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Measurement of Diabetic Foot Ulcers using SilhouetteMobile

Introduction

The ARANZ Medical Silhouette™ is a hand-held wound measurement and documentation system. Key components include SilhouetteMobile™, the point-of-care capture device, and SilhouetteCentral™, a centralised data storage and data management software tool.

SilhouetteMobile combines a digital camera and structured lighting in the form of two laser beams to automatically correct for camera location, image scale and skin curvature, allowing rapid and accurate measurements of the wound's surface area and depth.

The laser and camera assembly plugs into a standard Personal Digital Assistant (PDA) to form a portable acquisition device. SilhouetteCentral provides database and synchronization capabilities, allowing wound assessment data to be shared between multiple SilhouetteMobiles. Clinicians can also review, enter in and export wound data from SilhouetteCentral via the internet using a web browser on a PC.

Background

Previous reports have quantified the repeatability of SilhouetteMobile on vascular wounds[1,2], and the aim of this study was to assess the suitability of the device for measuring diabetic foot ulcers. These wounds provide a particular challenge for measurement, because of the varying nature of foot topology.

Aim

To assess the usability, ease of integration, and reliability of SilhouetteMobile for measuring diabetic foot ulcers in the primary care setting.

Method

SilhouetteMobile was used to measure diabetic foot ulcers of four patients. At the assessment of each patient's wound, each ulcer was measured four times in order to obtain a measure of intra-user variability, and the mean surface area and the maximum deviation from the mean was calculated.

Results

SilhouetteMobile exhibited good intra-user variability (within 4%) at all locations (Table 1, Figures 1, 2, 7-9). SilhouetteMobile was found to be easy and quick to operate (Figure 3), with training consisting of a one hour tutorial. The images and changes over time graphs aided with the monitoring of wound progress, and were useful for both the clinician and the patient (Figure 4-6). PDF reports (Figure 10) were automatically generated by the system for insertion into the patient notes, and a useful aid for specialist consultation.

Patient	1 (JM)	2 (MT)	3 (JH)	4 (LG)
Surface area mesurements (cm^2)	3.53	3.20	0.56	4.00
	3.46	3.04	0.57	4.11
	3.58	3.13	0.58	3.95
	3.52	2.98	0.56	4.19
Mean (cm^2)	3.52	3.09	0.57	4.06
Max. deviation (cm^2)	0.06	0.11	0.01	0.13
Max. deviation (%)	1.8%	3.6%	2.2%	3.1%

Table 1. The contemporaneous surface area measurements, mean, and maximum deviation for each patient. The maximum deviation is the absolute value of the largest deviation away from the mean

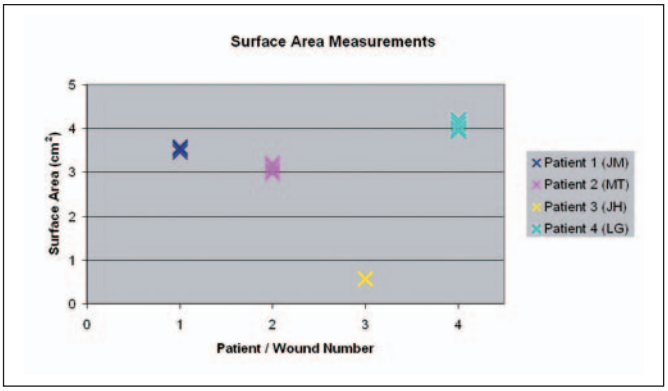

Figure 1. Plot of the surface area measurements for the four wounds in the study. Each wound was measured four times in order to obtain a measure of intra-user variability, and this is reflected in the spread of measurements for each wound

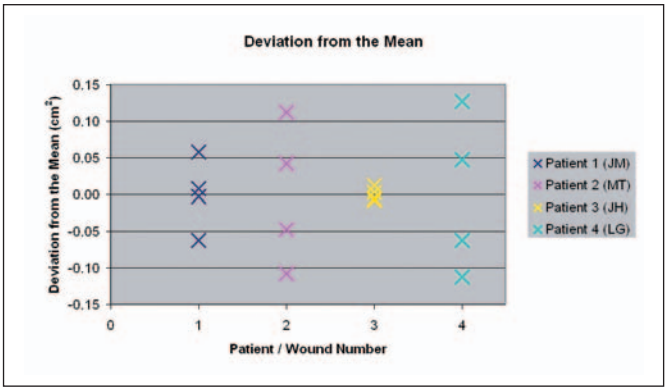

Figure 2. The deviation from the mean was calculated by subtracting the mean for each wound from the measurements

Conclusions

Clinicians found SilhouetteMobile easy to use. They could obtain measurements quickly and with precision – repeatable to within 4%. Silhouette generated reports automatically that were concise and clinically meaningful. ■

Figure 3. Performing an area measurement using SilhouetteMobile

Figure 4. Reviewing wound progress with the patient

Figure 5. SilhouetteMobile displaying surface area assessment

Figure 6. SilhouetteMobile displaying depth assessment and profile

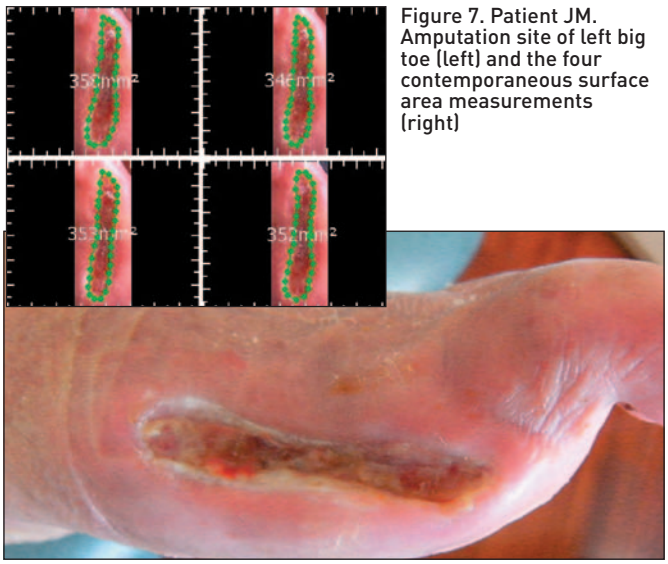

Figure 7. Patient JM. Amputation site of left big toe (left) and the four contemporaneous surface area measurements (right)

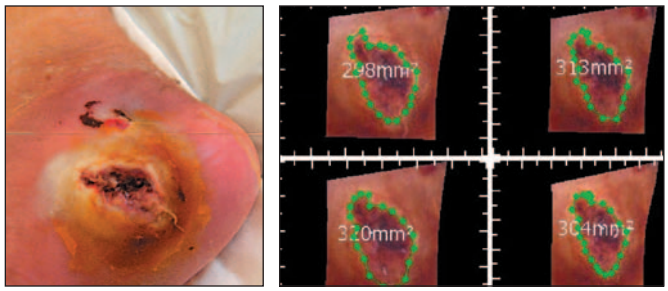

Figure 8. Patient MT. Left medial malleolus (left) and the four contemporaneous surface area measurements (right)

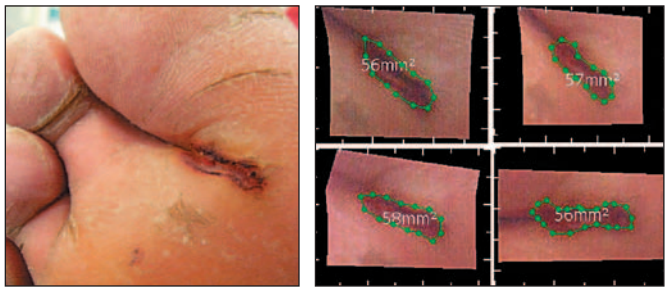

Figure 9. Patient JH. Base of big toe (left) and the four contemporaneous surface area measurements (right)

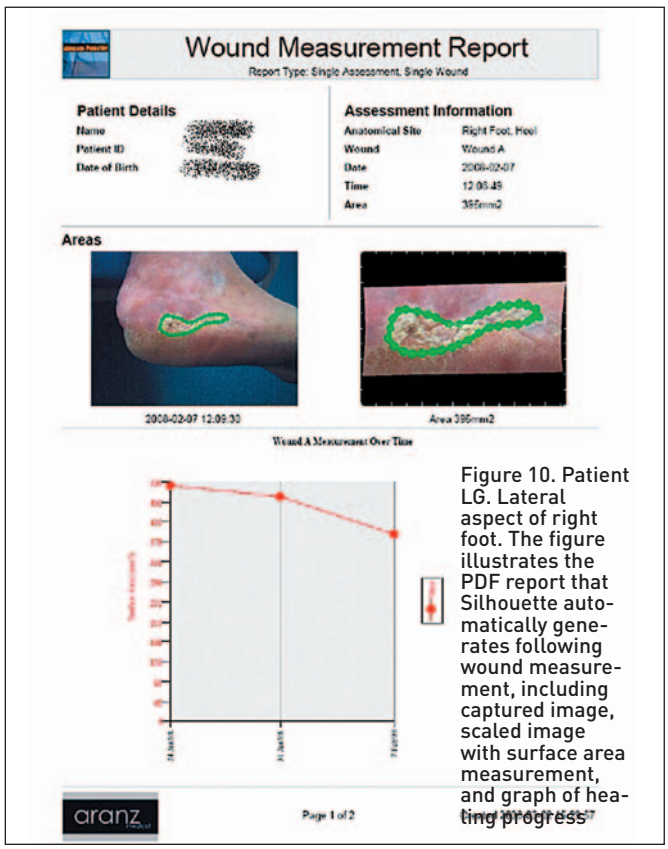

Figure 10. Patient LG. Lateral aspect of right foot. The figure illustrates the PDF report that Silhouette automatically generates following wound measurement, including captured image, scaled image with surface area measurement, and graph of healing progress

References

1. Hammond CE, Randles JM, Lewis DR, Roake JA, Nixon MA, McCallum BC, Davey BLK: Evaluation of a Hand Held, Electronic Wound Measurement and Documentation Device in Clinical Practice. Presented at the 20th Annual Symposium on Advanced Wound Care (SAWC), 2007, Tampa, Florida.

2. Romanelli M, Dini V, Rogers LC, Hammond CE, Nixon MA: Clinical Evaluation of a Wound Measurement and Documentation System. Wounds 2008; 20(9): 256-264.