Two Techniques for Achieving Primary Wound Closure: Undermining and Imbrication
Is There a Difference in Skin Tension and Perfusion?

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Introduction

For the non-colonized wound, achieving a tension-free, primary wound closure is ideal. Many surgeons advocate imbrication of deeper tissues rather than undermining, posing that imbrication preserves dermal perfusion while still reducing tension at the wound edge. The purpose of our study was to determine which technique most reliably reduced wound tension and what effect these techniques have on dermal perfusion at the wound edge.

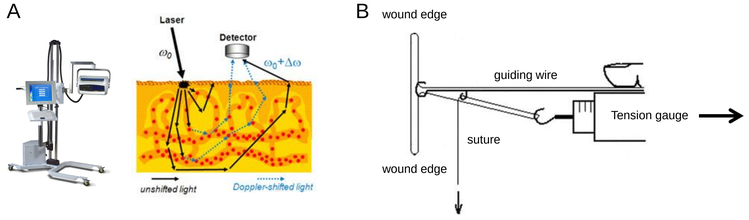
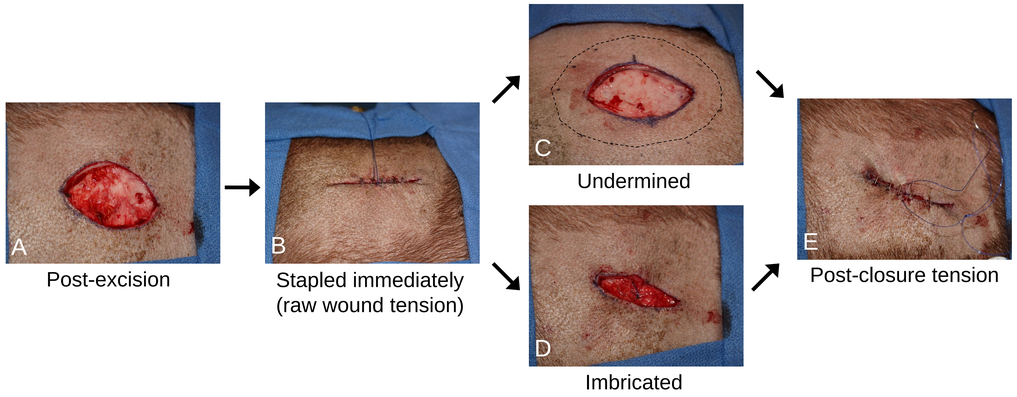
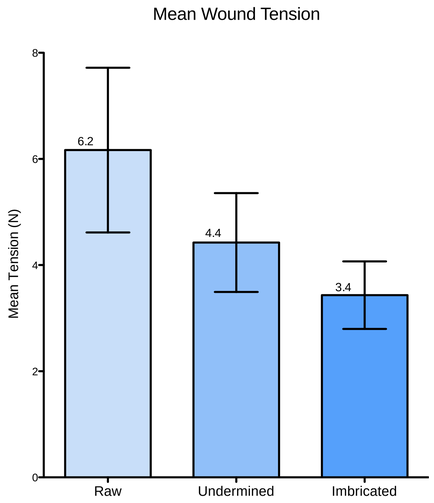


Figure 1: LDI photo and mechanism (A) and (B) diagram of the tensiometer apparatus

Methods

In a Duroc swine model, five symmetrical pairs of elliptical wounds were excised (photos, A). Wounds were closed primarily with staples and raw wound tension at the widest point was measured with a Tyrolean tensiometer (B). One group of wounds was then undermined in a subdermal plane to a distance of 4cm from the wound edge (C), while the other group of wounds underwent imbrication of the deep fascia (D). Wounds were again closed with staples at their widest point and tension was measured (E). Laser Doppler imaging (LDI) was performed at all time points to evaluate differences in skin perfusion. Statistical significance was evaluated for tension data with ANOVA and for perfusion data with a paired, two-tailed t-test.





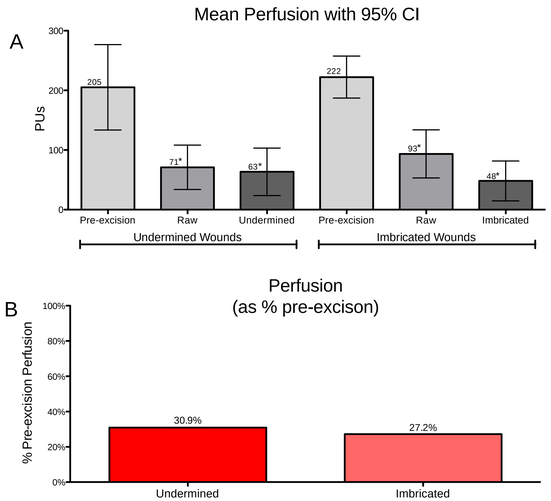


Figure 2: Mean tension with SEM

Figure 3: Mean perfusion with 95% CI (A) and perfusion expressed as % pre-excision (B)
* Significantly different from pre-excision ($p < 0.05$)

Results

The mean tension was 6.2 Newtons (N) after immediate stapling (raw tension), 4.4N after undermining, and 3.4N after imbrication (fig 2); these differences in wound tension were not statistically significant. LDI showed a significant reduction in perfusion between unwounded skin and and imbricated wounds (222 perfusion units (PUs), 95% CI 187-257 vs. 48.2 PUs, 95% CI 15-82), and also between unwounded skin and undermined wounds (205 PUs, 95% CI 134-277 vs. 63.4 PUs, 95% CI 24-103) (fig 3). When compared to pre-excision skin, perfusion was 31% in the undermined wounds and 27% in imbricated wounds.

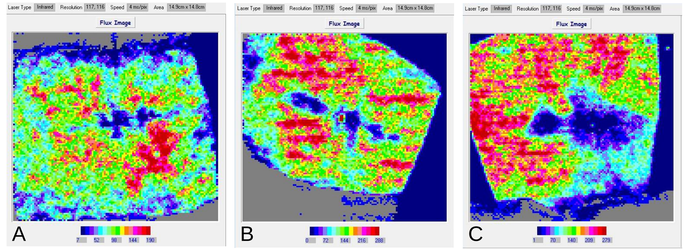


Figure 4: LDI flux images after immediate staple closure (A), after undermining (B), and after imbrication (C)

Conclusion

With respect to wound edge tension we found no significant difference between immediate primary closure, undermining or imbrication. With respect to wound edge perfusion, we found a significant decrease after both imbrication and undermining when compared to pre-excision. In conclusion, tension was the same in all three groups, and both imbrication and undermining were associated with decreased skin perfusion compared to pre-excision.

LDI images: http://us.moor.co.uk/product/moorlds2-laser-doppler-imager/8, http://www.hitlab.ch/en/node/2
Tensiometer image: adapted from Schubert HM, et al. Tyrolean tensiometer: A new instrument for easy intraoperative tension measurement before nerve coaptation. J Trauma. 2006 Sep;61(3):760-3.