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INTRODUCTION

Tissue loss is a complex clinical condition that commonly results from burns, trauma, oncologic resections, or necrotizing soft-tissue infections. Such injuries require appropriate reconstruction following initial resuscitation (1). The success of reconstruction is influenced by numerous factors, including mechanical stress, infectious and inflammatory processes, and underlying comorbidities (2,3). In conditions prone to severe infection prompt administration of appropriate antibiotics, timely and aggressive surgical debridement, and meticulous wound care are essential resuscitative measures to prevent mortality (4,5). Subsequent reconstruction combined with consistent postoperative wound management is critical for reducing morbidity.

A variety of reconstructive options are available, including

Staged primary tissue repair

Abstract

Aim: To illustrate the advantages of performing primary wound repair in a staged manner by utilizing the intrinsic expandability of soft tissue in wounds with extensive tissue loss.

Materials and Methods: *Staged Primary Tissue Repair* is a technique designed to minimize wound-related complications and promote safe healing by exploiting the natural elasticity of tissue rather than relying on abrupt treatment transitions. The method, including its procedural steps, has been described in detail, and a patent application has been submitted.

Results: Extensive tissue loss can arise from multiple etiologies and is associated with impaired wound healing when certain adverse factors are present. Although tissue expandability and elasticity are well-recognized—such as with the use of retention sutures for post-laparotomy abdominal closure or tissue expanders before flap surgery—these principles have not been widely applied to primary wound repair. In *Staged Primary Tissue Repair*, intermittent sutures are sequentially applied. As the wound edges gradually approximate and the defect decreases due to tissue elasticity, additional sutures are placed at each follow-up. This progressive approach ultimately allows tension-free approximation of the wound edges and complete resolution of the defect, thereby enabling safe primary wound closure.

Conclusion: *Staged Primary Tissue Repair* is a promising treatment modality for patients with extensive tissue loss, particularly those with high complication risk or significant comorbidities, by leveraging the natural expandability of soft tissue to achieve secure primary closure.

Keywords: Tissue repair, primary wound closure, staged primary tissue repair, tissue expansion, retention sutures, negative-pressure wound therapy

conventional dressings, negative-pressure wound therapy (VAC-Vacuum-Assisted Closure) flap procedures, and primary closure techniques (6–8). Treatment is typically individualized based on clinical effectiveness, patient comfort, and cost considerations, and no single approach serves as a universal gold standard.

The intrinsic expandability of skin, mucosa, and muscle within physiological limits is well established. Classical reconstructive practice frequently utilizes this property, as seen with tissue expanders placed prior to flap surgery for defects requiring additional soft tissue (9,10). Similarly, the application of retention sutures during abdominal closure after laparotomy reduces wound tension by exploiting the elastic properties of the tissues (11,12).

In patients with extensive tissue loss—particularly those with

significant systemic comorbidities or local factors impairing healing—a gradual, staged repair that leverages natural tissue expandability may offer advantages over immediate primary closure.

Technical Report

Staged Primary Tissue Repair is a technique utilized for the management of wounds with extensive tissue loss by leveraging the natural expandability of soft tissues rather than employing abrupt treatment transitions. The procedural steps of the technique are described in detail. This method aims to minimize wound-related complications and promote safe healing, while also reducing hospitalization duration, associated complications, and overall healthcare costs. The outcomes achieved with this approach have been documented.

To protect the originality of the technique, a patent application was submitted (Application date: 25.05.2023; Institution: Turkish Patent and Trademark Office; Invention title: *Staged Primary Tissue Repair*; Application type: Individual; Applicant: Betül Güzelyüz; Inventor: Betül Güzelyüz; Document number: 2023/005991).

This study was conducted in accordance with the principles of the Declaration of Helsinki. The results on the cases aren't included in the article, and informed consent was obtained from all intervened cases.

RESULTS

Staged Primary Tissue Repair was applied to wounds with extensive tissue loss using a staged suturing approach that utilizes the natural expandability of soft tissue to achieve tension-free primary closure. Following debridement of the wound and initiation of appropriate antibiotic therapy when infection was present, the decision to continue treatment with intermittent dressings or VAC was made based on patient and wound characteristics (Figure 1a).

In cases where the wound edges were too widely separated to permit immediate primary closure, several interrupted sutures were initially placed to approximate the wound edges (Figure 1b). As routine dressing changes or VAC continued over the subsequent days or weeks, progressive tissue elasticity allowed the wound edges to move closer together and the defect to partially contract. At this stage, additional interrupted sutures were placed to further reduce the defect size (Figure 1c).

When further contraction occurred, previously placed sutures were replaced or supplemented with new ones as needed, depending on tissue tension and wound-edge approximation (Figure 1d). This gradual, stepwise approach was continued until the wound edges were sufficiently approximated to allow complete, tension-free primary closure, resulting in elimination of the tissue defect (Figure 1e). Healing progressed with minimal scarring (Figure 1f).

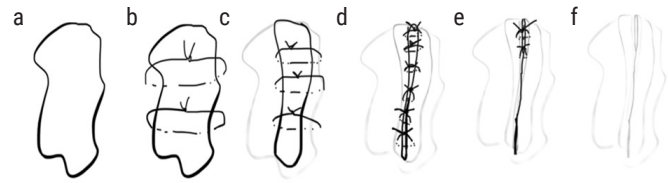


Figure 1 (a–f). Staged Primary Tissue Repair: Sequential approximation of wound edges in a defect with extensive tissue loss. (a) Open wound with a large tissue defect following debridement. (b) Initial interrupted sutures placed at intervals to approximate wound edges. (c) Further approximation as tissue elasticity allows progressive contraction of the defect; additional sutures placed. (d) Replacement or tightening of interrupted sutures as edges draw closer. (e) Complete, tension-free approximation of wound edges and closure of the tissue defect. (f) Final healing with minimal scarring

DISCUSSION

In wounds with significant tissue loss, contemporary management focuses on selecting the most appropriate reconstructive option following initial intervention. Owing to their inherent elasticity and capacity for expansion, soft tissues can be manipulated to facilitate closure in several established techniques. For example, retention sutures are commonly used to assist abdominal closure after laparotomy, and temporary approximation techniques—such as placing sutures and removing them after a short interval—have been described. However, these approaches do not involve a structured, stepwise suturing strategy designed to progressively reduce tissue tension and allow gradual approximation of wound edges over time.

Successful reconstruction of tissue defects requires reliable closure while minimizing procedure-related complications. VAC is frequently employed in modern practice to promote granulation tissue formation, reduce edema, and accelerate the wound-healing process. In wounds with small residual defects, secondary intention may be appropriate; however, in cases of extensive tissue loss, primary closure, grafting, or flap reconstruction are typically preferred. Each of these methods carries inherent risks. Primary closure may result in wound dehiscence when excessive tension is present, whereas closure with grafts or flaps may be compromised by partial or total necrosis (8,9).

The staged approach described in this study offers an alternative strategy by using the natural elasticity of tissue to gradually approximate wound edges, potentially reducing the tension-related complications seen with traditional primary repair.

In cases of tissue loss, administration of appropriate antibiotics, surgical debridement, and the use of frequently changed dressings or VAC are standard components of wound management and help render the defect repairable (9). Tissue expanders may also be used prior to flap reconstruction when necessary. When definitive wound closure is planned at the end of this process, primary closure—when feasible—generally offers advantages over more extensive procedures such as flap surgery, as it promotes

earlier wound healing provided that infection is controlled (8). However, primary closure carries the risk of wound dehiscence when excessive tension is present, whereas grafts and flaps may be associated with partial or total necrosis. For successful reconstruction, procedure-related complications must therefore be minimized (2,12,13).

Although outcomes vary depending on the method used, complication rates remain significant and may prolong hospitalization. Ideally, an effective wound-closure technique should be low-cost, simple to apply, associated with shorter hospital stays, produce minimal postoperative pain, and demonstrate low recurrence and complication rates (8). Following adequate debridement and antibiotic therapy, NPWT can accelerate healing and help the defect reach a reconstructable state more rapidly. Nevertheless, in wounds with extensive tissue loss—particularly those complicated by systemic or local factors impairing healing—direct primary closure is often under excessive tension, while graft or flap repair may still result in complications.

In such cases, we recommend performing primary closure in a staged manner while allowing a period of secondary healing supported by conventional dressings or intermittent NPWT. This approach takes advantage of the natural elasticity and expandability of soft tissues to gradually approximate wound edges, thereby reducing both the need for grafts or flaps and the tension associated with traditional primary closure.

A limitation of this study is the lack of standardization, as wound-healing outcomes are influenced by numerous multifactorial elements and the varied comorbidities present in each case.

CONCLUSION

Staged Primary Tissue Repair is an adaptation of established wound-management principles that utilizes the natural expandability of soft tissue to facilitate gradual, tension-free primary closure. This method offers a valuable treatment option for patients with extensive tissue loss, particularly those at high risk for complications or with significant comorbidities, and may also contribute to reduced overall healthcare costs.

Conflict of Interests

The authors declare that there is no conflict of interest in the study.

Financial Disclosure

The authors declare that they have received no financial support for the study.

Ethical Approval

This study was conducted in accordance with the principles of the Declaration of Helsinki. The results on the cases aren't included in the article, and informed consent was obtained from all intervened cases.

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