

Manipulating Wound Geometry and Skin Tension to Accelerate Healing

Katerina Grigoropoulos, DPM; Matthew Garoufalos, DPM; Rodney Stuck, DPM

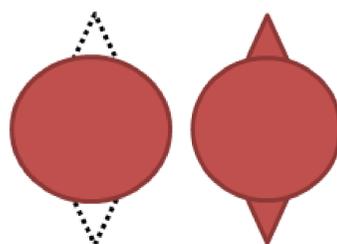
Edward Hines, Jr. Veteran Affairs Hospital - Surgical Service, Section of Podiatry
Hines, Illinois, USA

STATEMENT OF PURPOSE

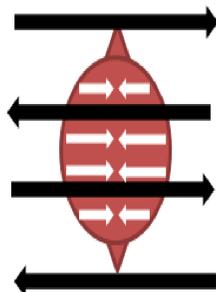
The purpose of this quality assurance review is to evaluate the effect of apical debridement and wound tension relief in wound healing. The combination of this sharp debridement technique along with the addition of wound edge tension relaxation has the power to manipulate wound geometry and facilitate wound closure. In theory, linear shaped wounds epithelialize faster compared to ones that are circular in nature. Apical debridement with the application of skin tension towards the wound has the power to transform a circular wound to one that is more linear. Relieving tension around the periwound, which ultimately reduces the distance between wound edges and promotes epithelial cell migration and bridging, can accelerate this evolution in shape geometry.

METHODS

Apical debridement consists of a wedge excision at the most extreme ends of the wound. This surgical wedge excision relieves tension to the wound and allows the manipulation of wound geometry. With this periwound tension relaxation, the skin edges at the most extreme ends become closer approximated which encourages epithelial cell migration to facilitate wound closure. Additionally, applying skin tension towards the wound from opposite directions using the steristrip technique further relaxes the wound edges and acts as a wound splint to limit skin edge movement, frictional forces and potential damage to the newly formed epithelial cells.



The steristrip technique consists of applying bidirectional opposing tension towards the wound by manual manipulation and applying steristrips across the wound to secure this position and allow the wound edges to rest in closer proximity. Proper offloading was ensured for all subjects to eliminate excess pressure to the wound using either a surgical shoe, CAM walker or TCC casting. Skin substitutes were applied to all subjects intermittently throughout their wound care course.



CASE EXAMPLES

CASE # 1: 61 yo DM male with left hallux wound sustained after wearing ill fitting military boots



CASE # 2: 71 yo DM male with right foot dehiscence after first ray amputation



CASE # 3: 77 yo DM male with dehiscence after hardware removal



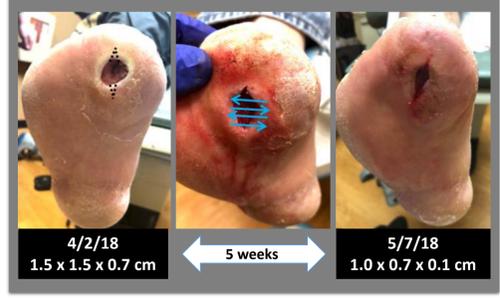
CASE # 4: 59 yo DM male with dehiscence after right fifth ray amputation



CASE # 5: 67 yo DM male with recurrent right plantar ulceration after TMA



Apical debridement and wound tension relief using the steristrip technique appears to manipulate wound geometry into a more linear shape to promote integumental bridging and accelerate wound healing. (Case #5)



ANALYSIS/DISCUSSION

The combination of apical debridement and wound tension relief appear to have positive effects in wound healing based on five reviewed case series. Apical debridement lessened the polar wound tension promoting wound edge relaxation and wound geometry manipulation. Opposing tension application towards the wound using steristrip splinting further relaxed the wound edges and limited wound edge motion.

Both the wound edge tension relaxation and limitation of movement showed weekly wound measurement improvement and promoted integumental bridging within the wound itself compared to standard wound debridement practices. Four out of the five subjects completely epithelialized by the end of this review (mean healing time was 4.75 weeks). The fifth subject showed significant improvement in wound dimensions.

CONCLUSIONS

The effects of manipulating wound geometry using apical debridement and wound tension relief can be used in various wound types not limited to the foot and ankle. These techniques can be used in conjunction with skin-substitutes, wound care products and casting techniques.

Apical debridement appears to be a valuable modification to the traditional wound debridement performed in practice today. This modification with the use of wound tension relief appears to expedite wound healing. Accelerating the healing time of wounds, decreases the risks of further complications including infection and amputation, decreases hospital costs and most importantly, reduces disability to promote a better quality of life.

REFERENCES

1. Select The influence of wound geometry on the measurement of wound healing rates in clinical trials Daniel Gorin-Paul Cordts-Wayne Lamorte-James Menzoian - Journal of Vascular Surgery – 1996
2. Select Wound shape geometry measurements correlate to eventual wound healing Matthew Cardinal-David Eisenbud-David Armstrong - Wound Repair and Regeneration – 2009
- 3.The role of surgical debridement in healing of diabetic foot ulcers Elizabeth Lebrun-Marjana Tomic-Canic-Robert Kirsner - Wound Repair and Regeneration – 2010
- 4.Lower extremity soft tissue and cutaneous plastic surgery G. Dockery-Mary Crawford - Saunders Elsevier - 2012