

Skin grafting for the management of cutaneous substance loss in orthopedic and traumatological surgery: a retrospective study of 40 cases

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Abstract: Skin grafting remains one of the most reliable techniques for managing cutaneous substance loss in orthopedic and traumatological surgery. We conducted a retrospective study of 40 patients treated at the Department of Orthopedic and Traumatological Surgery B4, CHU Hassan II, Fes, over a 6-year period (December 2019 to December 2025). Mean patient age was 50 years (range: 18-78), with male predominance (62.5%). The leading etiology was post-tumoral resection (39%), followed by traumatic origin (34%) and infectious sequelae (22%). The lower limb accounted for 65% of defects. The thigh was the donor site in 92% of cases. Full-thickness grafts were used in 55% of cases and split-thickness in 45%. Overall graft success rate was 95%. Dyschromia (17.5%) and hypertrophic scarring (7.5%) were the most frequent late complications. Functional outcomes were satisfactory in 85% of patients, confirming skin grafting as an effective and versatile technique in the orthopedic setting.

Keywords—skin graft; cutaneous substance loss; orthopedic surgery; full-thickness graft; split-thickness graft.

1. INTRODUCTION

Skin grafting is one of the oldest and most effective techniques in the therapeutic arsenal for managing cutaneous substance loss (CSL). It is defined as the free transfer of cutaneous tissue, intentionally separated from a donor site and transplanted to a recipient site where it recruits new vascularization to achieve wound closure [1,2].

The skin is the largest organ of the human body, covering approximately 1.8 m² in adults. When its integrity is disrupted, prompt reconstruction is essential to prevent infection, preserve limb function, and restore quality of life [3].

In orthopedic and traumatological surgery, cutaneous substance loss of the limbs threatens functional prognosis. Etiologies include high-energy trauma, surgical tumor resection, infectious sequelae, and burns [4]. Management must address both functional and aesthetic goals.

The choice between split-thickness and full-thickness grafts depends on defect size, location, recipient bed quality, and functional requirements [20]. The aim of this study is to evaluate the indications, techniques, results, and complications of skin grafting based on 40 cases, and to compare our results with published literature.

2. MATERIALS AND METHODS

2.1 Study Design

This is a retrospective descriptive study conducted in the Department of Orthopedic and Traumatological Surgery B4,

CHU Hassan II, Fes, Morocco, from December 2019 to December 2025. Inclusion criteria: age 16 years or older, CSL of the limbs, grafting performed in our department. Exclusion criteria: age under 16 years, grafting outside our unit, pregnancy, non-exploitable records.

2.2 Data Collection

A standardized form was completed for each patient covering: epidemiological variables (age, sex, comorbidities, tobacco use), clinical data (defect location and size, associated lesions), surgical technique (graft type, donor site, fixation, dressing), and functional and aesthetic outcomes. Data were analyzed using Microsoft Excel 2010.

2.3 Surgical Technique

All procedures were performed in an aseptic operating theatre. Positioning was supine (n=36), beach-chair (n=3, shoulder defects), or prone (n=1). Anesthesia was spinal (n=23), general (n=13), or loco-regional (n=4). The donor site was infiltrated with normal saline before harvest. An electric dermatome was used for split-thickness grafts; full-thickness grafts were harvested with a scalpel and defatted. The graft was meshed when required, applied to the recipient bed, and fixed with staples or sutures. A tie-over dressing was maintained for 5–7 days. Articular sites were immobilized with a plaster splint. All patients received analgesics and 8–10 days of amoxicillin-clavulanate prophylaxis. Rehabilitation began 6 weeks postoperatively.

3. RESULTS

3.1 EPIDEMIOLOGICAL DATA

The series comprised 40 patients: 25 men (62.5%) and 15 women (37.5%), sex ratio 1.66. Mean age was 50 years (range: 18–78); the 30–60 year group was most affected (53%). Seventeen patients (42.5%) had comorbidities, detailed in Table 1, and 16 (40%) were active smokers.

Table 1: Distribution of comorbidities

Comorbidity	n (%)
Diabetes mellitus	4 (25%)
Hypertension	3 (19%)
Treated pulmonary tuberculosis	2 (13%)
Chronic venous insufficiency	2 (13%)
Asthma	1 (6%)
Chronic kidney disease	1 (6%)
Valvular heart disease	1 (6%)
Peripheral arterial disease	1 (6%)

3.2 Etiology

The dominant etiology was post-tumoral resection (39%), followed by traumatic causes (34%: road traffic accidents 29%, occupational injuries 5%), infectious sequelae/osteitis (22%), burn sequelae (3%), and arteriopathy (2%), as shown in Table 2.

Table 2: Distribution of etiologies of cutaneous substance loss

Etiology	n	%
Post-tumoral resection	16	39%
Road traffic accident	12	29%
Infectious sequelae / Osteitis	9	22%
Occupational injury	2	5%
Burn sequelae	1	3%
Arteriopathy	1	2%
Total	40	100%

3.3 Defect Location and Size

The lower limb was involved in 65% of cases, the upper limb in 35%. The leg was the most affected segment (32%), followed by the shoulder (14%). Full distribution is shown in Table 3.

Table 3: Distribution of defects by anatomical segment

Anatomical segment	n	%
Leg	13	32%
Shoulder	6	14%
Forearm	4	10%
Hand	4	10%
Arm	4	10%
Thigh	2	5%
Foot	2	5%
Hip	1	2%
Other	4	10%
Total	40	100%

Defect size was under 20 cm² in 77%, 20–40 cm² in 20%, and 40–60 cm² in 3%, with a mean of 17 cm² (Table 4). Six patients had associated lesions, of whom 3 required concurrent osteosynthesis.

Table 4: Distribution by defect size

Defect size	n	%
< 20 cm ²	31	77%
20–40 cm ²	8	20%
40–60 cm ²	1	3%
Total	40	100%

3.4 Surgical Treatment

Mean time from injury/resection to grafting was 4.5 months (range: 2 weeks to 3 years). The thigh was the donor site in 37 patients (92.5%); the inner arm in 3 (7.5%). Graft type distribution is shown in Table 5.

Table 5: Distribution by graft type

Graft type	n	%
Full-thickness (GPT)	22	55%
Split-thickness (fine)	18	45%
Total	40	100%

3.5 Complications

No intraoperative complications occurred. Postoperative complications are summarized in Table 6. The two graft

failures both occurred in patients with chronic venous insufficiency. Overall graft success rate was 95% (38/40 patients).

Table 6: Summary of postoperative complications

Complication	n	%
Local graft infection (immediate)	4	10%
Total graft lysis / necrosis	2	5%
Donor site infection	< 2	< 5%
Dyschromia (late)	7	17.5%
Hypertrophic scarring	3	7.5%
Retraction / Keloid	2	5%
Pain sensitivity impairment	2	5%
Joint stiffness	2	5%

3.6 Functional Outcomes

Results were satisfactory in 34 cases (85%), acceptable in 4 (10%), and poor in 2 (5%). Functional gain distribution is shown in Table 7. Graft sensitivity was preserved in all patients at all follow-up stages.

Table 7: Functional gain assessment

Functional gain	n	%
100%	20	50%
75%	14	35%
50%	4	10%
25%	2	5%
Total	40	100%

4. DISCUSSION

4.1 Epidemiology and Etiology

The mean age in our series (50 years) is consistent with published literature, where means range from 24 to 79 years [6–13]. Trauma-dominant series tend toward younger patients, while tumor-driven cohorts show higher means, as in Reddy et al. [11] (mean 79 years; 86% tumoral). Male predominance (62.5%) is typical of trauma-dominant series [6,10]; sex has no independent prognostic impact on outcome [11].

Our high proportion of tumoral CSL (39%) reflects our unit's role as a referral centre for bone and soft-tissue tumors requiring wide resection. Infectious causes (22%) exceed

most Western series, reflecting the regional burden of chronic osteitis, a known characteristic of our patient population.

4.2 Defect Location and Size

Lower limb predominance (65%) is universal across series [6,10,11,13]. The leg is the most challenging zone due to sparse local soft tissue. Our mean defect size (17 cm²) is smaller than most comparative series (range 33–89 cm²), reflecting the targeted nature of our tumor resections. Rose et al. [14] found no significant impact of defect size on graft success in diabetic foot patients, consistent with our findings.

4.3 Donor Site and Technique

The thigh is the most widely used donor site [7,10], as in our cohort (92.5%), owing to its accessibility, large surface area, and cosmetically acceptable scar. The scalp is a validated alternative, particularly in children, offering rapid re-epithelialization and hair camouflage [8]. Plantar skin is preferred for glabrous reconstruction of the hand and foot [15]. Taylor et al. (2021) emphasized in a comprehensive primer for orthopaedic surgeons that donor site selection and meticulous recipient bed preparation remain the two most critical determinants of graft success, reinforcing our protocol [20].

4.4 Results vs. Published Series

Table 8 compares our results with published series. Our 95% success rate is consistent with most reports. The two failures both occurred in patients with chronic venous insufficiency, confirming vascular comorbidity as the principal risk factor [11,16]. A recent prospective study by Al-Hajri et al. (2025) similarly identified post-grafting bacterial infection as the only independent risk factor for graft failure on multivariate analysis, reinforcing the importance of strict aseptic technique and perioperative antibiotic prophylaxis [21]. Dyschromia (17.5%) and hypertrophic scarring (7.5%) are expected sequelae of split-thickness grafting, and their incidence in our series is comparable to that reported by Samuel et al. (2024) in a comparative review of meshed versus unmeshed grafts [22].

Table 8: Comparison of graft success rates with published series

Author	Success rate	Main complications	Setting / etiology
Polfer [6]	100%	Infection, haematoma	Traumatic — residual limb
Kern et al. [7]	N/A	—	Traumatic — outcomes analysis
Liu et al. [10]	100%	Haematoma, exudate	Lower limb — plantar grafts
Reddy et al. [11]	100%	Infection, dehiscence	Lower limb — risk factors

Author	Success rate	Main complications	Setting / etiology
Rubis et al. [12]	94%	Infection	Full-thickness defects
Al-Hajri et al. [21]	67.7%	Bacterial infection	Mixed — burn and trauma
Our series	95%	Necrosis (n=1), partial take (n=1)	Upper & lower limb — mixed

4.5 Dressing and Scar Assessment

No consensus exists on optimal donor site dressing [17]. Demirtas et al. [18] showed Aquacel Ag has the best performance in a 5-arm trial; Comfeel is preferred in resource-limited settings. We used lipid-impregnated tulle (Bactigras-equivalent), satisfactory at low cost, a practical priority in the Moroccan context. Standardized POSAS scar assessment [19] will be integrated in future prospective studies.

5. CONCLUSION

Skin grafting remains an indispensable and versatile technique in orthopedic and traumatological surgery. Our series confirms a 95% success rate and satisfactory functional outcomes in 85% of patients, consistent with published literature. The thigh is the preferred donor site. Success requires meticulous recipient bed preparation, adequate hemostasis, strict immobilization, and structured follow-up. Pre-existing vascular comorbidities are the principal risk factor for failure. Prospective studies incorporating POSAS scoring and randomized dressing comparisons are warranted to further optimize protocols in resource-limited settings.

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