

Table 2. Wound healing after surface dermabrasion

Pt.	Sx	Age	Burn type	%TBSA burned	Day of application	Type of cover	Area grafted (cm ²)	No. of applications	Wound preparation	Healing /days
17	M	4	Scald	15	7	RS	40	1	SD	Y/4
18	F	2	Scald	9	5	RS	75	1	SD	Y/3
19	M	2	Scald	8	5	RS	40	1	SD	N
3	M	14	Scald	13	4	RS	60	1	SD	N
12	M	3	Scald	30	4	RS	40	1	SD	N
20	M	9	Scald	8	6	RS	40	1	SD	N
21	F	2	Scald	28	2	RS	40	1	SD	N
22	M	3	Scald	10	5	RS	40	1	SD	N
18	F	2	Scald	9	5	Xe	60	1	SD	Y/3
17	M	4	Scald	15	7	Aq	40	1	SD	Y/4
3	M	14	Scald	13	4	Xe	50	1	SD	N
6	M	6	Scald	25	4	Xe	40	1	SD	N
5	M	1	Scald	26	3	Xe	50	1	SD	N
12	M	3	Scald	30	4	Aq	30	1	SD	N
19	M	2	Scald	8	5	Aq	40	1	SD	N
5	M	1	Scald	26	3	cream	200	1	SD	N

Pt - patient, Sx - sex, RS - RHPS, Xe - xenograft, Aq - Aquagel, SD - surface dermabrasion, Y/n - healed in n days, N - not healed

Table 3. Wound healing after deep dermabrasion

Pt.	Sx	Age	Burn type	%TBSA burned	Day of application	Type of cover	Area grafted (cm ²)	No. of applications	Wound preparation	Healing /days
12	M	3	Scald	30	13	RS	45	1	DD	Y/4
13	M	8	Scald	12	8	RS	50	1	DD	Y/3
13	M	8	Scald	12	8	RS	40	1	DD	Y/5
21	F	2	Scald	28	6	RS	50	1	DD	Y/4
12	M	3	Scald	30	17	RS	45	1	DD	N
21	F	2	Scald	28	8	RS	40	1	DD	N

Pt - patient, Sx - sex, RS - RHPS, Xe - xenograft, Aq - Aquagel, DD - deep dermabrasion, Y/n - healed in n days, N - not healed

The most rapid healing with RHPS that could even prevent conversion into full-thickness wounds has been achieved after early tangential excision. Alternatively, deep dermabrasion can be used with some delay in healing. Surface dermabrasion is not suitable for this purpose.

Discussion

Commonly used biological or synthetic covers do not promote fast epithelization of donor sites and deep dermal burns. Janzekovic found that for a fast, efficient therapy and prevention of further deepening and hypertrophic scarring, dermal burns may be grafted with thin split-thickness skin autografts, resulting in shorter hospital stay and pain reduction (Janzekovic, 1970). Also human epidermal keratinocytes, cultured by the technique described by Rheinwald and Green (Rheinwald and Green, 1975; Green et al., 1979), have resulted in

an important advance in the therapy of DDB. Nuñez-Gutiérrez et al. (1996) showed that with an integral combined therapy consistently utilizing cultured allo-keratinocyte sheets for donor sites and deep dermal burns (and cultured autografts when needed), the total hospital stay of extensively burned patients is shortened by 30–40%. The disadvantage of cultured keratinocyte sheets, however, is their fragility, hypersensitivity, complicated preparation and difficult manipulation.

In order to overcome these problems, we have developed recombined human/pig skin (Matoušková et al., 1993). The RHPS shows higher mechanical resistance permitting easy handling, optimal adhesiveness, as well as a haemostatic effect and noticeable relief of pain. All these effects are accompanied by an apparently increased level of resistance to infection (Matoušková et al., 1997).

Various types of keratinocyte grafts had frequently failed to take, often due to incorrectly prepared wounds. Our aim was to examine the ways and timing of wound preparation for successful RHPS application. We compared the healing effect of the RHPS on wound beds prepared by surface dermabrasion, tangential excision and deep dermabrasion.

The optimum healing effect of RHPS was achieved on wound beds prepared by tangential excision. The earlier the wound was excised and covered with RHPS, the faster was the healing. Conversion and hypertrophic scarring was prevented by early RHPS application, as resulted from comparison with xenografts or silver sulphadiazine creme effect. From the two tangentially excised wounds which did not heal (out of 17 RHPS treated), one was a part of an extensive burn, in which the RHPS was probably dissolved by the activity of proteolytic enzymes released to necrolyse the surrounding full-thickness burn areas. In the Aquagel controls, low adhesiveness and absence of a haemostatic effect appear to be disadvantages of this hydrogel cover, particularly for the use on larger freshly excised bleeding wounds.

The involvement of allo-keratinocytes delivered by the RHPS in wound healing was recently demonstrated in a parallel study (Pokorná et al., in this issue). Male keratinocytes were identified by FISH for the Y chromosome four days after transfer onto the wound of a female patient.

Deep dermabrasion represents an alternative to tangential excision. A great problem in burns and scalds is the depth diagnosis, because it may change in the early phase during 3–5 days (Deitch et al., 1983; Muller et al., 1996). In order to prevent further deepening, deep dermabrasion has to be performed as soon as possible. Usually 6–8 days after application of antibacterial creams the necrolysed layer in DDB is easily removed by blunt abrasion, making the wound bed suitable for RHPS grafting. This alternative has some advantages compared to early excision: in this phase the diagnosis of the burn depth is more precise, there is no danger of a too deep excision that could remove the remnants of the adnexa in the DDB, and there is minimal haemorrhage. The disadvantage of deep dermabrasion is a delay of 2–5 days compared to early excision, in the course of which deepening might occur.

It is apparent that in wounds prepared by surface dermabrasion healing was achieved only in 25%–33%, no matter what cover was used (RHPS, xenograft or Aquagel). This indicates that surface dermabrasion is not a suitable preparation of a deep dermal bed for RHPS grafting. The most probable explanation consists in the fact that a thin necrotic layer remains on the wound, because blunt abrasion was performed too soon, i.e. in the phase in which disintegration of the thin necrotic layer had not yet taken place. The positive influence of the RHPS on wound healing apparently depends on a close contact between the delivered keratinocytes and the capillaries in the wound bed.

A regular availability of the allo-RHPS can make early excision and perhaps also deep dermabrasion a feasible approach to deep dermal burns. The usual result is rapid healing and thus prevention of conversion.

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