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The impact of skin grafts on the management of deep burns: Approaches and results in the treatment of third-degree burns

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Abstract

Deep burns are serious and complex injuries, leading to complete destruction of the skin and subjacent tissues, with risks of major complications. Treatment requires a multidisciplinary approach, with skin grafting playing a key role in restoring skin integrity and promoting healing.

The aim of this study is to demonstrate the efficiency of skin grafting in the treatment of deep burns, and its impact on improving the management of burn patients. A retrospective study of 50 patients admitted for the management of deep burns, hospitalized in the plastic, reconstructive and burns surgery department of CHU Tanger-Tetouan-Al Hoceima, over a 12-month period. Patients were divided into two groups: 15 patients treated with skin grafting (30%) and 35 patients treated with directed wound healing (70%). The average age of the patients was 29 years. Men accounted for 60% of patients, with a predominance also in the graft group.

Patient comorbidities included arterial hypertension (14%), psychiatric disorders (10%), diabetes (8%) and epilepsy (6%). In terms of burns, 56% were thermal by flame, 32% by liquid contact and 12% electrical burns. Burns mainly affected the upper limbs (60%) and trunk (46%). Concerning the burn extent, 62% of patients had a BSI ≥ 20%. Skin grafts were mainly performed after 21 days, with a majority of thin skin grafts (87%). Graft uptake was optimal in the majority of cases, and we observed a minimal rate of post-operative complications consisting of partial graft lysis and one case of infection. Finally, major complications were more frequent in the directed healing group, including retractile bridles (14%) and hypertrophic scars (20%), whereas grafted patients mainly presented dysesthesia (8%) and hypertrophic scars (6%). Skin grafting has an important role to play in restoring skin integrity and preventing complications, improving healing and having a significant functional and aesthetic impact.

Keywords: Skin grafts; Deep burns; Functional; Aesthetic results; Complications

1. Introduction

Third-degree burns are one of the most serious and complex injuries seen in the emergency medicine and reconstructive surgery. These burns, characterized by a complete destruction of the cutaneous layers and in some cases the subjacent tissues, lead to significant complications, which can range from infection to functional and aesthetic damage to the affected zones. The treatment of these burns requires a multidisciplinary approach, in which skin grafting plays a crucial role, aiming to restore skin integrity and improve healing of damaged tissue.

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Objectives

Demonstrate the place and effectiveness of skin grafting in the coverage of deep burn lesions, as well as its role in improving and optimizing the management of burn victims.

2. Materials and Methods

This is a retrospective study involving a representative sample of 50 patients admitted for treatment of deep burns at the Department of Plastic and Reconstructive Surgery, CHU Tanger-Tetouan-Al Hoceima, over a 12-month period.

- **Inclusion criteria**: Patients of all ages with deep burns who had received a skin graft or had undergone directed wound healing.
- **Exclusion criteria**: Patients with superficial burns and patients with a contraindication to skin grafting.
- **Group 1**: Skin graft treatment
  Indication: Performed on patients with burns requiring coverage (large surface areas, damage to functional zones).
  Type of graft: Split-thickness skin graft or full thickness skin graft, depending on the location and severity of the burns.
- **Group 2**: Directed wound healing treatment
  Indication: Patients with deep burns that did not require skin grafting, who were treated with wound care to promote primary healing.
  Treatment method: includes dressings according to the healing phase, antiseptic and antibacterial care, and clinical monitoring to prevent infection and optimize healing.

2.1. Post-operative follow-up and clinical evaluation.

Patients were followed for the duration of the study, with regular visits scheduled at: 1 week, 1 month, 3 months, 6 months and 12 months to assess the progress of healing, any complications, and functional recovery.

Our study guarantees the anonymity of the participants and the confidentiality of the data collected.

3. Results

We managed 50 patients with deep burns, including 15 (30%) who benefited from skin grafting, while 35 (70%) were treated by directed wound healing. The average age of all patients was 29, with extremes ranging from 2 to 74 years.

In our sample, 30 (60%) were male and 20 (40%) were female. Of the patients who received skin grafts, 9 (60%) were male, while the remaining 6 (40%) were female.

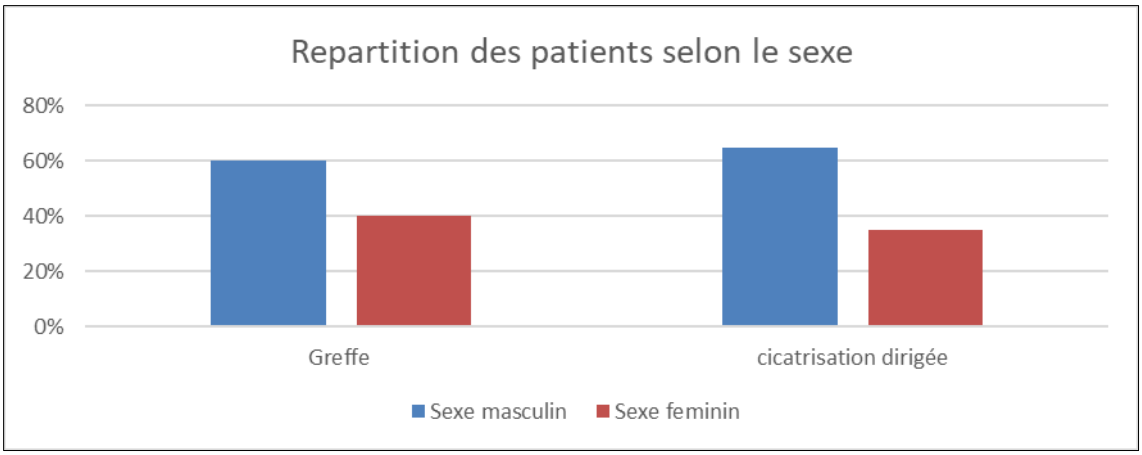

Figure 1 Distribution of patients by gender

Among the patients, 7 (14%) suffered from arterial hypertension, 5 (10%) had psychiatric disorders, 4 (8%) were diabetic, 3 (6%) were epileptic, and 1 (2%) patient suffered from arrhythmia due to atrial fibrillation.

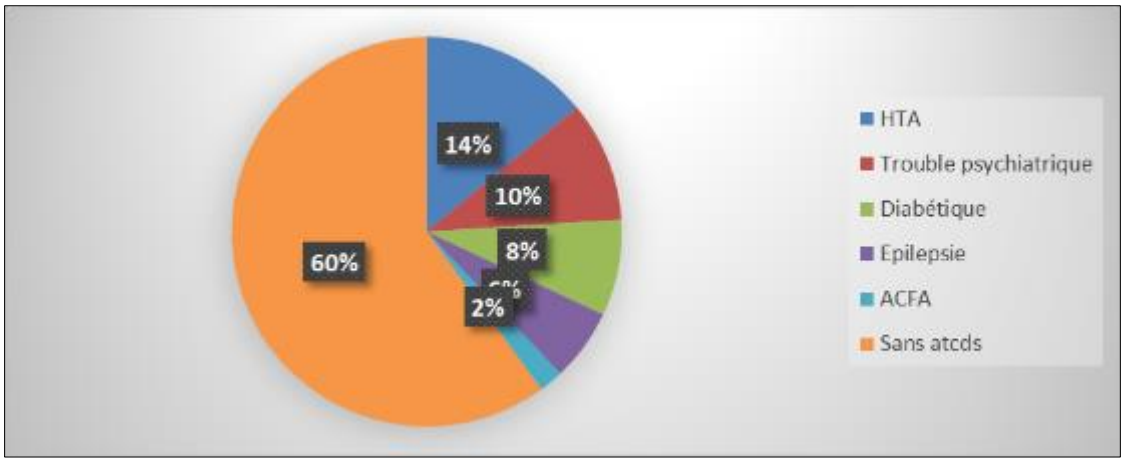

Figure 2 Distribution of patients according to their history of disease

In regards to burn mechanism, 28 (56%) suffered thermal burns due to flames, 16 (32%) suffered thermal burns due to liquid contact, mainly by scalding, and 6 (12%) patients suffered electrical burns.

In the case of patients who underwent skin grafting, the majority - 8 (53%) patients - suffered thermal burns due to flame, 3 (20%) patients suffered thermal burns due to contact, while 4 (27%) patients suffered electrical burns.

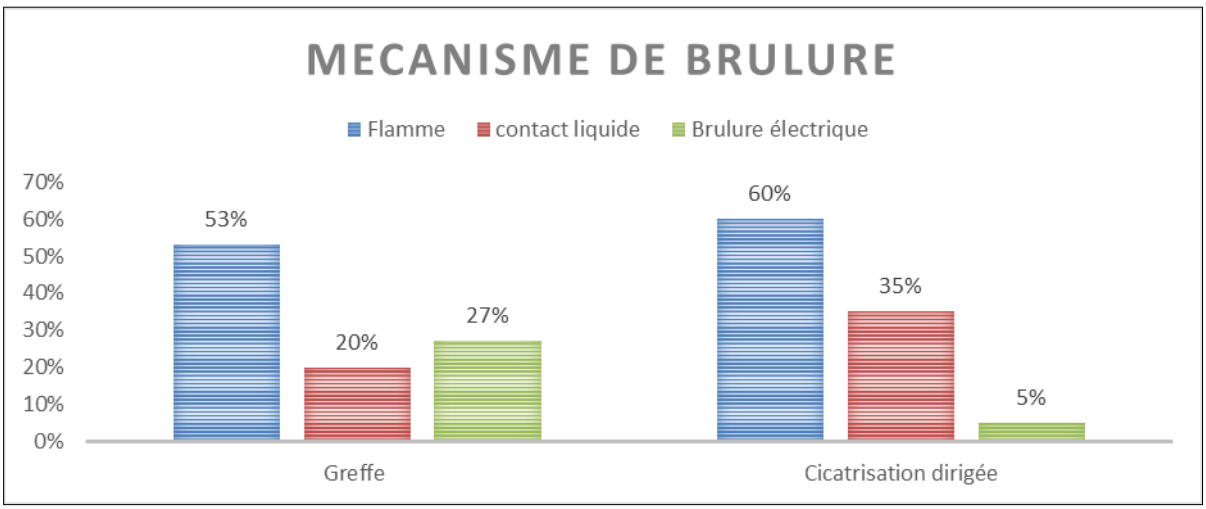

Figure 3 Distribution of patients by burn mechanism

Regions of the body were affected in different ways. 23 patients (46%) had burns affecting the trunk, while 30 (60%) suffered burns to the upper limbs. The lower limbs were affected in 19 (38%) patients, and finally the cephalic extremity was concerned in 8 (16%) cases. This distribution illustrates the diversity of body areas affected by burns, and the need to adapt treatments according to injury location.

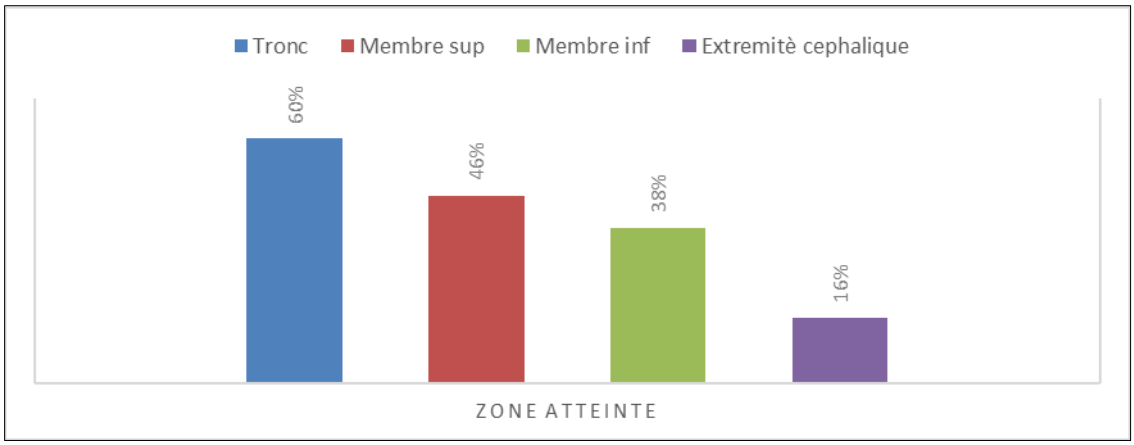

Figure 4 Distribution of patients according to the zones damaged by the burn

In terms of burn extent, 31 (62%) patients had a burned body surface area (BSA) equal to or greater than 20%, while 19 (38%) had a BSA of less than 20%. This classification is essential for assessing the severity of burns and determining the therapeutic approach to be adopted, particularly with regard to wound management and the choice of surgical interventions.

The groupe of skin graft patients, 9 (60%) had a BSA equal to or greater than 20%, reflecting the severity of their burns and the need for more intensive management. In contrast, 6 (40%) grafted patients had a SCB of less than 20%, and were thus treated with grafts in response to localized deep burns.

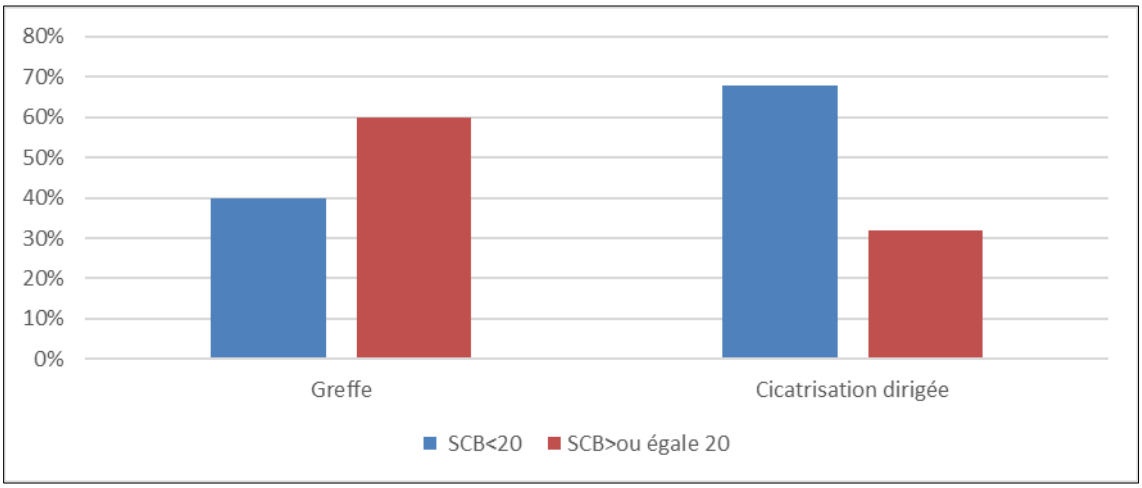

Figure 5 Distribution of patients by burned skin surface

In the majority of cases, the coverage was initiated within 21 days of the trauma.

For thin mallet skin grafting, this technique was used in 13 (87%) patients, concerning full skin grafting 2 (13%) patients benefited from this procedure, it is generally used in areas where function or aesthetic appearance is crucial, such as the face, hands or feet.

As for graft implantation, in 10 (67%) cases, the graft was implanted in the recipient area more than 90%, and 5 (33%) more than 70%.3 cases of partial lysis of the graft were observed, as well as one case of infection, no cases of hematoma or necrosis were reported.

There were no problems related to donor site healing in any of the patients, and donor site epithelization was generally completed about 10 days later.

Regarding complications, in the group of patients undergoing controlled wound healing, we observed the development of a retractile bridle in 7 (14%) patients, the formation of a major scar in 7 (14%) patients, hypertrophic scars in 10 (20%) patients, and the presence of chronic ulceration in 5 (10%) patients. For graft patients, the most frequently observed complications were dysesthesia in 4 (8%) patients and hypertrophic scars in 3 (6%) patients.

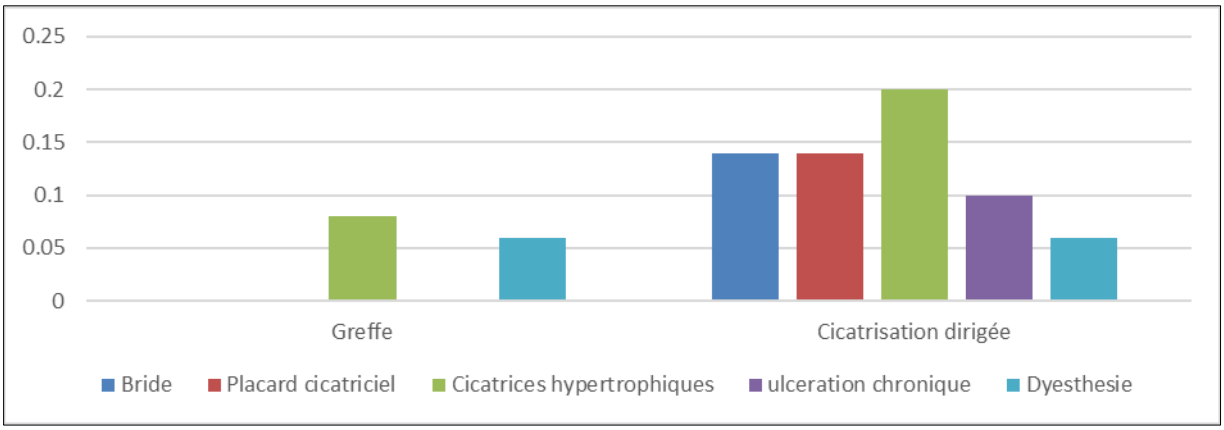

Figure 6 Distribution of patients according to complications

Functional results in patients who underwent skin grafting were satisfactory. The majority of patients showed significant functional recovery, with good mobilization of the grafted areas and a marked improvement in mobility.

The surgery was performed in the operating room after administration of a general anesthesia, with curettage of the granulation tissue. Then, from available donor sites such as the lower limbs or back, a skin graft of variable thickness (between 0.25 mm and 0.30 mm) was harvested using an electric dermatome. After checking hemostasis at the recipient site, the graft was placed transversely in sheets, with expansion. Immobilized with a tie-over dressing, the flexion zones were covered with a cast splint.

Figure 7 Case of a 74-year-old patient, Atcds: high blood pressure, admitted for treatment of a thermal burn by flame, having benefited from a graft on the lower limb

Figure 8 Case of a 70-year-old female patient, Atcds: T2DM, admitted for treatment of a thermal burn due to scalding, having benefited from a buttock graft

Figure 9 Case of a 35-year-old female patient, without Atcds, admitted for treatment of a thermal burn by flame, having benefited from a trunk graft

Figure 10 Case of a 28-year-old female patient, without Atcds, admitted for treatment of a thermal burn by flame, who benefited from a graft on the back and arm

Figure 11 Case of a 30-year-old patient, Atcds: epilepsy, admitted for treatment of a scalding thermal burn, who benefited from a graft on the trunk and right upper leg

Figure 12 Case of a 4-year-old girl, without Atcds, admitted for treatment of a scalding thermal burn, who benefited from a graft on the trunk, back, left arm and forehead

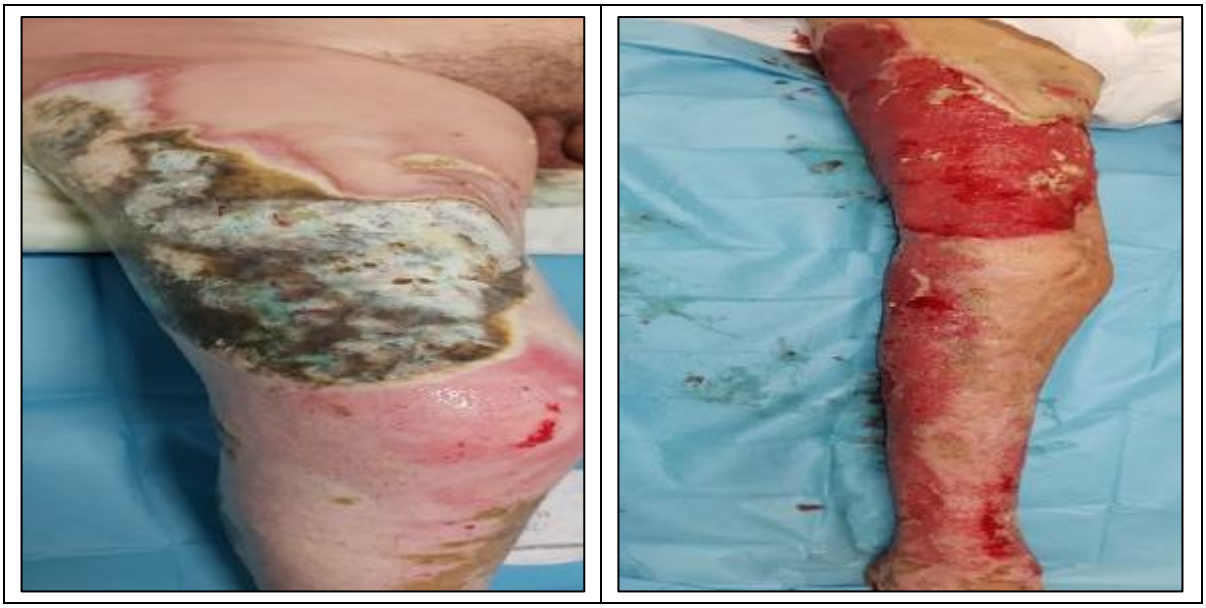

Figure 13 Case of a 40-year-old patient, with no Atcds, admitted for treatment of an electric burn, having benefited from a graft on the right lower limb

Figure 14 Case of a 37-year-old patient, without Atcds, admitted for treatment of a thermal burn by flame, who benefited from a full skin graft on the right hand

Figure 15 Case of a 65-year-old patient, Atcds: high blood pressure, admitted for treatment of a thermal burn by flame, having benefited from a full skin graft on the left hand

Figure 16 Case of a 39-year-old patient, without Atcds, admitted for treatment of a thermal burn by liquid contact, having undergone controlled healing, the patient presented a retraction at elbow level and persistent ulceration

4. Discussion

The distribution of patients by gender revealed a predominance of male patients (60%), reflecting the trend observed in many previous burn studies. Indeed, men are often more exposed to the risk of severe burns due to professional and social behaviors[1].

Among the 50 patients, many pre-existing pathologies were identified, which may directly affect wound healing and response to burn treatment, whether grafting or otherwise.

High blood pressure, present in 14% of patients in the sample. Although hypertension in itself does not directly interfere with graft take, it can increase the risk of post-operative vascular complications, such as disorders of healing or poor blood perfusion in the grafted areas. 10% of patients in our study suffered from psychiatric disorders; studies have shown that factors such as depression, anxiety or behavioral disorders can delay wound healing and increase the risk of complications, due to behaviors such as non-adherence to treatment, neglect of wound care. 8% of patients were diabetic, another common comorbidity that has a significant impact on wound healing[2].

In the case of skin graft patients, the majority (55%) had suffered thermal flame burns. This predominance can be explained by the typical severity and extension of flame burns, which result in deep damage to the skin and underlying tissues. 26% of transplant patients suffered electrical burns, which can cause deep internal damage in addition to visible skin lesions. These patients often require skin grafts to cover destroyed areas of skin[3].

Burns to the trunk (observed in 46% of patients) were the most frequent in our sample. Deep burns affecting the trunk can lead to respiratory complications, and the damage of the breast can result in unaesthetic sequelae. The upper limbs are also frequently affected by deep burns, the hands and arms are critical functional areas that require special attention in the management of burns. Burned hands can lead to significant loss of function, while rehabilitation and the prevention of retractive scarring are also key elements of management in this location. The lower limbs were affected in 38% of patients. In the leg and foot, healing in this area can be lengthy, and the risk of complications such as necrosis and infection is higher[4]. Skin grafts are becoming necessary to ensure complete coverage of burned areas, reduce the

risk of delayed healing and improve patient mobility. In addition, retractile scars on the lower limbs can affect locomotor function and make post-operative rehabilitation more complex. Finally, damage to the cephalic extremity (observed in 16% of cases) constitutes a special category of burns, requiring multidisciplinary management. Burns to the face and scalp are of particular concern, due to their aesthetic and functional impact. Skin grafting is often used in these cases to restore quality skin coverage and avoid visible scarring, which can have a significant psychological impact on patients[5].

Among skin graft patients, the majority (60%) had a BSI equal to or greater than 20%. This high prevalence of severe burns among skin graft patients is to be expected. BSI influences not only the choice of treatment, but also the overall therapeutic approach. For patients with high BSI (≥ 20%), skin grafting is often essential due to the extent of the lesions and the increased risk of systemic complications.

The therapeutic advantage of thin skin grafting is its ability to cover a large surface area with a minimum of donor tissue, which is crucial when the burned body surface is extensive. Full skin grafts, however, although performed on only 2 patients, are generally reserved for areas where aesthetics and functionality are particularly important, such as the face, hands or feet[6].

In the group of patients undergoing directed wound healing, complications were relatively frequent and varied. Retractile bridle was observed in 14% patients, highlighting one of the main challenges of deep burns, compromising mobility and function of the affected areas. Major scarring placards, observed in 14% patients, can also lead to deformity and functional restriction. Hypertrophic scars, noted in 20% of patients, are a well-known phenomenon in the healing of deep burns. Finally, chronic ulceration, which developed in 10% of patients, testifies to the difficulty of maintaining stable, continuous healing in severe burns. These complications underline the limitations of directed wound healing, which, while effective for less severe burns, may be insufficient in cases of extensive deep burns[7].

In the grafted group, the complications observed were generally less severe than those in the directed healing group. Dysesthesia was observed in 8% of patients. This phenomenon, although relatively common after skin grafts, is often transitional and tends to resolve over time. Hypertrophic scars, observed in 6% of patients, are also possible complications of skin grafts, although their frequency is lower than that of the directed healing group[8].

Comparing complications in the two groups highlights the advantages and challenges associated with each therapeutic approach. Skin grafts appear to offer better management of deep burns, notably by preventing serious complications such as retractive bridles and chronic ulceration. Grafted patients generally present less severe complications, suggesting that skin grafting not only enables faster healing but also more stable scarring that is less prone to functional deformities[9].

5. Conclusion

This study highlights the importance of skin grafting in the management of deep burns. The results show that patients who have undergone skin grafts have fewer major sequelae, such as retractile bridles and chronic ulcerations. Skin grafts promote faster, more stable healing, contributing to better functional and aesthetic restoration, and restoring patients' quality of life.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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