Handheld, Non-Contact Wound Measurement Device

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Background
Repeateable and accurate wound measurement forms an important part in the assessment and treatment of chronic wounds and pressure ulcers.

Current wound measurement methods span a continuum:
- From the ruler method which is easy to perform but lacks accuracy
- To devices using steroophotogrammetry which are accurate and repeatable but are expensive

Design Goal
To design, fabricate and test a handheld, non-contact, affordable and repeatable but is expensive

Current wound measurement methods span a continuum:
- From the ruler method which is easy to perform but lacks accuracy
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Distance & Skew Accuracy
- 3.8 x 3.8 cm wound (14.44 sq cm)
- Image taken at different heights and degrees of skew

Design Features
- Simple digital camera (current device uses a cell phone)
- Laser pointers and computer vision techniques permit
- Wound margin detected using canny edge detection

User Interface
Touch screen interface permits the user to:
- Accept the area (if the wound boundary detection is correct)
- Modify the wound boundary by dragging the outline using a stylus on the touch screen
- Reject the wound boundary and re-trace the wound margin using the stylus

Skew Correction

Manual Tracing Repeatability

Two wounds
- One wound selected because of its poorly defined margin

Ten repeated measurement trials
- Results blinded to subject

Distance & Skew Test Results

- Distance ± 9.3 cm
- Distance ± 17.7 cm

<table>
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<tr>
<th>Subject</th>
<th>Distance &amp; Skew (%)</th>
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<tr>
<td>0</td>
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<tr>
<td>10</td>
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<td>15</td>
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Mean 13.55
Mean error 6.2%
Coefficient of variation 2.6%

Conclusion
- A simple wound measurement device has been developed and tested
- Novel distance and skew determination permits non-contact measurement
- Low cost components (<$100) will lead to affordable device

- Accuracy at different distances & skew:
  - ~ 6%
  - ≈ exceed those of photography, tracing & Kundin gage
  - Repeatability
  - Coefficient of variation
  - Coefficient of variation <7% for well-defined ulcer
  - <10% for poorly-defined ulcer
  - Clinical testing underway
  - Ready for Technology transfer