# Primary Closure of Wounds as Augmented by DermaClose™ RC: A Retrospective Case Study

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## Introduction:

An estimated 15% of patients with diabetes will develop a lower extremity ulcer during the course of their disease (3). In addition, foot ulceration is the precursor to approximately 85% of lower extremity amputations in persons with diabetes (3). Moreover, there is a 50% incidence of a contralateral amputation within 2 to 5 years of a lower extremity amputation (3). Treatment of infected foot wounds comprises up to one quarter of all diabetic hospital admissions in the US and Britain and, thus, is the most common reason for diabetes related hospitalization in these countries (3). Persons with diabetes have an increased risk of developing an infection of any kind and a several-fold risk of developing osteomyelitis (3). The same risk factors that predispose to ulceration are also generally considered to be contributing causes of amputation (3). When a limb-threatening infection is present, early surgical treatment of the affected site is typically necessary as an integral part of infection management (3). Subsequently, obtaining wound closure is paramount in avoiding the additional complications associated with a chronic open wound. Tissue expansion has been studied as an aid in the rapid closure of wounds after ulcer debridement, bone resection, and amputation (4). Mechanically assisted wounds have been shown to close up to 40% times faster as compared to wounds left to heal by secondary intention (5). Mechanically assisted wound closure with tissue expansion can also be a viable alternative to skin flaps and skin grafting. Recently, a product that has been used in plastic surgery for tissue expansion, DermaClose™ RC, has been found to be useful in lower extremity post-operative wound closure and its use investigated by wound care experts from the specialty of podiatric medicine and surgery (6). Small to large skin voids are commonly seen in plastic surgery following removal of cancer affected areas of the skin, excision of tissue, and debridement of dehisced wounds (6). Rapid closure of skin deficits has been obtained through use of the DermaClose™ RC tissue expander following these procedures with success and less scarring being noted (6).

## Design/Method:

Six patients who had the DermaClose™ RC system applied to obtain primary closure of postoperative wounds were studied retrospectively. Past medical history, age, sex, location of the wound, pre and post operative wound size, and duration of application of the DermaClose™ system was recorded for each patient. The wound area pre and post DermaClose™ RC application was calculated for each patient along with the total percent of wound area reduction.

## Results:

In all six patients, the post operative wound was closed using delayed primary closure. There were no reported or observed cases of dehiscence. Although in some of the cases there was residual gapping present, these areas completely healed without any complications. Patients consisted of 4 males and 2 females with an average age of 59 years. All patients had longstanding diabetes mellitus, type II. All wounds were postoperative after either an incision and drainage of an abscess or post partial ray amputation secondary to osteomyelitis The mean wound area before and after application of the DermaClose™ system was 11.79 cm² and 2.5 cm² respectively, with a mean area of reduction of 79 percent and a mean time of application of 28 hours.

## References

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** DermaClose™ RC, Wound Care Technologies, Inc., Chanhassen, MN*

## Design/Method Chart

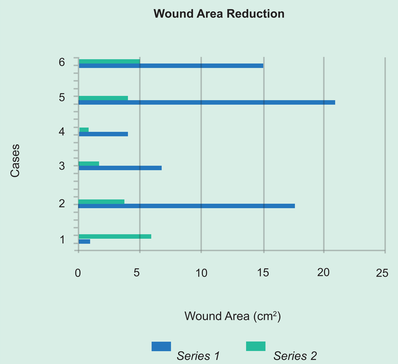
**Summary of Patient Data**

| Case | Age | Sex | Locations | Type of Wound | Pre Application Size (cm²) | Post Application Size (cm²) | Percent Reduction in Wound Size (cm²) | Duration of Application (Hr) |
|---|---|---|---|---|---|---|---|---|
| 1 | 58 | M | Left Medial Forefoot | Post-partial 1st Ray Amputation | 6 | 1.2 | 80 | 24 |
| 2 | 47 | M | Left Lateral Forefoot | Post - I&D of Abscess | 17.5 | 3.5 | 80 | 24 |
| 3 | 61 | M | Left Medial Forefoot | Post-partial 1st Ray Amputation | 7.5 | 1.2 | 84 | 24 |
| 4 | 60 | F | Right Lateral Forefoot | Post-partial 5th Ray Amputation | 3.75 | 0.75 | 80 | 1 |
| 5 | 58 | M | Right Lateral Forefoot | Post-partial 4th Ray Amputation | 21 | 3.5 | 83 | 24 |
| 6 | 66 | F | Left Lateral Forefoot | Post-partial 1st Ray Amputation | 15 | 5 | 67 | 72 |

**Summary of Mean Measurements**

| Mean Age | Male to Female Ratio | Mean Wound Area Pre-Application (cm²) | Mean Wound Area Post-Application (cm²) | Mean Percent of Wound Area Reduction | Mean Time of Application |
|---|---|---|---|---|---|
| 59 years old | M:F, 4:2 | 11.79 | 2.5 | 79 | 28 Hours |

## Wound Area Reduction Graph




** Series 1 shows wound area prior to DermaClose™ application in cm². Series 2 shows the wound area after DermaClose™ application. The difference between the two series represents the wound area reduction. The mean area reduction is 79%.*

## Patient #1

*This 58-year-old male with diabetes mellitus presented with osteomyelitis of the 1st metatarsal. On 2/01/07, he underwent a partial first ray amputation which was left open for anticipated delayed primary closure. The patient's wound was treated for one year without any improvement. The DermaClose™ device was applied for skin expansion on 02/07/08. The patient ambulated in a post-op shoe while the DermaClose™ unit was in place. The patient returned 24 hours later on 02/08/08, for delayed primary closure. After delayed primary closure was performed, an Unna boot and Coban compression dressing was applied and then re-applied twice a week. On 02/21/08, sutures were removed. Slight superficial dehiscence at the proximal wound margin was noted. On 3/25/08 the wound was completely epithelialized.*

## Patient #2

*This 47-year-old diabetic male was undergoing treatment of a neuropathic plantar forefoot ulcer when he developed an infection of the wound with abscess formation. He was subsequently admitted to the local hospital on 6/23/08, where he underwent incision and drainage of the forefoot followed by wet-to-dry dressing changes and local wound care for four days. Due to the large defect at the central aspect of the wound, delayed primary closure could not be performed. Therefore, DermaClose™ was applied on 6/26/08, and delayed primary closure was performed on 6/27/08, upon removal of the DermaClose™. The patient was discharged on 6/28/08, on oral antibiotic therapy. As of 8/14/08, there was a residual ulcer of the plantar left forefoot measuring 0.8 cm by 0.4 cm by 0.3 cm with mild superficial gapping at the proximal aspect of the wound. On 8/28/2008 the entire incision was completely closed.*

## Patient #3

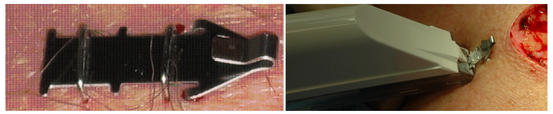
*This 64-year-old male presented with an infected ulceration at the medial aspect of the first metatarsophalangeal joint which had been present for three weeks. On 02/11/08, he underwent debridement of the medial aspect of the first metatarsal head performed under local anesthesia. He was placed on wet-to-dry dressing changes for one week. On 02/18/08, the patient returned to the office and a DermaClose™ tissue expander device was applied. He ambulated in a post-op shoe while the DermaClose™ unit was in place. The patient returned 24 hours later on 02/19/08, with the skin margins more closely approximated and delayed primary closure was performed. The patient returned for follow-up on 02/25/08, having not incurred any complications. The wound site had 3 mm gapping centrally with the remainder of the incision being well approximated. The patient returned on 03/03/08, for follow-up and sutures were removed. There was central gapping of 3-4 mm filled-in with granulation tissue with no exposed bone. On 4/21/08, the wound was completely closed.*

## Conclusion

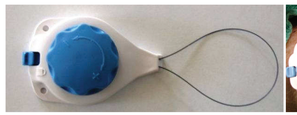
Closure of wounds following surgical debridement procedures and/or amputations frequently poses a problem for the wound care surgeon. However, the DermaClose™ RC system has been shown to facilitate or accelerate closure of wounds that otherwise would either go on to skin grafting or healing via secondary intention. Our experience using the DermaClose™ system yielded satisfactory results for all patients on which it was used. It has been the authors' experience that the DermaClose™ system can range in application from 1 hour to several days. It is the authors' opinion that new and innovative techniques are needed to help surgeons overcome the challenges faced in the demanding field of wound care. In conclusion, we found that the DermaClose™ RC system allowed for the closure of wounds that would otherwise have remained open for a longer period of time, thus exposing patients to the risks associated with a chronic wound. In addition, the skin expansion device proved to be well tolerated by all of our patients without causing any skin necrosis during or after its application.

## About the DermaClose™ RC Continuous External Tissue Expander:

The DermaClose™ RC is an innovative new device used to facilitate rapid closure of acute or chronic wounds. This unique device gently expands skin adjacent to a full thickness wound facilitating wound closure or significant reduction in wound size. The DermaClose™ RC 'tension controller' applies a continuous controlled pulling force and does not require additional tightening after initial application. This capability results in safer, faster tissue expansion compared to other techniques. Depending on wound size and location, significant expansion can occur inter-opertivley, while many wounds may take a few days to obtain maximum results. Once adequate expansion is accomplished the DermaClose™ RC is removed and the wound is either sutured closed or the smaller wound is allowed to heal by secondary intention or alternative interventions. The DermaClose™ RC can be used on any size linear wound using one or more of the DermaClose™ RC devices in a "shoelace" configuration. The "shoelace" technique provides considerable flexibility by utilizing constant force tension on opposing wound margins. The DermaClose™ RC can also be used on radial wounds up to 15 cm in diameter.



*The flat barbs of the skin anchors insert into the skin 4.5 mm and are held in place with two skin staples.*



*The line from the tension controller attaches under the tab of the skin anchors.*

*The DermaClose™ RC is often used in a radial configuration.*

*A 3M skin stapler and staple remover is included in the DermaClose kit.*