Tibial Cortex Transverse Transport for Limb Salvage in Diabetic Foot Ulcers

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INTRODUCTION:

Diabetic foot ulcers (DFUs) are among the most severe complications of diabetes mellitus, often leading to high morbidity, major amputations, and premature mortality. Despite advancements in wound care and limb salvage techniques, treatment failures remain prevalent.

Tibial Cortex Transverse Transport (TCT) has undergone significant evolution since its initial conception, offering a promising limb-salvage technique for patients with recalcitrant DFUs. Originally derived from Ilizarov's principles of distraction osteogenesis, TCT was first applied for limb lengthening, fractures, and nonunion management before expanding its utility to peripheral vascular disease (PVD). The initial resurgence of TCT in the 1990s and its subsequent application to DFUs, starting in 2017, highlighted the technique's ability to promote neovascularization and tissue regeneration in ischemic environments. Modern adaptations, including the Accordion Maneuver and refinements in distraction protocols, have improved procedural safety and efficacy, making TCT a valuable adjunct in the armamentarium for DFU management.

The primary aim of this review was to assess TCT's healing rates. The review's secondary aims assess complications associated with TCT including pin-site infection rates, closed-fracture rates, recurrence rates, major amputation rates, and mortality rates. This analysis aims to provide a robust synthesis of available evidence and a comprehensive understanding of TCT's efficacy and safety profile in DFU treatment. Our goal is to not only validate TCT's role as a viable alternative to major amputations but also to identify future directions for optimizing its clinical application and expanding its adoption in Western healthcare systems.

METHODS:

The authors independently searched databases, including PubMed and Google Scholar, for transverse cortex tibial bone transport-related articles and pooled procedure and patient data from the studies found. Inclusion criteria included studies with Wagner Grade 2+ ulcers, controlled trials, and documented healing rates. Statistical analysis was performed to assess pooled healing rates and complication rates. A total of 1,877 patients from 11 Chinese studies treated with TCT were reported. The studies compared treatment protocols, healing and limb salvage rates, complications, and procedure improvements.

RESULTS:

Our analysis demonstrated a remarkably high pooled healing rate of 95.1% (95% CI: 93.9–96.1%), suggesting that TCT is highly effective in facilitating wound closure and limb salvage. Notably, five studies reported 100% healing rates, underscoring TCT's success in well-selected patient populations. In addition, no studies reported a success rate below 90%.

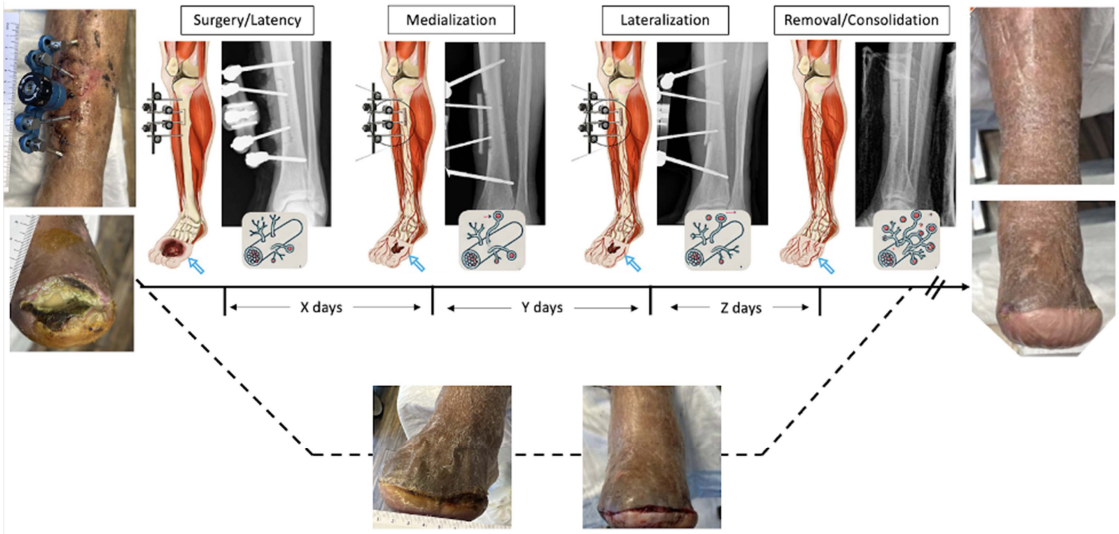
Ulcer recurrence rates were low 2.7% (95% CI: 2.0–3.6%), suggesting that TCT not only promotes initial healing but may also contribute to sustained closure, possibly due to its enhancement of local vascularization and microcirculation. The major 11 amputation rate was relatively low at 4.3% (95% CI: 3.3–5.6%), with most amputations occurring in patients presenting with Wagner Grade 4+ ulcers, where extensive tissue necrosis limited the effectiveness of limb salvage. Similarly, the mortality rate of 4.2% (95% CI: 2.4–7.2%) highlights the potential for improved long-term outcomes with TCT compared to major amputation in high-risk patients.

DISCUSSION AND CONCLUSION:

TCT presents several advantages over traditional DFU treatments. One of its primary benefits is its ability to enhance microcirculation to the distal tibia and thereby accelerating the healing process.

Surgical debridement was commonly performed in conjunction with TCT, with the primary goal of removing devitalized tissue and necrotic bone, as well as draining abscesses. This process is essential to eliminate non-viable tissue that could otherwise impede healing and serve as a nidus for infection. Empirical antibiotic therapy should always be considered in the presence of infection.

In addition, large vessel reperfusion should be performed when indicated, and comparative revascularization studies with and without TCT should be designed. Furthermore, TCT should be used within a multidisciplinary approach when managing DFUs, including vascular interventions, physical therapy, diabetes education, and mental health support.


Surgery/Latency
Medialization
Lateralization
Removal/Consolidation
X days
Y days
Z days