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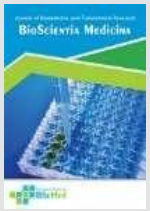

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# Orthoplastic Limb Salvage of a Gustilo-Anderson Grade IIIB Open Trans-Articular Knee Fracture: A Case Report on Staged Reconstruction with a Rotational Fasciocutaneous Flap

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**A B S T R A C T**

**Background:** High-energy, open trans-articular knee fractures with extensive soft-tissue loss represent a formidable challenge, carrying a high risk of deep infection, nonunion, and amputation. Successful limb salvage necessitates a collaborative orthoplastic approach, combining aggressive surgical debridement and skeletal stabilization with timely, vascularized soft-tissue coverage. **Case presentation:** A 16-year-old male was admitted after a severe traffic accident, sustaining a Gustilo-Anderson Grade IIIB open fracture of the right knee. The injury comprised a comminuted distal femur fracture, a comminuted tibial plateau fracture (Schatzker VI), a comminuted patellar fracture, and a proximal fibula fracture. A 12x15 cm soft-tissue defect with a depth of 6 cm exposed the joint capsule and all fracture sites. The patient underwent a staged management protocol. The initial surgery involved extensive debridement of non-viable tissue and stabilization with a spanning multi-planar external fixator, followed by a second-look debridement. Definitive coverage was achieved on day five with a large, medially-based rotational fasciocutaneous flap and a split-thickness skin graft over the donor site. At the 1-year follow-up, all fractures had united, and the soft-tissue envelope was stable and sensate. The patient achieved a functional knee range of motion of 0-100 degrees and could ambulate without aids. The Lysholm knee score was 85, and the Knee Society Score (KSS) was 88. **Conclusion:** This case report demonstrates that a meticulously planned, staged orthoplastic strategy can achieve successful limb salvage even in devastating open knee injuries. A large, local rotational fasciocutaneous flap can serve as a reliable and less complex alternative to free tissue transfer for covering massive defects in this region, particularly in young patients with favorable tissue characteristics.

## 1. Introduction

High-energy trauma to the lower extremities frequently results in complex fracture patterns, often complicated by severe damage to the surrounding soft-tissue envelope.[1] Among the most challenging of these injuries are open, trans-articular fractures of the knee joint. These devastating injuries, involving concomitant fractures of the distal femur, proximal tibia, and patella, disrupt the structural integrity of the joint and breach the protective barrier of the skin and underlying fascia, directly exposing the sterile intra-articular space and fractured bone to the external environment.[2] This breach creates a high-risk scenario for bacterial colonization, leading to potentially catastrophic complications such as deep infection, osteomyelitis, septic arthritis, fracture nonunion, and, in many cases, limb amputation. The incidence of deep infection following high-energy open

fractures can be as high as 50%, underscoring the gravity of these injuries.[3]

The Gustilo-Anderson classification system remains the most widely used framework for stratifying open fractures based on the degree of soft-tissue injury, which directly correlates with the risk of infection and subsequent complications.[4] Grade I and II injuries, characterized by smaller wounds and less severe soft-tissue stripping, can often be managed with standard protocols of debridement and fracture fixation. Grade III injuries, however, represent a distinct leap in severity.[5] They are defined by extensive soft-tissue laceration, periosteal stripping, and significant contamination. The most severe subtype, Gustilo-Anderson Grade IIIB (GA-IIIB), is characterized by massive soft-tissue loss requiring complex reconstructive procedures, typically a local or free flap, to achieve wound closure.[6] The injury presented in this report—a complete destruction of the knee's extensor mechanism and soft-tissue envelope with exposed, comminuted fractures of the femur, tibia, and patella—is a quintessential example of a GA-IIIB injury.

The management of such cases has evolved significantly over the past few decades, moving from a paradigm of delayed closure and frequent amputation towards an integrated, multidisciplinary approach known as orthoplastic surgery.[7] This collaborative model, involving orthopedic and plastic surgeons from the moment of patient presentation, has become the gold standard of care. The core principles of modern orthoplastic management for GA-IIIB injuries are centered on a staged protocol.[8] The initial, most critical step is immediate and aggressive surgical debridement of all contaminated and non-viable tissue—skin, subcutaneous fat, muscle, and bone—to reduce the bacterial load and remove the nidus for infection. This is followed by stabilization of the bony architecture, typically with an external fixator that spans the zone of injury, providing skeletal stability without implanting hardware into a contaminated field. This "damage control" approach prepares the wound bed for the final and definitive stage: soft-tissue reconstruction.

The goal of reconstruction is to provide stable, durable, and vascularized coverage over the exposed bone and joint. The "reconstructive ladder," a hierarchical concept guiding the choice of closure method, dictates that the simplest effective technique should be used. For a GA-IIIB defect around the knee, simple methods like direct closure or skin grafting are impossible due to the lack of a vascularized bed. The decision, therefore, lies between local tissue flaps and free tissue transfer. The workhorse local flap for this region has traditionally been the gastrocnemius muscle flap, which can reliably cover defects over the anterior aspect of the proximal tibia and knee.[9] However, its reach can be limited, and the muscle itself is often compromised in the zone of high-energy trauma. The alternative is free tissue transfer, such as a latissimus dorsi or anterolateral thigh (ALT) free flap, which involves microsurgical anastomosis to a recipient vessel outside the zone of injury. While versatile and capable of covering massive defects, free flaps are technically demanding, require specialized expertise and resources, and are associated with longer operative times and potential donor site morbidity. Between these two options lie local fasciocutaneous flaps, which incorporate skin, fascia, and their underlying perforating blood vessels. These flaps, when properly designed, can provide large segments of vascularized tissue with less functional deficit than a muscle flap and less complexity than a free flap.[10]

Herein, we present the case of a young patient with a devastating GA-IIIB open trans-articular knee fracture successfully managed with a staged orthoplastic protocol. The novelty and primary aim of this report are to provide a detailed account of the successful use of a large, local rotational fasciocutaneous flap to cover a massive anterior knee defect. We aim to discuss the critical decision-making process that favored this technique over a gastrocnemius or free flap and to highlight the specific surgical and post-operative management strategies that contributed to a successful limb salvage and a

favorable functional outcome in a limb-threatening injury.

**2. Case Presentation**

A 16-year-old male with no significant past medical history was transferred to the emergency department of Dr. Moewardi Regional General Hospital, a tertiary trauma center, following a high-energy traffic accident where his motorcycle collided with a truck. He was initially treated at a regional hospital before urgent referral for definitive care. Upon arrival, the patient was conscious and hemodynamically stable, with a Glasgow Coma Scale score of 15. His chief complaint was severe pain in his right knee, which was grossly deformed and had a large, open wound.

Physical examination of the right lower extremity revealed a devastating injury centered on the knee. A massive, contaminated wound measuring approximately 12x15 cm was present over the entire anterior aspect of the knee. The wound extended deep to the bone, with a depth estimated at 6 cm, exposing the fractured surfaces of the distal femur and proximal tibia. The patella was visibly fractured and dislocated inferiorly. The wound base consisted of shredded muscle, fascia, and exposed, comminuted bone fragments, with significant periosteal stripping and necrotic bone visible on the femoral trochlea. Peripheral vascular status was tenuous; though specific pulses were not detected, capillary refill time in the toes was less than 2 seconds, and $SpO_2$ on the digits ranged from 98-99%. Plain radiographs confirmed a complex fracture pattern, revealing a comminuted, intra-articular fracture of the distal femur, a comminuted fracture of the tibial plateau with articular depression and metaphyseal extension consistent with a Schatzker Type VI injury, a comminuted and displaced patellar fracture, and an associated simple fracture of the proximal fibular head. Based on the massive soft tissue defect requiring flap coverage, the injury was diagnosed as a Gustilo-Anderson Grade IIIB open fracture of the right knee (Table 1).

The management and follow-up timeline detailed in Table 2 illustrates a systematic and meticulously executed staged orthoplastic protocol, which is the cornerstone of modern limb salvage for severe open fractures. The patient's journey begins with immediate adherence to established trauma protocols in the emergency phase, focusing on hemodynamic stabilization and the prompt administration of broad-spectrum antibiotics to mitigate the high risk of infection inherent in a Gustilo-Anderson Grade IIIB injury. The surgical management was appropriately divided into distinct, logical stages. The initial "damage control" surgery on day one prioritized the most critical elements: aggressive debridement to remove the source of contamination and skeletal stabilization with a spanning external fixator. This approach wisely avoids introducing permanent internal hardware into a contaminated field while providing the mechanical stability necessary for both soft tissue and bone healing. The planned second-look debridement on day three is a crucial step, demonstrating a commitment to ensuring a completely clean wound bed before attempting definitive closure. This diligence is paramount in preventing deep-seated osteomyelitis.

Definitive reconstruction was performed on day five, falling within the ideal 5-7 day window recommended for soft-tissue coverage after high-energy trauma. This timing allows for the initial inflammatory response to subside while preceding the onset of chronic bacterial colonization. The successful execution of a large rotational flap and skin graft at this stage marks the pivotal moment in the limb salvage effort.

The post-operative and follow-up phases demonstrate a structured, progressive rehabilitation plan. The timeline shows a seamless transition from skeletal fixation to protected mobilization with a hinged knee brace, followed by a gradual increase in weight-bearing. This careful progression is essential for protecting the healing fractures and the soft-tissue reconstruction while preventing joint stiffness. The successful management of a minor pin-site infection

highlights the importance of vigilant follow-up. Ultimately, the 12-month outcomes—solid radiographic union, a stable and sensate soft-tissue envelope, and excellent scores on validated functional assessments like the Lysholm and Knee Society Scores—serve as a testament to the efficacy of this comprehensive and well-timed management strategy. The entire process, from emergency intervention to final rehabilitation, reflects a successful application of modern orthoplastic principles, directly leading to an outstanding functional recovery in a limb that was at very high risk of amputation.

Table 1. Summary of clinical findings on admission.

| PARAMETER | CLINICAL FINDINGS |
|---|---|
| **Anamnesis** | |
| **Chief Complaint** | Severe pain and large open wound on the right knee. |
| **History of Present Illness** | Patient was the driver of a motorcycle involved in a high-energy collision with a truck. He reports being dragged after the initial impact. He experienced a brief loss of consciousness at the scene but denies nausea, vomiting, or seizures. Initial wound care was provided at a regional hospital before transfer for definitive management. |
| **Disease History** | |
| **Past Medical History** | No history of chronic illnesses such as hypertension, diabetes mellitus, or heart disease. No known drug allergies. |
| **Past Surgical History** | None. |
| **Family History** | No family history of hereditary diseases, bleeding disorders, or significant orthopedic conditions. |
| **Physical Examination** | |
| **General Status** | Conscious (GCS 15), alert, and oriented. Vital Signs: BP 125/80 mmHg, HR 98 bpm, RR 20/min, Temp 37.1°C. |
| **Local Status (Right Knee)** | Massive 12×15 cm open wound over the anterior aspect with a depth of 6 cm. Gross contamination with dirt and road debris. Visible, comminuted bone fragments of the distal femur, tibial plateau, and patella. Significant periosteal stripping. External rotation deformity of the lower leg. |
| **Neurovascular Status** | Distal pulses (Dorsalis Pedis, Posterior Tibial) were not palpable due to swelling, but distal capillary refill was <2 seconds. SpO2 on digits 98-99%. Sensation to light touch was intact in the foot. Full active range of motion of the ankle and toes. |
| **Laboratory Examination** | |
| **Complete Blood Count** | Hemoglobin: 11.2 g/dL (Low); Hematocrit: 34%; Leukocytes (WBC): 14,500/µL (High); Platelets: 280,000/µL. |
| **Blood Chemistry** | BUN: 18 mg/dL; Creatinine: 0.9 mg/dL; Sodium: 140 mEq/L; Potassium: 4.1 mEq/L. |
| **Coagulation Profile** | Prothrombin Time (PT): 12.5 seconds; aPTT: 30 seconds. Both within normal limits. |
| **Diagnosis** | |
| **Working Diagnosis** | **Gustillo-Anderson Grade IIIB Open Fracture of the Right Knee, comprising:**<br>• Comminuted intra-articular fracture of the distal femur.<br>• Comminuted tibial plateau fracture (Schatzker VI).<br>• Comminuted, displaced fracture of the patella.<br>• Associated fracture of the proximal fibula. |

Table 2. Summary of management and follow-up.

| TIMELINE / PHASE | DETAILS OF MANAGEMENT / FINDINGS |
|---|---|
| **Emergency Management (Day 1)** | |
| **Initial Interventions** | ATLS protocol initiated. IV access established, fluid resuscitation started. Tetanus prophylaxis administered. Broad-spectrum IV antibiotics (Cefazolin & Gentamicin) started. Leg splinted and wound covered with sterile dressing. Patient prepared for emergency surgery. |
| **Surgical Stage 1: Debridement & Stabilization (Day 1)** | |
| **Procedure Details** | Aggressive debridement of all non-viable tissue. Irrigation with 9L of normal saline. Skeletal stabilization with a multi-planar spanning external fixator. Gross reduction of articular fractures. Application of Vacuum-Assisted Closure (VAC) dressing at -125 mmHg. |
| **Surgical Stage 2: Second-Look Debridement (Day 3)** | |
| **Procedure Details** | Planned return to OR. Removal of VAC dressing. Re-assessment of wound bed. Minor additional debridement of dusky tissue. Wound bed appeared healthy and granulating. VAC dressing reapplied. |
| **Surgical Stage 3: Definitive Reconstruction (Day 5)** | |
| **Procedure Details** | Medially-based rotational fasciocutaneous flap (18×10 cm) raised and inset to cover the 12×15 cm knee defect. Donor site covered with a split-thickness skin graft (STSG). |
| **Post-operative & In-hospital Care (Day 5 - 10)** | |
| **Management** | Close flap monitoring (color, warmth, capillary refill). DVT prophylaxis. Pain management. IV antibiotics completed. Patient discharged on Day 10. |
| **Follow-up Timeline & Outcomes** | |
| **4 Weeks** | Flap and graft well-healed. Minor superficial pin-site infection noted and treated with oral antibiotics. Sutures removed. |
| **8 Weeks** | External fixator removed. Placed in a hinged knee brace. Formal physical therapy initiated (non-weight-bearing range of motion). |
| **3 - 6 Months** | Gradual progression of weight-bearing (partial at 12 weeks, full at 16 weeks). Radiographs at 6 months show good callus formation and fracture healing. Knee ROM improving. |
| **12 Months (Final Follow-up)** | • **Clinical:** Independent ambulation without aids. Stable, sensate soft-tissue coverage.<br>• **Radiographic:** Solid union of all fractures in acceptable alignment.<br>• **Functional Outcome:** Knee ROM: 0-100°. Lysholm Score: 85. Knee Society Score: 88 (Knee), 80 (Function). |

## 3. Discussion

This case report details the successful limb salvage of a devastating Gustilo-Anderson Grade IIIB open trans-articular knee fracture through a modern, staged orthoplastic approach.[11] The excellent outcome achieved underscores several key principles and decision-making points in the management of such complex injuries, particularly regarding the choice of soft-tissue reconstruction. The central challenge in this case was the management of a massive 12x15x6

cm avulsive wound that exposed the entire knee joint, a scenario with a historically high rate of amputation. The successful restoration of a stable, functional, and pain-free limb in the face of such extensive trauma is a testament to the power of an integrated, multidisciplinary treatment philosophy that addresses both skeletal architecture and the biological envelope concurrently.[12]

The pathophysiology of a high-energy crush injury, as seen here, extends far beyond the visible wound. The kinetic energy transfer creates a "zone of injury" characterized by widespread vascular damage, microcirculatory disruption, tissue ischemia, and significant periosteal stripping. This compromised biological environment is profoundly susceptible to infection and is incapable of supporting fracture healing.[13] The foundational principle of management, therefore, is to convert this contaminated, avascular wound into a clean, vascularized one. Our approach adhered strictly to this principle. The immediate, aggressive debridement on day one, followed by a planned second-look debridement, was critical in removing the bacterial load and necrotic tissue. The use of a spanning external fixator provided excellent skeletal stability—a prerequisite for both soft-tissue healing and eventual bone union—while wisely avoiding the introduction of permanent internal fixation into a highly contaminated field.

The most critical decision in the reconstructive phase was the choice of flap. The "reconstructive ladder," a hierarchical concept guiding the choice of closure method, dictates that the simplest effective technique should be used. For a GA-IIIB defect around the knee, a local or free flap is required. The workhorse local flap for this region has traditionally been the gastrocnemius muscle flap.[14] However, in high-energy anterior trauma, the gastrocnemius muscle itself is frequently located within the zone of injury, suffering direct contusion or vascular compromise that renders it an unreliable reconstructive option. The alternative is free tissue transfer, which is technically demanding and carries its own risks and morbidities.

This led to the selection of a local rotational fasciocutaneous flap. These flaps, based on perforating vessels from major source arteries, have gained significant popularity in lower extremity reconstruction. Their primary advantage is that they import "like tissue for like tissue"—a composite of skin, fat, and fascia—providing a durable and sensate cover without sacrificing a major functional muscle. In this specific case, the patient's youth afforded him pliable, well-vascularized tissue with significant laxity. By designing a large flap with a wide base and a robust perforator-based pedicle, a long arc of rotation was achieved, allowing for tension-free coverage of the entire massive defect. This approach provided all the benefits of vascularized tissue coverage while avoiding the complexity and risks of a free flap and the functional loss of a gastrocnemius flap. The successful outcome in this case strongly supports the consideration of large, perforator-based local flaps as a powerful tool in the orthoplastic armamentarium.[15]

The orthopedic and functional outcomes are also noteworthy. The management of a Schatzker VI tibial plateau fracture with a spanning external fixator is often a temporary measure.[16] However, in this case, the gross reduction achieved initially, combined with the prolonged stability and the patient's excellent healing potential, resulted in union in a satisfactory anatomical position. This obviated the need for a second major orthopedic procedure. The final functional outcome—a pain-free, stable knee with a 100-degree arc of motion—is remarkable for an injury of this magnitude and is a testament to the patient's compliance and the success of the integrated orthoplastic approach in providing a biological environment conducive to both soft-tissue and bone healing.

The successful outcome detailed in this report is fundamentally rooted in the philosophy of orthoplastic surgery, an integrated approach that has become the standard of care for complex extremity trauma.[17] Historically, the management of such injuries was often sequential: the orthopedic surgeon would first address the fracture, and a plastic surgeon would be

consulted days or weeks later to manage a resulting soft-tissue problem, such as an exposed implant or a non-healing wound. This fragmented approach often led to suboptimal outcomes, as the delay in providing vascularized coverage allowed for bacterial biofilm formation on hardware, desiccation of bone, and the establishment of deep-seated infections that were difficult or impossible to eradicate.[17] The orthoplastic model, in contrast, involves a collaborative team from the moment of patient presentation. This synergy ensures that both the skeletal injury and the soft-tissue defect are considered as a single, interconnected problem. The choice of fixation, the placement of external fixator pins, and the timing of debridement are all planned with the final reconstructive goal in mind.[18] This holistic perspective is critical; for instance, orthopedic pin placement must not disrupt the vascular pedicle of a potential future flap, and the plastic surgeon's knowledge of soft-tissue vascular territories can guide the extent of debridement. This case exemplifies the benefits of this model: a clear, staged plan was formulated from day one, leading to a clean, stable wound bed ready for reconstruction within the optimal time frame.[18]

The pathophysiology of the injury itself warrants deeper consideration (Figure 1). A high-energy crush and avulsion injury, as sustained by this patient, is not merely a "cut." The immense kinetic energy transferred to the limb creates a three-dimensional "zone of injury" that extends far beyond the visible margins of the wound. At the cellular level, this energy transfer causes widespread endothelial damage to the microvasculature, leading to interstitial edema, sludging of red blood cells, and microthrombosis. This cascade of events progressively compromises tissue perfusion in the hours and days following the initial trauma. Consequently, tissue that appears viable in the initial debridement may demarcate and declare itself non-viable 24 to 48 hours later. This is the critical rationale behind the planned second-look debridement. The initial operation serves to remove all grossly contaminated and clearly necrotic tissue, reducing the bacterial load and the inflammatory burden. The second-look procedure, performed after the initial inflammatory wave has peaked, allows the surgeon to re-assess the wound and perform a more definitive debridement of any tissue that has succumbed to the secondary ischemic insult. Bypassing this step is a common pitfall that can lead to closing a flap over a nidus of retained necrotic tissue, dooming the reconstruction to failure from deep infection. Our adherence to this staged debridement protocol was fundamental to creating a truly clean and viable recipient bed for the flap.[19]

The choice of skeletal stabilization is another cornerstone of successful management. For a GA-IIIB injury, the principle of "damage control orthopedics" dictates that definitive internal fixation with plates and screws is contraindicated in the acute setting.[20] Introducing a large foreign body into a highly contaminated wound dramatically increases the risk of implant colonization and chronic osteomyelitis. A spanning external fixator, as used in this case, is the ideal solution. It provides excellent mechanical stability to the fractured femur and tibia, neutralizing the bending, rotational, and axial forces that would otherwise disrupt healing. This stability is crucial, as micromotion at the fracture site can shear delicate new blood vessels and inhibit both soft-tissue and bone healing. By placing the pins far from the zone of injury, the fixator "spans" the damaged area, leaving the wound itself completely accessible for debridement, assessment, and eventual flap coverage. It acts as a temporary external skeleton, maintaining limb length and alignment while the biological environment is being optimized.

The most nuanced and critical decision in this patient's care was the selection of the reconstructive method. The "reconstructive ladder" provides a conceptual framework, but its application requires sophisticated surgical judgment.[20] For a defect of this magnitude—12x15 cm over the mechanically demanding anterior knee—the options were realistically limited to a large local flap or a free tissue transfer. A detailed analysis of these options justifies our ultimate choice.


Figure 1. Pathophysiology of a high-energy open knee fracture.

The gastrocnemius muscle flap has long been the workhorse for knee coverage. Based on the robust medial sural artery, the medial head of the gastrocnemius can be elevated and transposed to cover the patella and proximal tibia. However, its application has significant limitations that made it unsuitable for this case. First, the arc of rotation of the muscle is limited, and it is highly unlikely that it could have provided tension-free coverage for a defect of this size. Attempting to stretch the muscle to cover the entire area would have compromised its distal blood supply, leading to necrosis. Second, the high-energy, anterior nature of the trauma placed the gastrocnemius muscle itself directly within the zone of injury, making its vascularity suspect. Using a potentially compromised flap would be an unacceptable risk. Finally, sacrificing the medial head of the gastrocnemius, a powerful knee flexor and ankle plantarflexor, would have resulted in a permanent,

measurable functional deficit for this young, active patient.

This logically leads to the consideration of free tissue transfer. A free flap, such as a latissimus dorsi myocutaneous flap or an anterolateral thigh (ALT) fasciocutaneous flap, represents the pinnacle of the reconstructive ladder. Its primary advantage is that it brings completely healthy, robustly vascularized tissue from a distant part of the body, entirely outside the zone of injury. A microsurgical anastomosis is performed to a healthy recipient artery and vein in the leg (such as the posterior tibial or anterior tibial vessels), providing a new, independent blood supply to the reconstructed area. For massive defects, a free flap is often the only viable option and is considered the gold standard. However, this approach is not without its significant drawbacks. It requires a specialized microsurgical team, prolonged anesthesia and operative time (often exceeding 8-10 hours), and carries an inherent risk of total flap failure (typically 2-5%) due to thrombosis at the delicate microvascular anastomosis site. A failed free flap is a catastrophic event, often leading to amputation. Furthermore, it creates a significant donor site defect, which can have its own complications and cosmetic or functional consequences.

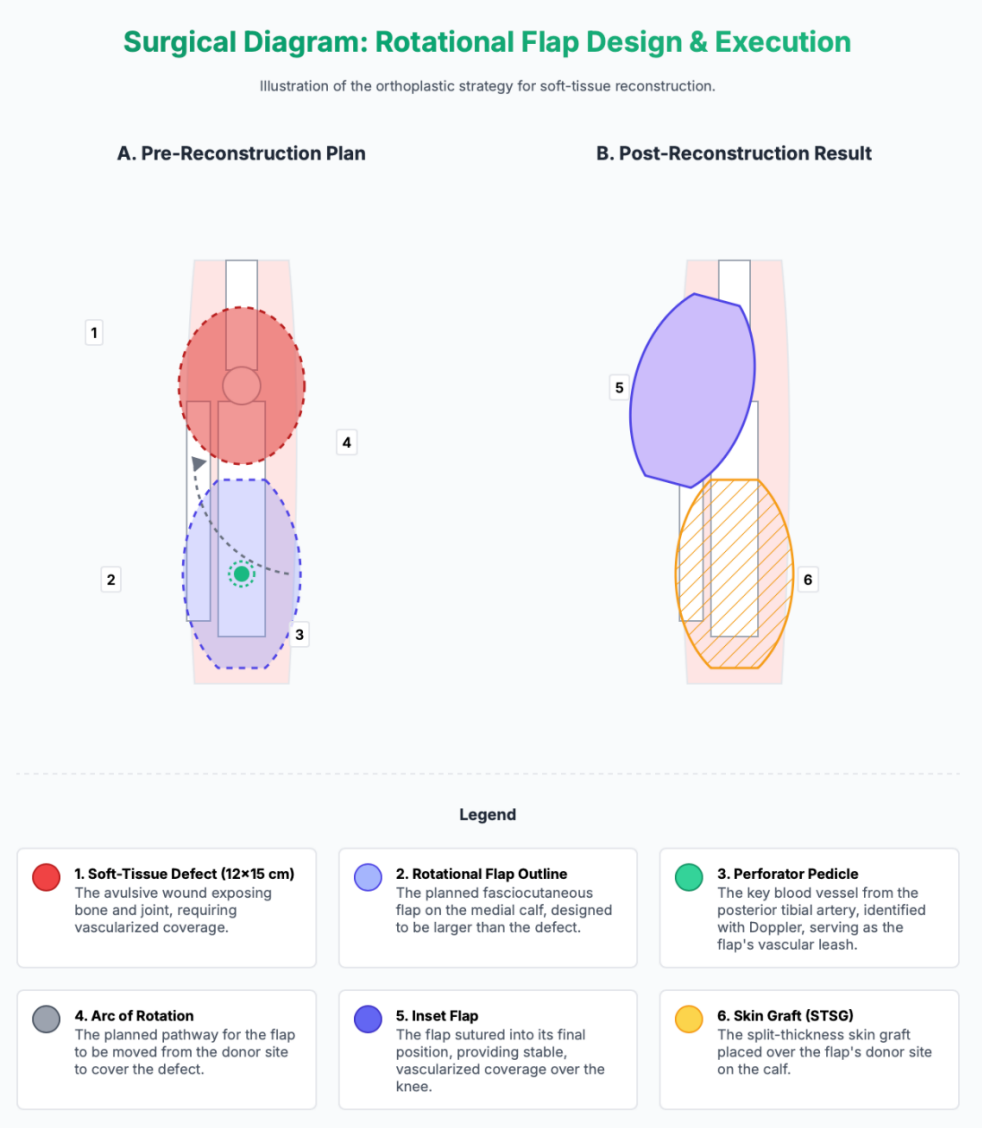


Figure 2. Illustration of rotational flap design and execution.

It was within this context that the decision was made to use a large, local rotational fasciocutaneous flap based on a perforator (Figure 2). The advent of perforator flap surgery has revolutionized reconstructive options. Rather than taking an entire muscle, this technique identifies the small "perforating" blood vessels that travel through or between muscles to supply the overlying skin and fascia. By carefully dissecting and preserving one of these perforators and the tissue territory it supplies (its "perforasome"), a large segment of skin and fascia can be elevated and moved on this narrow vascular leash. In this case, a Doppler probe was used to identify a strong perforator from the posterior tibial artery in the medial calf. A large flap was designed around this point. This choice offered a "best of both worlds" solution. Like a free flap, it provided a large area of well-vascularized tissue. However, because its vascular pedicle was never detached, it avoided the risks and technical demands of microsurgery. Unlike a gastrocnemius flap, it did not sacrifice a major functional muscle, and it provided "like-with-like" tissue—durable, gliding skin and fascia—which is ideal for covering a mobile joint like the knee. The success of this large local flap was contingent on several factors: the patient's youth, which endowed his tissues with excellent vascularity and laxity; the careful pre-operative planning with Doppler localization; and the meticulous surgical technique used to preserve the delicate perforator during elevation. This successful application demonstrates that in the right patient, the boundaries of what can be achieved with local tissue can be pushed, potentially avoiding the need for more complex free tissue transfer.

Finally, the orthopedic and functional outcomes are particularly noteworthy. A Schatzker VI tibial plateau fracture is a severe intra-articular injury that disrupts the congruence of the knee joint. The standard of care often involves a staged approach: initial stabilization with an external fixator followed by a second surgery for definitive open reduction and internal fixation (ORIF) with plates and screws to perfectly restore the joint surface. The fact that this patient went on to achieve solid union in an excellent anatomical position with the external fixator alone is a significant success. This spared him a second major operation, which would have involved extensive dissection around the newly placed flap and the introduction of a large amount of metal hardware, carrying its own risks of infection and soft-tissue complications. This favorable bone healing outcome cannot be viewed in isolation; it is a direct consequence of the successful soft-tissue reconstruction. The robustly vascularized flap did more than just cover the wound; it imported a healthy blood supply to the underlying bone, creating a biological environment that was highly conducive to fracture healing. This symbiotic relationship between bone stability and soft-tissue vitality is the essence of orthoplastic surgery. The final functional results—a pain-free, stable knee with a 100-degree arc of motion and high validated outcome scores—are a direct reflection of this integrated success. The patient not only kept his leg but also regained a high level of function, which is the ultimate goal of limb salvage.

**4. Conclusion**

This case report demonstrates that a devastating Gustilo-Anderson Grade IIIB open trans-articular knee fracture, an injury with a high risk of amputation, can be successfully managed to achieve limb salvage with an excellent functional outcome. The cornerstone of this success is a disciplined, staged orthoplastic protocol centered on aggressive, serial debridement, stable external fixation, and timely, well-planned soft-tissue reconstruction. We have shown that for massive defects of the anterior knee, a large, well-designed local rotational fasciocutaneous flap, based on a reliably identified perforator, can provide durable, sensate coverage. In select patients, particularly the young, this technique represents a powerful and effective alternative to more complex free tissue transfer, successfully restoring form and function to a severely traumatized limb.

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