

Place of Total Self-Skin Transplant in the Management of Burns in Children: Results and Predictive Factors

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Abstract

Introduction: Skin transplant is essential in the management of skin substance losses, especially in deep burns. Our work aims to present, through a series of cases, the results of the skin self-transplant carried out to supplement the treatment of skin burns. **Materials and Methods:** A one-year prospective study of the total self-skin transplant performed in the management of burns in children was included. After clinic and biologic considerations, a total self-skin transplant was performed. **Results:** Forty-five burns were hospitalized, of which six patients received a total self-skin transplant. The average age was 7.43 years with male predominance. The burns were deep thermal burns, preferentially located on the trunk and upper limbs covering over 10% - 25% of the body surface of which 3% - 13% was transplanted. Transplant held in all patients. The surfaces left in spontaneous healing took at least 6 months to heal with some complications. **Discussion:** We performed a total self-skin transplant beyond technical reasons, for the best aesthetic and functional result it offers. The transplant significantly reduced the healing time with better aesthetic and functional results. The burned surfaces left to direct healing took an average of 6 months to heal and there were associated complications such as formation of keloid scars, hypertrophic plaques and skin retractions leading to cosmetic deformities. The final results appear to be independent of the time required to complete the transplant, and it will be necessary to ensure that there is no local and systemic infection and anaemia. **Conclusion:** Total self-skin grafting still has its place in the initial management of burns in children. It offers good aesthetic and functional results.

Keywords

Skin Transplant, Burn, Child

1. Introduction

Skin transplant is an indispensable tool for treating skin loss, particularly in the case of deep burns [1]. Depending on the origin of the transplant, a distinction is made between self-skin transplant when it is taken from the patient himself, skin transplant from a genetically identical donor, homologue transplant when it is taken from another human being and hetero transplant taken from an animal [2] [3]. Depending on the size of the transplant, we have a free skin transplant, total skin transplant and semi-thick skin transplant. The free skin graft uses the epidermis and a more or less deep part of the dermis. The total skin transplant takes all the layers of skin as well as the appendages. Semi-thick skin transplant is intermediate between the two previous [2]. The transplant relies on the vascularisation of the recipient site for its nourishment, which distinguishes it from the flap which contains its own vascular network [2].

In general, a total skin transplant or total self-skin transplant is indicated in the management of burns sequelae or fresh deep burn located at a functional zone with a high risk of retraction. No previous study has been made in our institution focused on total self-skin transplant. Therefore, this study aimed to present, through a series of cases, the results of total self-skin transplant carried out for the management of skin burns in children in our setting.

2. Material and Methods

Type and period of study. This was a prospective and descriptive study carried from January 2019 to January 2020 at the department of pediatric surgery at Hassan II University Hospital of Faz-Morocco.

Inclusion criteria: All patients aged from 0 to 16 years old admitted for deep burn requiring a total self-skin transplant were included.

Non Inclusion criteria: Were not included:

- The other burns left entirely to direct healing;
- The total self-skin transplant was performed in the context of a substantial loss of skin from a different aetiology other than burns.

The variables were: socio-demographic (age, sex), clinical (the type and the site of the burn, its extent, the depth, and the time to onset), biological (the haemoglobin' rate and CRP), the result (healing time, aesthetic and functional aspect).

Protocol and procedure. We choose as a predictor factor the patient's age, the extent of the burn, and the period of transplant (from burn to the day of transplantation). To give a maximum chance to the transplant, the patients recruited for this study were transfused with red blood cells 24 hours before the transplant with the aim to achieve a haemoglobin concentration of 14 g/dl, and antibiotic therapy (amoxicillin + clavulanic acid) before and post-transplant.

We carried out a total self-skin transplant that was completely defatted and perforated to make it into a mesh as well as increase the surface area. The transplant was taken according to availability from either the inguinal, the calf; the thigh or the abdomen. The donor site was sutured by a continuous subcuticular

with 0000 nylon. The transplant islands were fixed by separate stitches to 0000 catgut. The dressing was left in place without any local care for 10 days. Thereafter, the degree of healing in the grafted area and the direct-healing areas was monitored intermittently at specific intervals.

Data analysis: Data were collected and analyzed by Epi info version 7.2.2. We performed a description of patients and their management. We analyzed the impact of the predictor factors on the result of the self-skin transplant. We compared the transplanted zone to those left in spontaneous healing.

Ethical aspects: parental consent was obtained for the use of patients' clinical data. We strictly respect anonymity. The images do not take any part of the body that could identify the patient.

3. Results

Epidemiology: During our study period, forty-five (45) serious burns were hospitalized in our department; of which six (6) patients received a total self-skin transplant, a frequency of 13.33%. The average age was 7.43 years [7 months - 13 years] with a male predominance (4/2) (**Table 1**).

Clinical and biological aspects: Four patients were seen immediately after the burn, two had a neglected burn, one of which was a one-day burn and the other a seven-day burn. They were all thermal burns (fire, hot water, petrol explosion, hot tea). Most of them were located on the trunk and upper limbs, deep and extensive on average 17.67% [10% and 25%] (**Table 1**). The mean haemoglobin level was 10.8 g/dl, white blood cells 10786/mm³.

Management: After clinic and biologic considerations, the patients were transplanted on average on the 46th day after the burn [range 27 and 91 days]. The transplant area varied between 3% and 13% of the body surface area with an average of 4% of the burnt area, by 2 or 3 transplant islands (**Table 1**).

Results: The transplant was held in all patients for an average of 22 days (**Figures 1(a)-(d)**). One patient had a second series of transplants on the one hundred and second day (102) of her burn which failed. The period of transplant, patient's age, the extent of the burn, have no impact on the result of the total self-skin transplant. The burned surfaces left to direct healing took an average of 6 months to heal and others were still healing after more than one year of follow-up (**Figures 2(a)-(c)**). In addition to a longer period taken to heal, there were associated complications such as the formation of keloid scars, hypertrophic plaques (five patients) and skin retractions (two patients) leading to cosmetic deformities (**Table 1**). These last two patients were scheduled for surgery in our institution, while the other three were referred to dermatologists for further treatment.

4. Discussion

Overall burn mortality has improved thanks to progress in resuscitation and understanding of the pathophysiological mechanisms. However, in our African

context, the challenges remain major.

We aim to present, through a series of cases, the results of total skin self-transplant carried out for the management of skin burns in children.

Table 1. Description of the six (6) children who received a total self-skin grafting for the management of their skin burns.

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6
Age	4 years	11 years	13 years	4 years	7 months	12 years
Sex	Boy	Boy	Boy	Girl	Boy	Girl
Agent	Hot tea	Fire	Petrol	Hot water	Hot tea	Fire
Delay of consultation	Day 0	Day 0	Day + 7	Day 0	Day + 1	Day 0
Burn' location	Neck, trunk, arm, forearm	Trunk, arm, forearm	Leg	Forearm, trunk, perineum, buttocks, thigh, leg	Trunk, arm	Trunk, perineum, buttocks
Burn Surface	10%	25%	16%	18%	10%	24%
Burn depth	2 nd degree	2 nd degree	3 rd degree	2 nd degree	2 nd degree	2 nd and 3 rd degree
Period of transplantation	Day + 27	Day + 34	Day + 43	Day + 91; Day + 102	Day + 44	Day + 41
Biologic parameters before the transplantation						
Haemoglobine (g/dl)	10	11	13	9	12	10
White blood cells/mm ³	11,000	13,000	10,740	15,071	7230	7680
CRP (mg/l)	17	42	232	21	8	2
Donor site	Thigh	Thigh	Thigh, inguinal	1: Abdominal, calf 2: Inguinal	Inguinal, thigh	Abdominal, calf
Transplanted site	Arm, thunk	Thrunk	Leg	1: Thigh, buttocks 2: Back	Thrunk	Abdominal, thigh
Number of Island	2	3	3	3	3	2
Transplanted surface	3%	5%	13%	7%	4%	8%
Postoperative management						
Antibiotics	7 - 14 days	15 - 21 days	>21 days	>21 days	7 - 14 days	>21 days
Others	Honey	Honey	Kinésithérapie + Honey	Honey	Honey	Honey
Healing time						
Transplant	16 days	25 days	28 days	1:19 days; 2: failure	23 days	21 days
Directed healing	4 months	6 months	11 months in progress	13 months in progress	3 months in progress	6 months in progress
Squelles	Chloids, rétraction	Cheloids	None	Cheloide	Cheloids	Cheloids

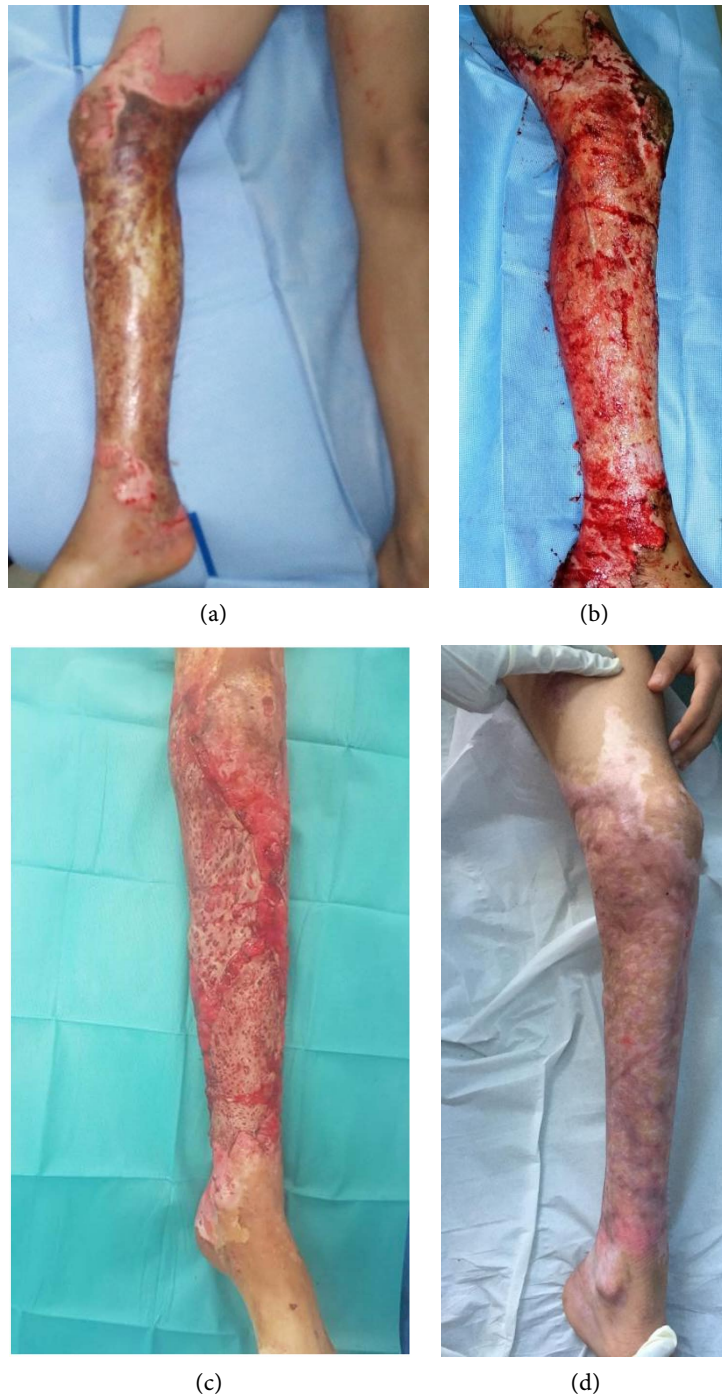


Figure 1. (a) Clinical image of a patient burned by exposure to 3rd-degree fire sitting on the circumferential leg extended over 16%; (b) Clinical image of a patient burned by exposure to 3rd-degree fire sitting on the circumferential leg extended over 16%; after necrosectomy; (c) Clinical image of a patient burned by exposure to 3rd-degree fire sitting on the circumferential leg extended over 16%. After necrosectomy and clinical and biological consideration, a total skin graft was performed on 43rd day out of 13%; (d) Clinical image of a patient burned by exposure to 3rd-degree fire sitting on the circumferential leg extended over 16%. After necrosectomy and clinical and biological consideration, a total self-skin transplant was performed on 43rd day out of 13%. Final result (d) after one year of follow-up.



(a)



(b)



(c)

Figure 2. (a) Clinical image of a patient with a deep 2nd and 3rd-degree thermal burn spread over 25% after necrosectomy; (b) Clinical image of a patient with a deep 2nd and 3rd-degree thermal burn spread over 25% after necrosectomy, total self-skin transplant with good aspect tenth day 10; (c) Clinical image of a patient with a deep 2nd and 3rd-degree thermal burn spread over 25% after necrosectomy, total self-skin transplant with the result after 11 months of follow-up; areas left in directed healing are still healing.

Domestic accidents are common in pediatric population where burns are a major concern. In Morocco, 6 out of 10 burn victims are children, 85% of whom are of domestic origin. The burns are a frequent reason for emergency consultations and hospitalization, accounting for 2% of emergency admissions in Morocco's university hospitals [4]. Burns occur mainly in early childhood when children are in the process of discovering their environment, and the turbulence of boys could explain the predominance of the male sex [3].

The trunk and upper limbs are more exposed [4] [5] [6]. This is an extreme emergency, which is consulted immediately or in the hours following the accident. Thermal burns are by far the most frequent leaving a large burnt area. Se-

verity criteria vary according to the age of the child, the causative agent, the extent and depth of the burn and the associated defects [3] [4]. Our epidemiological and clinical data are according to the literature. We did not find any particular differences.

Deep second-degree and third-degree burns take a longer time to heal and require a skin transplant for faster and better healing. In our study, skin transplant was needed in 13.33% of the burns cases, which is close to the 14% observed by *H. Droussi* [4] [7]. We performed a total self-skin transplant beyond the technical reasons, for the best aesthetic and functional result it offers [8] [9].

Thus, for a transplant to be taken, the recipient site must be well-vascularized, not infected, and the transplant must be sufficiently immobilized to hope for a successful transplant [8]. The re-vascularization of the transplant is preceded by an ischemic phase, and the duration of this process depends on the quality of the recipient bed [9]. Tolerance to this ischemic phase increases with the thickness of the transplant. The transplant adheres in a few hours by a deposit of fibrin exuded by the recipient bed which serves as glue. Until the 4th day, the transplant survives by plasma imbibition [9]. From the 4th to the 8th day, vascular penetration continues [9]. Lymph circulation is restored in parallel with blood revascularisation [9]. Re-innervation of the graft is completed within a few weeks [9].

Early transplant excision is recommended before the 15th day. It is to limit the conversion of fibroblasts into myofibroblasts responsible for hypertrophic scars [5]. However, early graft excision indication is for deep burns reaching functional areas and whose surface area does not exceed 20% of the skin surface [3]. Our period of transplant was longer than that reported 22 days on average compared to the 15 days recommended in the literature [5]. This is explained by our strictness regarding the rules of the transplant: no clinical or biological infection, with a haemoglobin level satisfactory for the age of the patient.

The size of our sample (6) is insufficient to lend itself to a statistical cause and effect analysis. However; the observation and the follow-up of our patients allow us to suppose that neither the age of the patient nor the time of the transplant seems to influence the outcome of the transplant. But we understood that it is formally imperative to ensure a good blood cell level and no evidence of local or general infection.

Only 4% (1/4) of the average burnt skin surface was transplanted. This one can be explained by the extent of the burns, with little availability of the site to take the transplant. The second series of grafting which failed was due to *Klebsiella* infection.

The place of antibiotic therapy is a subject of controversy [1] but it is systematic in our training. The transplant has considerably reduced the healing time from 4 months to 16 days, not to mention the aesthetic and functional cost of direct healing (cheloid scars, hypertrophic plaques, retraction).

5. Conclusion

Total self-skin grafting still has its place in the initial management of burns in

children. It offers good aesthetic and functional results. It considerably reduced the healing time with better aesthetic and functional results. However, it is carried out in a non-infected patient, prepared before with a good hemodynamic and nutritional status.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Tiry, E., Leduc, A., Dumont, R., Ridet, P., Perrot, P. and Duteille, F. (2018) Antibiothérapie péri opératoire et greffe de peau: état des lieux sur les prescriptions dans les centres français de traitement de la brûlure, vers une harmonisation des pratiques? *Annals of Burns and Fire Disasters*, **31**, 3.
- [2] Depoortère, C., François, C., Belkhou, A., Duquennoy-Martinot, V. and Guerreschi, P. (2016) Particularités de la greffe cutanée en chirurgie plastique pédiatrique. *Annales de Chirurgie Plastique Esthétique*, **61**, 722-731.
<https://doi.org/10.1016/j.anplas.2016.07.015>
- [3] Casanova, D., Voinchet, V., Berret, M. and Magalon, G. (1999) Brûlures: prise en charge et indications thérapeutiques. *EMC, Appareil Locomoteur*, 15-170-A-10. (Google Scholar)
- [4] Droussi, H., Benchamkha, Y., Ouahbi, S., Dlimi, M., Elatiqi, O.K., Boukind, S., Elamrani, D., Bisanzo, M. and Ettalbi, S. (2013) Epidémiologie et traitement des brûlures pédiatriques dans un grand hôpital pour enfants au Maroc: l'analyse de 394 cas. *African Journal of Emergency Medicine*, **3**, 110-115.
<https://doi.org/10.1016/j.afjem.2013.04.002>
- [5] Plancq, M.C., Goffifinet, L. and Duquennoy-Martinot, V. (2016) Les spécificités de la brûlure chez l'enfant. *Annales de Chirurgie Plastique Esthétique*, **61**, 568-577.
<https://doi.org/10.1016/j.anplas.2016.06.009>
- [6] Abdelhafid, M.H. (2011) Profil épidémiologique des brûlures chez l'enfant: à propos de 120 cas. thèse de doctorat en médecine, université Sidi Mohamed Ben Abdallah Fès-Maroc Thèse N°08211.
- [7] Schneider, M. (2016) Brûlures. *Forum Médical Suisse*, **16**, 910-915.
<https://doi.org/10.4414/fms.2016.02775>
- [8] Barry, L., Jeanne, M., Martinot-Duquennoy, V. and Pasquesoone, L. (2019) Greffes de peau chez les patients brûlés: principes et techniques. *Revue Francophone de Cicatrisation*, **3**, 26-31. <https://doi.org/10.1016/j.refrac.2019.06.003>
- [9] Amici, J.M., Bailly, J.Y. and Guillot, P. (2005) La greffe de peau totale en chirurgie cutanée oncologique. *Nouvelles Dermatologiques*, **24**, 72-81.