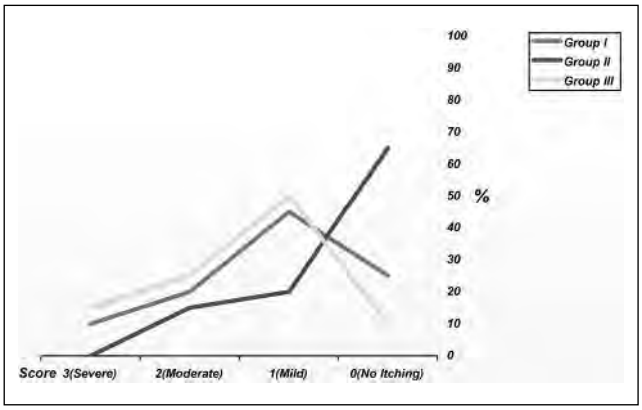

Fig. 8 - Itching scores.

Table I - Ease of patient movement with dressing *in situ*

Ease of movement	Group I		Group II		Group III	
	No.	%	No.	%	No.	%
1 Excellent	4	20	14	70	0	0
2 Good	15	75	5	25	2	10
3 Fair	1	5	1	5	3	15
4 Poor	0	0	0	0	15	75

Table II - Odour of the dressing

Odour score	Group I		Group II		Group III	
	No.	%	No.	%	No.	%
0 No odour	19	95	1	5	15	75
1 Acceptable odour	1	5	15	75	2	10
2 Bad odour	0	0	4	20	3	15

in group III reported "No odour" and 75% of cases in group II reported "Acceptable odour" (also in group II, 20% of cases opted for the definition of "Bad odour" (*Table II*). The difference between groups was highly significant ($p < 0.001$).

The mean duration before complete healing was 10.05 ± 2.3 days in group I, 10.35 ± 2.8 days in group II, and 12.05 ± 2.4 days in group 3 (*Figs. 9-11*). There was a significant difference between groups with regard to healing time ($p < 0.05$).

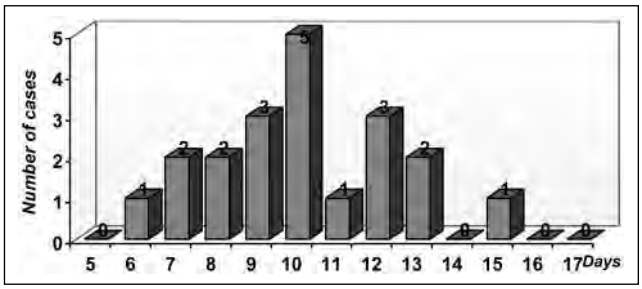

Fig. 9 - Duration of healing (group 1).

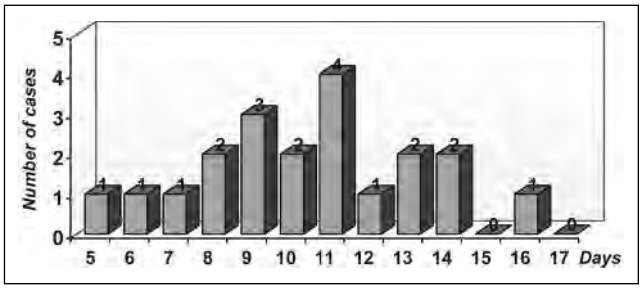

Fig. 10 - Duration of healing (group 2).

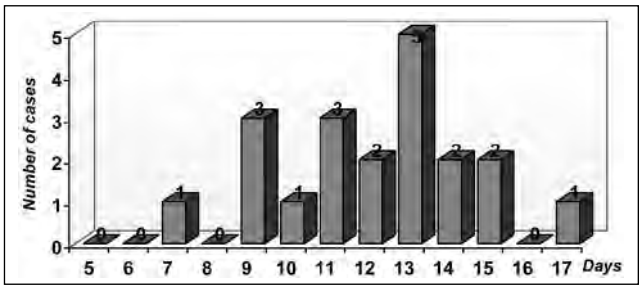

Fig. 11 - Duration of healing (group 3).

The commonest judgement on quality of healing in all groups was "Excellent", constituting 80% of cases in groups I and II and 55% in group III (*Table III*). *P* was > 0.05, so there was no significant difference between the groups in the quality of healing. The cost of the dressing until healing occurred was calculated for each patient as "total cost". In group I the total cost ranged from 140 to 420 Egyptian pounds (mean cost, 298.6 ± 91.8 Egyptian

Table III - Quality of healing

Quality of healing	Group I		Group II		Group III	
	No.	%	No.	%	No.	%
1 Excellent	16	80	16	80	11	55
2 Good	3	15	2	10	5	25
3 Fair	1	5	2	10	2	10
4 Poor	0	0	0	0	2	10

pounds); in group II the total cost ranged from 108 to 432 Egyptian pounds (mean cost, 236.5 ± 81.2 Egyptian pounds; and in group III the total cost ranged from 30 to 66 Egyptian pounds (mean cost, 40.1 ± 13.1 Egyptian pounds (*Table IV)*. The difference between groups was highly significant ($p < 0.001$).

Table IV - Cost of dressing

Cost of dressing (Egyptian pounds)	Group I	Group II	Group III
Cost range	140-420	108-432	30-66
Mean cost	298.6 ± 91.8	236.5 ± 81.2	40.1 ± 13.1

The commonest groups in the patient satisfaction scores were that of "Excellent", in group I (55% of cases) and group II (60% cases), while group III recorded "Fair" in 45% of cases. This means that group II and I were the most satisfied and group III the least (*Table V*). *P* was < 0.05 and there was therefore a significant difference between groups.

Table V - Patient satisfaction

Patient satisfaction	Group I		Group II		Group III	
	No.	%	No.	%	No.	%
1 Excellent	11	55	12	60	2	10
2 Good	5	25	6	30	9	45
3 Fair	3	15	2	10	4	20
4 Poor	1	5	0	0	5	25

Discussion

The head and neck have been identified as the sites most frequently affected by thermal injuries. Facial burns vary from relatively minor insults to severe debilitating injuries.[1,2]

Sustaining a burn injury is often a psychological trauma to the victim and is especially menacing when the face and neck are involved.[17]

In our study, pain score was rated by the patients to evaluate the degree of pain for each dressing. There was a significant difference between the groups ($p < 0.05$). Group II - the MEBO® (moist exposed burn ointment) group - felt the least pain. Many studies[5,18-22] showed that MEBO had an analgesic effect, together with an anti-inflammatory and anti-oedema effect. In our study, Aquacel Ag® came second as regards analgesic effect. Hemeda et al.[23] used Aquacel Ag® in the treatment of partial-thickness burns and skin graft donor sites and found that 40% of patients experienced slight pain while the dressing was *in situ* and on final removal of the dressing. No pain was recorded in 88.3% of cases and slight pain in 11.7%.

Caruso et al.[24] compared the effect of Aquacel Ag® and of silver sulphadiazine in the treatment of partial-thickness burns and observed that there was less pain and less anxiety during dressing changes with Aquacel Ag® and also that fewer analgesics and narcotics were used in patients treated with Aquacel Ag®.

There was mild itching in 50% of cases treated with saline-soaked dressings. This was less frequently observed with Aquacel Ag® and there was no itching in most cases treated with MEBO®. These results confirmed those of previous studies.[5,18,21,22]

Itching was observed in the first few days of treatment with saline dressing (due to irritation of non-epithelialized wound by saline), but it then reduced, while with Aquacel Ag® itching was observed in the healing stage (when the Aquacel Ag® sheet started to separate). Another study[25] stated that itching was an annoying and unrelenting manifestation of healing.

Another unpleasant impression was the dressing's odour. While more or less no unpleasant odour was perceived by patients treated with Aquacel Ag®, 75% of MEBO® patients reported an acceptable odour (of burned peanuts) and 20% of the same defined the odour as bad.

A previous study by our burn unit[26] found that most patients treated with MEBO® disliked the dressing's unpleasant odour.

Regarding patients' ease of movement while the dressing was *in situ*, MEBO® gave excellent results, followed by Aquacel Ag®, while the saline-soaked dressing appeared to interfere with free patient movement as the dressing had to be soaked with saline all the time and therefore had to be changed frequently (there was nothing fixing the soaked dressing *in situ*). Caruso[24] found significantly greater flexibility during wearing of the dressing in patients treated with silver sulphadiazine than in patients treated with Aquacel Ag®.

Thus, on the basis of the above findings, overall patient satisfaction was least with saline-soaked dressings (more pain and itching sensation, plus limitation of patient's ambulation).

However, other studies found positive results with regard to patient compliance with both Aquacel Ag®[8,23,24] and MEBO®.[19,20,22,23]

The time needed for complete healing was comparable in the Aquacel Ag® and the MEBO® treated groups (10.05 ± 2.3 days and 10.35 ± 2.8 days, respectively); more time was needed for complete healing using saline dressing (12.05 ± 2.4 days). The longer duration needed in group III (saline-soaked dressing) may have been due to the absence of a definite barrier comparable to Aquacel Ag® and MEBO®. Other studies[23,27] found that healing rates with Aquacel Ag® were comparable to those using allograft skin and other synthetic membranous materials. Also, many studies[5,14,22] have stated that MEBO® prevents desiccation of denuded dermis and allows faster migration of keratinocytes, thus significantly accelerating wound re-epithelialization.

Regarding the quality of the healed skin, there was no significant difference between the three methods of dressing. Vloemans[27] stated that it was difficult to draw conclusions with respect to the final cosmetic results, since this depended on a large number of variables that could not be individually analysed and correlated.

The cost of the dressing for the entire course of treatment until healing occurred was evaluated. Aquacel Ag® was the most expensive method (mean cost, 298.6 ± 91.8 Egyptian pounds for the entire course of treatment) and the saline-soaked dressing was the cheapest method (mean cost, 40.1 ± 13.1 Egyptian pounds). MEBO® was comparable to Aquacel Ag® (mean cost, 236.5 ± 81.2 Egyptian pounds). For our study we calculated only the cost of the dressing material (excluding personnel, hospital stay, and other costs, e.g. drugs).

Robinson et al.[28] reported that a cost-benefit study of the hydrofibre dressing demonstrated a significant saving of clinical time, owing to the fact that the largest component in the cost-benefit equation was staff time. Caruso[24] analysed the cost of primary and secondary dressings, labour, and medications, establishing that the mean total cost of Aquacel Ag® was less than that of silver sulphadiazine. However, in the same study, the cost of primary dressing materials was significantly higher for Aquacel Ag®.

Conclusion

We found that burn patients managed with MEBO® complained of less pain and itching, and had greater ease of movement, than those managed with sodium carboxymethyl-cellulose silver (Aquacel Ag®). However, Aquacel Ag® allowed more rapid healing and, compared to MEBO®, was odourless. Quality of healing and patient satisfaction were practically the same with MEBO® as with Aquacel Ag®.

Saline-soaked dressings were the least recommendable as they caused most pain and itching, limited patients' movements, required most time for healing, and obtained least patient satisfaction.

Lastly, regarding the cost of the dressing, the cost of the Aquacel Ag® dressing was slightly higher than that of MEBO® (with regard to the entire duration of treatment, the cost was comparable). The cost of MEBO® was nearly three times that of the saline-soaked dressings.

Recommendations

- It is important to recognize the importance of facial burns in clinical practice, dedicating to them special care in our management of burn patients.
- There are many types of dressing materials for facial burns, but keeping the wound moist, with avoidance of desiccation of newly formed tissues, is the most important factor to promote healing.
- Moist exposed burn ointment (MEBO®) is an excellent choice for management of facial burns owing to its soothing effect, ease of patient movement, easy handling, and good healing properties. MEBO® is especially recommended for patients who cannot tolerate the occlusive dressing used to cover Aquacel Ag® over the face. MEBO® is also easy for patients to use when they are managed as outpatients.
- Aquacel Ag® is comparable to MEBO® and is specially recommended when frequent dressings are difficult for patients and for patients who cannot tolerate its odour.
- Saline-soaked dressings are not recommended for the management of facial burns because of the extra pain, itching, limitation of patient movement, and delayed healing.
- Further studies are needed in order to find the ideal dressing for facial burn management.

RÉSUMÉ. Les brûlures du visage varient de cas relativement mineurs aux lésions graves et débilitantes. Subir une brûlure constitue souvent un traumatisme psychologique pour la victime et il est particulièrement inquiétant lorsque le visage et le cou sont en cause. Cette étude a été réalisée sur 60 patients atteints de brûlure cutanée dermique superficielle du visage admis à l'Unité des Brûlures de l'Hôpital Universitaire de Tanta, Egypte, de septembre 2007 à juillet 2008. Les patients ont été répartis au hasard en trois groupes et chaque groupe a été traité avec l'emploi ou de carboxyméthylcellulose contenant de l'argent (Aquacel Ag®) ou de MEBO® (moist exposed burn ointment/onguent pour les brûlures exposées humides) ou des pansements trempés dans une solution saline physiologique**).** L'Auteur a constaté que les patients traités avec le MEBO® avaient moins de douleur et de prurit et une facilitation majeure dans les mouvements par rapport aux patients traités avec Aquacel Ag®. Par rapport aux patients traités avec le MEBO®, la période de la guérison était plus brève et sans odeur désagréable. La qualité de la guérison et la satisfaction des patients ont été à peu près égales pour MEBO® et Aquacel Ag®. Les pansements trempés dans une solution saline physiolo-

gique étaient les moins indiqués, à cause de la douleur qu'ils provoquaient, le prurit, la limitation des mouvements du patient et les temps de la guérison trop longs - cette méthode a été évaluée par les patients celle qui donnait la moindre satisfaction. L'Auteur conclut que le MEBO® constitue un excellent choix pour la gestion des brûlures du visage en raison de son effet apaisant, la facilité des mouvements du patient, la simplicité d'emploi et les bonnes qualités de guérison. Aquacel Ag® est comparable au MEBO® et son emploi est particulièrement recommandé dans les cas où le changement fréquent des pansements crée des difficultés pour les patients et quand ils ne peuvent pas tolérer son odeur. Les pansements trempés dans une solution saline physiologique ne sont pas recommandés pour la gestion des brûlures du visage à cause de la douleur, le prurit, la limitation des mouvements du patient et la guérison tardive.

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