

OBJECTIVE ULCER QUANTIFICATION BY RIM CURVATURE MAP

¹Xiang Liu, ²Wangdo Kim, ³Reiner Schmidt, ³Burkhard Drerup and ⁴Jinsup Song

¹School of Mechanical and Production Engineering, Nanyang Technological University, Singapore,

²Biomechanics Laboratory, Legacy Clinical Research & Technology Center, Portland, Oregon, USA

³Klinik und Poliklinik für Technische Orthopädie und Rehabilitation, Universitätsklinikum, Münster, Germany

⁴Advanced Wound Healing Center, Temple University School of Podiatric Medicine, Philadelphia, USA

email: wkim@biomechresearch.org

INTRODUCTION

A method of 3D optical technique for quantifying wound size is presented. More traditional measures of the wound length and width fail to account for irregular wound shape. A reliable and accurate wound size assessment is needed to objectively evaluate efficacy of various wound care modalities.

METHODS

A special platform was constructed to position the wand of the laser scanner and a digital camera in a common coordinate system when the ulcer surface is scanned. Using a FastSCAN laser scanner (Polhemus, Colchester, Vermont, USA), the ulcer's rim curvature map [1-2] is computed. Utilizing a specified rim curvature value, the wound edge is detected and processed via a cubic spline smoothing. The digital photo is, then, transformed into the same coordinate system as the laser scanner to qualitatively verify the wound boundary. The wound dimensions are reconstructed by interpolating the surface regions outside the ulcer using a second order polynomial fitted to the points outside the ulcer boundary. The averaged difference between the reconstructed surface and the scanned ulcer surface is taken as the mean ulcer depth. The volume is the product of area and the mean depth. Using this technique, a venous status ulcer at the lateral malleolus was scanned ten times during one month period. Three repeated measurements are made for each session.

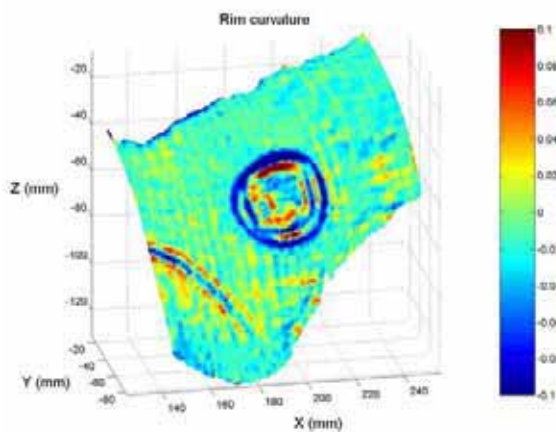


Figure 1: The rim curvature map of the ulcer.

RESULTS AND DISCUSSION

From the map of rim curvature (Fig. 1), the ulcer boundary can be readily delineated. Calculated wound depth, area, and volume are shown in Fig. 2 with the maximum, minimum and mean values of the three independent measurements. While there is slight increase in area, the ulcer depth and the volume

have decreased over time, which are in agreement with the clinical observation.

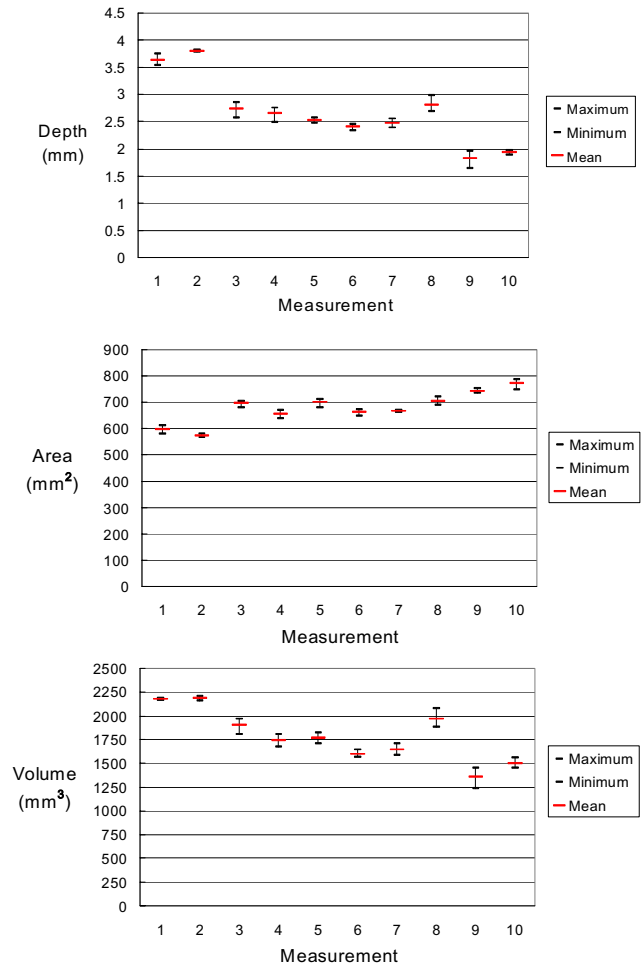


Figure 2: Calculated dimensions of the ulcer over a month.

CONCLUSIONS

The surface scanning aided by rim curvature maps and photograph is shown to be a potentially viable non-contact method of wound measurement. Additional studies are needed to test its reliability, accuracy, and utility of this technique in wound related studies.

REFERENCES

1. Frobin W. and Hierholzer, E. *Moiré Fringe Topography and Spinal Deformity* 71-82, 1983.
2. Liu X, et. al. *Real-Time Imaging* **10**, 217-228, 2004.