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Reconstruction of a Post-Oncologic Knee Defect Using Negative Pressure Wound Therapy and Acellular Dermal Matrix: A Reconstruction 2.0 Approach

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ABSTRACT

Reconstruction of lower-extremity defects following oncologic resection is challenging, particularly around mobile joints such as the knee. The reconstructive approach must ensure oncologic safety while preserving limb function, durability of coverage, and acceptable aesthetic outcomes. Recent advances advocate a non-linear, individualized reconstructive strategy consistent with the principles of Reconstruction 2.0.

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INTRODUCTION

Reconstruction of tissue defects in the extremities following excision of dermatologic and soft-tissue malignancies poses a significant surgical challenge. The reconstructive strategy must balance oncologic radicality with preservation of limb function, durability of coverage, and acceptable aesthetic outcomes. Wide local excision or en bloc resection with histologically negative margins remains the cornerstone of treatment for cutaneous and soft-tissue malignancies, and reconstructive planning must never compromise oncologic safety or the ability to revise margins when required.[1-3]

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Advances in multimodal oncologic therapy and reconstructive techniques have resulted in a paradigm shift from amputation toward limb-salvage as the standard of care for most extremity malignancies.[2-4] Limb-preserving resections, however, frequently produce complex defects with limited local tissue availability, particularly around joints such as the knee, where constant motion and thin soft-tissue envelopes increase the risk of wound complications and functional impairment.[3,4]

Although the traditional reconstructive ladder remains a useful conceptual framework, contemporary reconstructive philosophy increasingly favors a non-linear, goal-directed approach. This evolution, described as the reconstructive grid, or Reconstruction 2.0, emphasizes selection of the most appropriate technique based on wound biology, functional demands, and patient-specific factors rather than sequential escalation from simpler to more complex options.[5,6]

Within this evolving reconstructive landscape, biologic matrices and adjunctive technologies such as negative pressure wound therapy (NPWT) have expanded reconstructive options for lower-extremity

defects, particularly when staged reconstruction is advantageous or when flap morbidity is undesirable.[5] We present a case demonstrating successful reconstruction of a post-oncologic knee defect using NPWT-assisted acellular dermal matrix (ADM) followed by split-thickness skin grafting (SSG), exemplifying a Reconstruction 2.0 approach.

MATERIALS AND METHODS

A 32-year-old male presented with an ulceroproliferative lesion over the anterior aspect of the right knee (Figure 1). Clinical examination revealed an indurated ulcer with irregular margins. Incisional biopsy confirmed well-differentiated squamous cell carcinoma. Regional lymph node evaluation and imaging showed no evidence of metastasis.

The patient underwent wide local excision (Figure 2) with oncologically safe margins. Intraoperatively, the post-resection defect measured approximately 6 × 5 cm, with exposure of subcutaneous tissue and fascia but no involvement of the joint capsule or underlying bone. Final histopathology confirmed clear margins.

Figure 1. Preoperative clinical photograph showing an ulceroproliferative lesion over the anterior aspect of the right knee with indurated margins, subsequently diagnosed as squamous cell carcinoma.

Figure 2: Post–wide local excision defect following oncologic resection of the squamous cell carcinoma, demonstrating a circular soft-tissue defect over the knee with exposed subcutaneous tissue.

Given the periarticular location and the need to preserve knee mobility, a staged reconstructive strategy was adopted. NPWT was applied at –125 mmHg in continuous mode for 7 days to promote granulation tissue formation, control wound exudate, and optimize the wound bed (Figure 3). Once a healthy, vascularized wound surface was achieved, a bilayer acellular dermal matrix was applied and secured to the wound margins. NPWT was reapplied over the ADM to facilitate integration and neovascularization (Figure 4).

After 14 days, successful incorporation of the ADM was confirmed clinically. A split-thickness skin graft harvested from the ipsilateral thigh was applied over the neodermis (Figure 5). The graft was secured with a bolster dressing, and knee immobilization was maintained temporarily to protect graft take.

Figure 3: Apclication of negative pressure wound therapy (NPWT) to the post-resection defect to promote granulation tissue formation and optimize the wound bed prior to definitive reconstruction.

Figure 4: Intraoperative view following placement of bilayer acellular dermal matrix (ADM) over the prepared wound bed prior to reapplication of NPWT.

Figure 5: Split-thickness skin graft applied over the integrated acellular dermal matrix after confirmation of neodermis formation.

RESULTS

The ADM integrated well with the underlying wound bed, with no evidence of infection, seroma, or matrix loss. Following skin grafting, graft take was greater than 95% at first inspection. The postoperative course was uneventful.

At 1-month follow-up, the reconstructed area demonstrated stable, durable coverage with good pliability and contour (Figure 6). Knee joint mobility was preserved without functional limitation. There was no evidence of wound breakdown or local tumor recurrence during follow-up.

DISCUSSION

Reconstruction of oncologic defects around the knee is particularly challenging due to constant joint motion, limited availability of local tissue, and the risk of scar contracture compromising function. Traditional reconstructive options, such as local flaps, regional muscle flaps, or free tissue transfer, provide reliable coverage but are associated with increased operative complexity and varying degrees of donor-site morbidity, especially in periarticular regions of the lower limb.[2-4]

Figure 6: Healed reconstruction at 1-month follow-up demonstrating stable coverage, good contour, and preserved knee joint mobility.

The concept of Reconstruction 2.0 promotes individualized, non-hierarchical decision-making, wherein reconstructive options are selected based on biological suitability, functional goals, and patient-specific considerations rather than strict adherence to the reconstructive ladder [6]. In the present case, although flap reconstruction was a feasible option, the moderate defect size, absence of exposed vital structures, and the need to preserve knee mobility supported the use of a less invasive yet biologically sound reconstructive strategy.

Acellular dermal matrix (ADM) functions as a biologic scaffold that facilitates fibroblast migration, angiogenesis, and organized collagen deposition, resulting in formation of a durable neodermis. When combined with NPWT, ADM integration is enhanced through improved wound–matrix contact, reduction of interstitial edema, and promotion of neovascularization, thereby improving graft take and overall wound stability.[5] This combination occupies a critical position within the reconstructive grid, bridging the gap between skin grafting alone and flap reconstruction.

Advantages of NPWT-Assisted ADM Reconstruction

- Avoidance of bulky flap reconstruction, thereby minimizing donor-site morbidity and surgical trauma[2,4]
- Improved pliability and elasticity over a mobile joint, reducing the risk of secondary contracture and functional limitation[3,6]
- Ability to stage reconstruction after definitive histopathological confirmation of oncologic clearance[1,2]
- Shorter operative time and reduced surgical complexity compared to regional or free flap procedures.[5,6]
- Preservation of limb function with durable and stable wound coverage consistent with limb-salvage principles.[4,6]

This case supports emerging evidence that NPWT-assisted ADM reconstruction represents a reliable, function-preserving, and biologically driven option for selected lower-extremity oncologic defects, particularly in periarticular regions such as the knee.[5,6]

CONCLUSION

NPWT-assisted acellular dermal matrix reconstruction followed by split-thickness skin grafting provides a safe, effective, and biologically sound option for coverage of post-oncologic knee defects. This approach achieves durable wound closure, preserves joint function, and minimizes morbidity, exemplifying the principles of Reconstruction 2.0 in modern extremity oncologic reconstruction.

REFERENCES

1. Kraenzlin F, Sacks J. Reconstruction of oncologic defects. In: *Oncologic Reconstruction. Springer; 2020.*
2. Brambullo T, L'Erario S, Marena F, et al. Microsurgical reconstruction with free tissue transfer in skin cancer patients: a systematic review. *Cancers.* 2025;17:2371.
3. Stiles Z, Lohman R, Mann G. Plastic surgery reconstruction of sarcoma resection defects: form and function. *Surg Clin North Am.* 2022;102(4):679–693.
4. Orgill DP. Lower extremity reconstruction following tumor, burns and infections. *Plast Reconstr Surg.* 2020.
5. Ross K, Zinck N, Wilson D, et al. Integra dermal regeneration template in reconstruction of primary oncologic defects of the lower extremities. *Plast Surg.* 2025.
6. Mohapatra DP, Thiruvoth FM. Reconstruction 2.0: restructuring the reconstructive ladder. *Plast Reconstr Surg.* 2021;147(6):1486–1495