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A Novel Method of Postoperative Wound Care Following Total Ankle Arthroplasty

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Improvements in total ankle arthroplasty (TAA) implant design, instrumentation, surgeon training, outcomes, and survivorship have created a resurgence of TAA interest and use in recent years.[3,5,11] Operative technique plays a critical role in the short- and long-term survivorship of TAA and the association of a learning curve with complication rates has been reported in the literature.[7,10] Key aspects of TAA include meticulous handling of the soft-tissue envelope, postoperative wound care, and early mobilization with physical therapy. Glazebrook et al analyzed TAA complications in a series of 20 studies with a total of 2,386 ankle replacements and determined the relative risk of failure due to each complication.[6] The overall failure rate was 12.4% at 5.3-year follow-up. Complications were graded as "high" (deep infection, aseptic loosening, implant failure) if they resulted in failure greater than 50% of the time, "medium" (technical error, subsidence, and postoperative fracture) if less than 50% failure rate, and "low" (intraoperative fractures, wound healing problems) if minimal morbidity and no associated failure. Wound healing problems were the fourth most commonly reported complication and can significantly impair postoperative mobilization, therapy, and, as a direct consequence, clinical outcomes.

Wound complications are multifactorial in scope. Incisions due to prior surgery that lie in close approximation to the operative approach for a TAA are a significant factor, and may be incorporated into this approach to lessen soft tissue bridge necrosis. Similarly, a dysvascular extremity, or angiosome violation, can lead to poor wound healing. All of these factors are exacerbated in the lower extremity by postoperative swelling, as further decreases in tissue perfusion and microcirculation worsen healing potential.[12] To help reduce postoperative swelling and assist in the prevention of operative wound breakdown after TAA, we have developed a unique compression wrap protocol that is low-cost, quick, easy to apply, and well tolerated by patients. The compression wrap protocol utilizes a series of dressings consisting of petroleum gauze, 4-inch × 4-inch gauze, kerlix, tubular gauze, multipurpose underpadding, short-stretch cotton compression bandages, and silk tape. Our technique allows for decreased pressure directly over the anterior operative wound while reducing surrounding tissue edema throughout the foot and ankle. As such, it facilitates early motion, and in doing so limits rigid scar tissue formation. This protocol can also be extended for use in a variety of other ankle or hindfoot procedures to reduce postoperative swelling.

Technique

The compression dressing technique and materials are versatile and can be used in the operating room after skin closure, in the inpatient setting, and in the outpatient clinic (Figure 1). The patient is kept in the supine position and the incision is first painted with Betadine (polyvinylpyrrolidone and elemental iodine) and allowed to fully dry (Figure 2). Sterile nonadhering petroleum gauze is placed on top of the incision followed by two 4-inch × 4-inch dry gauze on top and 1 layer of kerlix dressing from the base of the toes to the ankle. Small pieces of silk tape are used to secure the kerlix dressings. One layer of Tricofix® (BSN Medical, Charlotte, NC) tubular gauze is placed on the skin surface, distal to the toes and proximally above the knee where it functions to wick away moisture and provide an adherent surface for additional padding and compression bandages.

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Figure 1. Compression dressing materials used include petroleum gauze, kerlix, tubular gauze, multipurpose underpadding, short-stretch cotton compression bandages, and silk tape.

Two layers of 10-cm Artiflex® (BSN Medical, Charlotte, NC) multipurpose underpadding bandage are placed over the tubular gauze from the base of the toes to the ankle with an even distribution of pressure while conforming to the contours of the foot and ankle (Figure 3). An additional layer of 15-cm Artiflex is then applied from the malleoli to the tibial tubercle for extra padding with even compression across the ankle and calf. With the foot and ankle passively dorsiflexed to neutral to avoid bunching along the anterior ankle, 1 layer of 6-cm Comprilan® (BSN Medical, Charlotte, NC) short-stretch cotton compression bandage is placed over the foot from the base of the toes to the proximal ankle at 50% stretch. This provides both compression and high resistance to stretch to increase venous and lymphatic return. An additional 1 to 2 rolls of 12 cm Comprilan bandage are placed over the lower extremity from the ankle to the tibial tubercle. Bandage sizes and quantity can be adjusted depending on the size of the patient and the width and length of the lower extremity. Finally, the underlying tubular gauze is cut, folded back onto the bandages, and secured with silk tape.

The lower extremity is placed in controlled ankle motion (CAM) boot for support and made non-weight-bearing for protection of the arthroplasty. Strict elevation of the limb is maintained at all times with gravity dependency no more than 1.5 hours per day and for no more than 30 minutes at a time. Dressings and compression wraps are changed 2 to 3 times per week depending on the amount of postoperative edema until sutures are removed at 2.5 weeks after surgery. If edema is well controlled after suture removal, patients are transitioned into 2 layers of Tubigrip® (Molnlycke Health Care, Norcross, GA) anatomically shaped elastic tubular bandage for skin and soft tissue maintenance. Careful attention is paid to any blistering around the wound and necrosis along the incision and education is given regarding proper nutritional support for healing. Circumferential edema of the foot, ankle, and calf is serially measured to track progress. Patients are initially mobilized with gentle ankle range of motion exercises with progressive weight-bearing beginning at 6 weeks. Transition out of dressings entirely into normal shoe wear is typically achieved at 10 to 12 weeks after surgery.

Discussion

Incision healing problems after TAA are a commonly reported complication that can negatively effect postoperative therapy, outcomes, and patient satisfaction.[6] In large TAA series, there is no standard for postoperative wound care with many surgeons electing to use a combination of local occlusive or dry dressings, CAM boot, splints, and/or cast immobilization for the first several weeks after surgery.[3,5,11] Wound problems can lead to infection, delayed healing, persistent drainage, and dehiscence requiring operative intervention.[2] Intraoperative soft tissue handling should be done carefully and judiciously, but the literature is lacking regarding postoperative dressing management for TAA to reduce incision pressure and swelling. Casting an ankle in maximal dorsiflexion can produce vascular congestion at the tenuous suture line across the ankle, creating increased potential for skin necrosis. In addition, such immobilization encourages local edema to develop, creating further compromise. Eradicating early edema can enhance vascular flow and circulation to the soft tissues, thus lessening this risk factor. There is no current evidence to suggest that any specific dressing protocol after surgery is more advantageous than another in regards to wound complications or clinical outcomes. Several studies have investigated various dressing protocols after ankle fractures, calcaneus fractures, and hindfoot surgery with promising results.[1,2,4,8,9]

Bergin et al investigated the effects of an inpatient soft tissue management protocol on wound complications compared with outpatient dressings in a retrospective review of 102 calcaneus fractures.[1] Inpatient dressings consisted of a series of compressive wraps to the operative extremity using webril and elastic bandages along with ice water inflow cold therapy to the foot and ankle and strict bed rest with elevation above the level of the heart. Outpatient dressings were composed of soft compression dressings and plaster splints. The authors found that patients using the inpatient protocol had a significantly shorter time to achieve

Figure 2. (A) The anterior ankle incision is first sterilized with Betadine swab sticks and allowed to fully dry. (B) A single layer of petroleum gauze is placed on top of the incision followed by two 4-inch × 4-inch dry gauze and 1 layer of kerlix dressing from the base of the toes to the ankle. (C) One layer of tubular gauze is placed on the skin surface, distal to the toes and proximally above the knee.

return of skin wrinkles prior to surgery at an average of 6.2 days. The outpatient group took 10.8 days and also had a significantly higher rate of wound complications. Eagan et al reported the use of a cotton batting compression dressing and fiberglass cast for postoperative use after ankle or hindfoot surgery to accommodate swelling.[4] The cast protocol included sterile dressing, stockinette, cotton layers, kerlix for compression to create a pressure gradient (but released anteriorly), cast underpadding, and fiberglass tape. No bivalved casts were used and all casts were well tolerated in a series of 38 patients undergoing ankle and/or hindfoot surgery. The authors reported no incision complications and that the cast was able to accommodate swelling in all patients.

In a randomized clinical trial studying the effects of pulsatile cold compression on soft tissue swelling in a series of 24 ankle fractures, Mora et al found that cold compression had a greater decrease in swelling from 24 to 72 hours after surgery as measured by ankle circumference compared with standard padded posterior splints.[8] Cold compression therapy was well tolerated by patients and had high reported satisfaction rates. Myerson and Henderson investigated the effects of a pneumatic impulse compression device to reduce swelling after trauma and major foot and ankle surgery in a prospective study of patients with acute and chronic postoperative edema.[9] In both patients with acute swelling after surgery and chronic postoperative swelling, the authors found that use of a pneumatic device

Figure 3. (A) Two layers of multipurpose underpadding bandage are placed over the tubular gauze from the base of the toes to the ankle with an even distribution of pressure. (B) An additional layer of bandage is applied from the malleoli to the tibial tubercle with even compression across the ankle and calf. (C) One layer of short-stretch cotton compression bandage is placed over the foot from the base of the toes to the proximal ankle at 50% stretch. (D) An additional 1 to 2 rolls of compression bandage are placed from the ankle to the tibial tubercle. (E) The underlying tubular gauze is cut, folded back, and secured with silk tape. The lower extremity is placed in a controlled ankle motion boot and strict elevation of the limb is maintained with non-weight-bearing precautions.

significantly reduced swelling and was well tolerated. However, no mention was given regarding rebound edema, a potential complication of rapid edema resolution that can occur as range of motion and therapy progress.

We have used our compression wrap protocol in a series of 100 TAA using an anterior approach with significantly improved wound healing and decreased wound-related complications compared to prior postoperative dressings in a padded circumferential cast (Figure 4). We found only 2 major wound complications requiring secondary surgery after implementing our compression dressings. Our dressings failed in these patients due to previous anterior ankle incisions combined with their previous history of wound complications and poor healing. The secondary injury to the local soft tissues and blood supply caused by our total ankle anterior approach likely caused further damage to the soft tissues that could not be addressed alone with our wound care protocol. All of our total ankle patients have tolerated

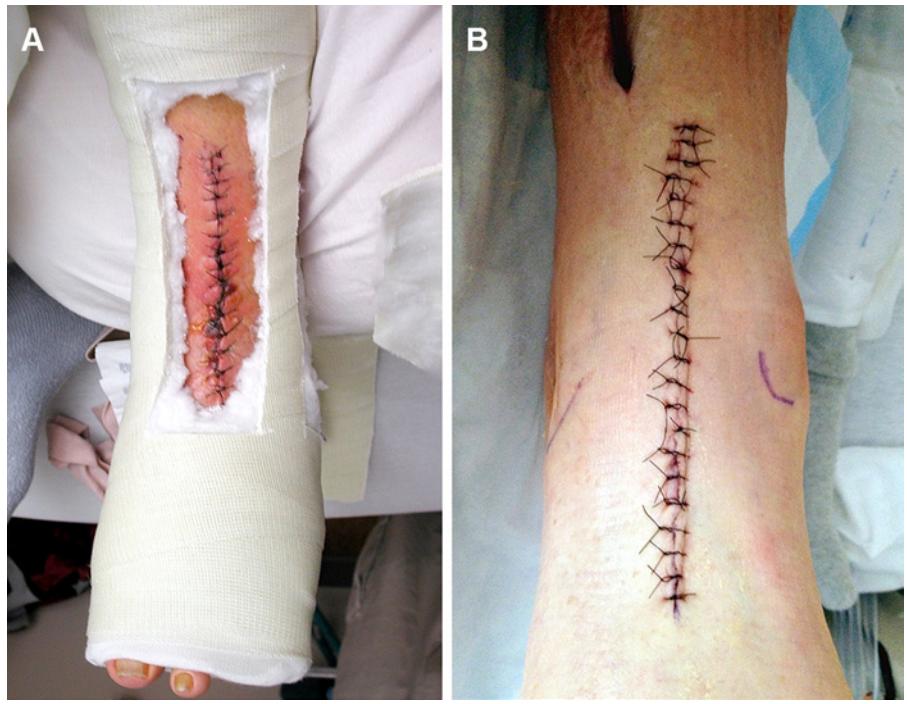

Figure 4. (A) Anterior total ankle arthroplasty (TAA) incision with marked erythema and edema 3 days after surgery using a padded circumferential cast. (B) Anterior TAA incision with minimal edema 3 days postoperative after using compression wrap dressings.

compression dressings with high satisfaction and compliance rates. Monitoring our operative incisions every 2 to 3 days during wrap changes allows prompt attention to any potential progressive incision complications, thus reversing a potentially adverse outcome. If rebound edema occurs, we are able to continue or restart compression dressings without delay. Overall, we believe that our proposed series of quick, easy to apply compression dressings helps to significantly reduce the development of operative wound breakdown and reduce postoperative edema after TAA. This technique has utility and can be easily applied to other ankle and hindfoot reconstructive procedures.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: ARH and DF have no disclosures. SLH is currently serving as president of the American Orthopaedic Foot and Ankle Society (AOFAS). He is a paid consultant for Wright Medical Technology, Inc.

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