

## A Case Study of Knee Joint Abscess Managed by Debridement & Split Thickness Skin Grafting

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### ABSTRACT

Skin grafting is one of the most fundamental and time-tested procedures in reconstructive surgery, providing definitive coverage for wounds where primary closure or spontaneous healing is not feasible. Despite advances in flap surgery and tissue engineering, skin grafting continues to hold a central role due to its simplicity, versatility, and reliable outcomes. This article presents a comprehensive descriptive review of skin grafting, including historical background, anatomical and physiological basis, types of grafts, indications, contraindications, operative techniques, graft healing mechanisms, and complications. A clinical case of split-thickness skin grafting following drainage of a knee joint abscess is discussed to highlight practical considerations and outcomes. The review aims to serve as a concise yet detailed reference for postgraduate students and practicing surgeons.

**Keywords:** Skin grafting, Split-thickness skin graft, Full-thickness skin graft, Wound healing, Reconstructive surgery

### I. INTRODUCTION-

Skin grafting is an essential and well-established procedure in reconstructive surgery, employed for coverage of skin defects resulting from trauma, burns, infections, surgical excision, and chronic non-healing wounds. The historical roots of reconstructive surgery can be traced to Acharya Sushruta, who is universally recognized as the Father of Plastic Surgery for his extraordinary surgical contributions documented in the Sushruta Samhita (circa 600 BCE). His detailed descriptions of reconstructive techniques reflect a highly advanced understanding of tissue handling, wound healing, and restoration of form and function.

In modern surgical literature, the development of skin grafting began in the nineteenth century with Reverdin's pinch grafts (1869), followed by modifications by Ollier and Thiersch, forming the foundation of contemporary skin grafting practices. Despite significant

advances in reconstructive options such as local and free flaps, skin grafting continues to play a pivotal role due to its simplicity, reliability, and favorable outcomes when performed on a well-prepared wound bed.

### Ayurvedic Perspective of Plastic Surgery:

Ayurveda describes reconstructive surgical procedures under the concept of Sandhāna Karma.

Acharya Sushruta has elaborately explained Nasā-Sandhāna (reconstruction of the nose), which is regarded as the earliest documented example of plastic surgery. The procedure involved reconstruction of the nasal defect using a pedicled skin flap harvested from the cheek or forehead, with careful preservation of tissue vitality and vascularity.

Karṇa-Sandhāna involves reconstruction of the ear using adjacent viable tissue, with careful attention to shape, symmetry, and tissue nourishment. Sushruta advised selection of healthy surrounding skin and meticulous approximation, highlighting principles similar to contemporary auricular reconstruction and composite grafting.

Oṣṭha-Sandhāna (repair of cleft or traumatic lip defects) is described with the objective of restoring oral competence, speech, and facial aesthetics. The procedure emphasizes proper alignment of tissue layers and tension-free closure, which parallels modern principles of cleft lip repair and reconstructive surgery.

The principles laid down by Sushruta—such as Vrana Shodhana (cleansing of the wound), Sandhāna (approximation and union of tissues), Vrana Bandhan (covering of exposed structures), and appropriate postoperative care—closely resemble the fundamental principles of modern reconstructive surgery and skin grafting. These descriptions emphasize the importance of a clean wound bed, adequate blood supply, immobilization, and protection of reconstructed tissues for successful healing.

Thus, the concept of skin grafting and reconstructive surgery finds a strong conceptual

correlation in Ayurvedic literature. The integration of classical Ayurvedic surgical principles with modern techniques provides a holistic understanding of wound management and reconstruction. The present article reviews the principles of skin grafting and presents a clinical case of split-thickness skin grafting following knee joint abscess drainage, highlighting both modern surgical practice and its Ayurvedic correlation.

#### Classical Ayurvedic References (Samhita)

Ayurvedic concepts applied in the present case are primarily derived from Sushruta Samhita, which is regarded as the foundational text of surgery (Shalya Tantra). Acharya Sushruta has described Vrana (wound) in detail, including its etiology, classification, management, and complications.

#### • Concept of Vrana and Dushta Vrana-

Acharya Sushruta defines Vrana as a condition that leads to destruction or discontinuity of tissues and leaves a permanent scar after healing:

“व्रणोनाममांसभेदात्संजायते, सरोहणे अपिवर्णो भवति।”

—सुश्रुतसंहिता, चिकित्सास्थान १/६

This description correlates with traumatic wounds resulting in tissue loss, as seen in the present case. Further, Dushta Vrana is characterized by pain, discharge, foul smell, discoloration, and delayed healing:

“अतिरुजः, अतिस्रावः, दुर्गन्धिः,

दीर्घकालानुबन्धी च दुष्टव्रणः।”

—सुश्रुतसंहिता, चिकित्सास्थान १/८-९

The infected knee wound with abscess formation in this patient closely resembles the features of Dushta Vrana.

#### Vrana Shodhana (Wound Cleansing)

Sushruta emphasizes that proper wound cleansing is essential before attempting healing measures:

“नशुद्धे व्रणो रोहणं भवति।”

—सु, चि-१/१६

Incision and drainage (Bhedana Karma) performed in this case corresponds to Shastra Karma advised for pus-filled wounds:

“पक्वशोफान्भेदयेत्सस्त्रेण।”

—सु, चि-९/४

#### Vrana Ropana and Vrana Bandhan (Covering of Wound)-

After achieving a clean wound (Shuddha Vrana), Sushruta advocates measures to promote healing and tissue union:

“शुद्धस्य व्रणस्य रोहणार्थ उपक्रमः कर्तव्यः।”

—सु, चि-१/२४

The concept of covering exposed wounds to promote healing is implied under Sandhana Karma and Avarana of tissues, which can be correlated with modern skin grafting techniques.

#### Wounds Over Joints (Sandhi Pradesha)

Sushruta has specifically warned about wounds occurring over joints due to risk of stiffness and functional impairment:

“सन्धिषु व्रणाः कष्टसाध्याः।”

—सु, चि-२१/३७

This highlights the importance of early wound coverage and controlled mobilization, as adopted in the present case.

#### Dosha Involvement in Wound Healing

Trauma-induced wounds are predominantly Vataja, with suppuration involving Pitta Dosha:

“अभिघातात्वातप्रकोपः।”

—सु, चि-२४/८

Postoperative immobilization and gradual physiotherapy help prevent Vata Vaigunya and Sandhi Sankocha (contracture).

#### Anatomy and Physiology of Skin-

The skin consists of three principal layers:

1) Epidermis: A stratified squamous epithelium providing barrier and protective functions.

2) Dermis: Rich in collagen, elastin, and vascular networks, responsible for tensile strength and nourishment.

3) Hypodermis: Composed mainly of adipose tissue, providing cushioning and thermoregulation.

Cutaneous blood supply is arranged in subdermal and subpapillary plexuses, which play a critical role in graft survival. Understanding wound healing phases—hemostasis, inflammation, proliferation, and remodeling—is essential, as graft integration closely follows these physiological processes.

#### Types of Skin Grafts

Selection of a skin graft depends on defect size, depth, vascularity, anatomical location, and cosmetic requirements.

Type of Graft	Characteristics	Clinical Applications
Split-Thickness Skin Graft (STSG)	Epidermis + part of dermis, easy take, more contraction	Burns, trauma, ulcers
Full-Thickness Skin Graft (FTSG)	Epidermis + entire dermis, better cosmesis	Face, eyelids, hand
Composite Graft	Skin with cartilage/mucosa	Nose, ear reconstruction
Mesh Graft	Expanded graft, allows drainage	Extensive burns
Cultured Epithelial Autograft	Laboratory-grown keratinocytes	Massive burn injuries

**Indications:**

Extensive burns.  
 Post-traumatic raw areas  
 Chronic non-healing ulcers  
 Post-excisional defects following tumor surgery  
 Congenital anomalies

**Contraindications:**

Poorly vascularized wound beds (bare bone or cartilage without periosteum/perichondrium)  
 Active infection  
 Severe anemia, malnutrition, or uncontrolled diabetes mellitus

**Operative Technique of Skin Grafting-**

• **Preoperative Preparation-**

Optimization of nutritional status, correction of anemia, control of infection, and stabilization of comorbidities are essential. The wound bed should be clean with healthy granulation tissue.

• **Donor Site Selection-**

Common donor sites include thigh, buttock, upper arm, and scalp (especially in pediatric patients). Donor skin should match recipient area in color and thickness as closely as possible.

• **Harvesting Technique-**

Split-thickness grafts are harvested using a dermatome or Humby knife, while full-thickness grafts are excised with a scalpel and require primary closure of the donor site.

• **Recipient Site Preparation-**

Meticulous hemostasis is crucial. Hematoma or seroma formation is a major cause of graft failure.

• **Graft Fixation-**

The graft is placed dermal side down and secured using sutures, staples, or adhesive agents. Tie-over dressings or negative-pressure wound therapy may be employed.

• **Postoperative Care-**

Immobilization of the grafted area, prevention of shear forces, and monitoring for infection are mandatory. First inspection is typically performed after 4–5 days.

**Healing and Integration of Skin Graft**

Graft take occurs in **four** stages:

- 1)Plasmatic imbibition
- 2)Inosculation
- 3)Revascularization
- 4)Remodeling

Successful graft survival depends on vascularity of the recipient bed, immobilization, and absence of infection.

**Complications**

- 1)Graft failure-  
Poor vascularity, hematoma, infection
- 2)Partial graft loss-  
Edge necrosis or central sloughing
- 3)Infection-  
Commonly Staphylococcus or Pseudomonas
- 4)Donor site morbidity-  
Pain, scarring, delayed healing
- 5)Contracture  
Especially with STSG
- 6)Cosmetic problems  
Pigmentary changes, contour defects

• **Case Discussion-**

A 60-year-old male patient presented to the surgical outpatient department with complaints

of persistent pain, swelling, and purulent discharge over the right knee joint region. The patient gave a history of blunt trauma to the right knee approximately three weeks prior to presentation. Initial treatment was taken at a local healthcare facility, where primary wound care and antibiotics were administered. However, despite treatment, the wound failed to heal and symptoms progressively worsened.

**On clinical examination**, the right knee showed signs of localized infection including erythema, tenderness, increased local temperature, and fluctuant swelling over the anterior aspect of the knee joint. There was restricted knee movement due to pain. Systemic examination did not reveal fever or features of septicemia. Radiological evaluation and ultrasonography confirmed the presence of a localized abscess involving the periarticular soft tissues of the right knee joint, without bony involvement.

#### **Initial Surgical Management-**

An incision and drainage procedure was performed under appropriate anesthesia to control the infection. Approximately 40–50 ml of purulent material was evacuated, and the cavity was thoroughly irrigated with antiseptic and saline solution. Pus culture and sensitivity testing were performed, and targeted antibiotic therapy was initiated based on the results. Following adequate drainage, the infection subsided; however, a large raw area remained over the anterior aspect of the knee joint.

#### **Preoperative Assessment for Skin Grafting-**

After control of infection, the patient was planned for definitive wound coverage. Detailed preoperative assessment revealed healthy granulation tissue covering the wound bed, indicating adequate vascularity and suitability for grafting. Hematological investigations showed hemoglobin levels within normal limits, normal total leukocyte count, and controlled blood sugar levels. The patient was nutritionally optimized and counseled regarding the procedure, donor site morbidity, and postoperative care.

#### **Surgical Procedure**

Under spinal anesthesia, the recipient site was prepared with meticulous hemostasis to prevent hematoma formation. A split-thickness skin graft measuring approximately 0.012 inches in thickness was harvested from the left thigh using a dermatome. The harvested graft was carefully

trimmed and placed over the raw area on the right knee with the dermal surface facing the wound bed. The graft was secured using skin staples, and a tie-over dressing was applied to ensure uniform pressure and immobilization.

Due to the anatomical location over a mobile joint, negative-pressure wound therapy was avoided. Instead, strict immobilization was ensured using a posterior plaster splint to prevent shear forces and displacement of the graft.

#### **Postoperative Course**

The patient was monitored closely in the postoperative period. Limb elevation and immobilization were maintained. Antibiotics and analgesics were continued as per protocol. The first graft inspection was carried out on the fifth postoperative day, which revealed approximately 90–95% graft uptake. Minor peripheral graft loss was noted but did not require secondary intervention. The donor site showed healthy epithelialization and healed completely within 10 days.

#### **Rehabilitation and Follow-up**

After stabilization of the graft, gradual physiotherapy was initiated to prevent knee stiffness and preserve joint mobility. At 3-month follow-up, the graft had completely integrated with the recipient site, showing stable coverage with mild hypopigmentation. The patient had regained near-normal range of motion of the right knee and reported satisfaction with both functional and cosmetic outcomes.





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## II. DISCUSSION

This case highlights the importance of staged management in infected wounds. Adequate control of infection prior to skin grafting is crucial for graft survival. Although flap coverage such as a gastrocnemius flap could have been considered in case of poor vascularity or exposed bone, split-thickness skin grafting proved to be an effective and economical solution due to the presence of healthy granulation tissue. Proper wound bed preparation, secure fixation, and strict immobilization were key factors contributing to successful graft take in this case.

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