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# 3D photography is as accurate as digital planimetry tracing in determining burn wound area



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## ABSTRACT

**Background:** In the paediatric population careful attention needs to be made concerning techniques utilised for wound assessment to minimise discomfort and stress to the child. **Aim:** To investigate whether 3D photography is a valid measure of burn wound area in children compared to the current clinical gold standard method of digital planimetry using Visitrak™.

**Method:** Twenty-five children presenting to the Stuart Pegg Paediatric Burn Centre for burn dressing change following acute burn injury were included in the study. Burn wound area measurement was undertaken using both digital planimetry (Visitrak™ system) and 3D camera analysis. Inter-rater reliability of the 3D camera software was determined by three investigators independently assessing the burn wound area.

**Results:** A comparison of wound area was assessed using intraclass correlation co-efficients (ICC) which demonstrated excellent agreement 0.994 (CI 0.986, 0.997). Inter-rater reliability measured using ICC 0.989 (95% CI 0.979, 0.995) demonstrated excellent inter-rater reliability. Time taken to map the wound was significantly quicker using the camera at bedside compared to Visitrak™ 14.68 (7.00) s versus 36.84 (23.51) s ( $p < 0.001$ ). In contrast, analysing wound area was significantly quicker using the Visitrak™ tablet compared to Dermapix® software for the 3D Images 31.36 (19.67) s versus 179.48 (56.86) s ( $p < 0.001$ ).

**Conclusion:** This study demonstrates that images taken with the 3D LifeViz™ camera and assessed with Dermapix® software is a reliable method for wound area assessment in the acute paediatric burn setting.

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## 1. Introduction

Wound surface area measurements are a valid indicator of wound progress [1]. There are a number of methods utilised to measure wounds ranging from a simple ruler, which is quick and inexpensive but inaccurate when wounds are irregular [2],

to complex computerised systems, which may be accurate but are costly and time consuming [3]. In order for a wound measurement technique to be useful in clinical practice and research it needs to be time and cost efficient, easy to use and minimise patient discomfort.

It has been well documented that burn wound care procedures are highly traumatic for children and as such

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the resultant stress interrupts the cascade of healing [4]. Therefore in the paediatric population careful attention needs to be made concerning techniques utilised for wound assessment to minimise discomfort and stress to the child.

Percentage of wound re-epithelialisation is an important outcome in determining treatment efficacy in acute burn injury. The most common wound measurement device used in burns is digital planimetry using the Visitrak™ wound measurement system (Smith & Nephew Medical Limited, Hull HU3 2BN, England). The entire burn area can be traced with additional tracings of non re-epithelialised areas to allow for calculation of percentage of re-epithelialisation [4]. Although widely used in the burns research arena the Visitrak™ system does have some limitations. Contact with the wound is required which may cause patient discomfort, increase the risk of infection and potentially cause wound bed damage. Tracing the wound requires the patient to stay still which can be difficult within the paediatric setting. Fogging of the film can occur which can make the wound border difficult to assess and as the film is quite shiny reflective light can also hinder accurate identification of wound border. Finally, the Visitrak™ film is quite stiff, making it difficult to conform to some body parts such as little fingers.

Wounds are three dimensional (3D). If wounds are on curved body surfaces or tapering limbs, two dimensional photography is unlikely to allow for accurate measurement [5]. Stereophotogrammetry involves the use of two or more cameras and the computer to reconstruct 3D images of wounds allowing calculation of wound area and volume. Recently, the 3D LifeViz™ system has been developed by Quantificare (Sophia Antipolis, France). The system is very easy to operate and comes with dedicated software for wound area and volume assessment (Dermapix®). The aim of this study was to investigate whether 3D photography is a valid measure of burn wound area in children compared to the current clinical gold standard method of Visitrak™.

## 2. Method

### 2.1. Participants

This study included children with acute burns presenting to the Stuart Pegg Paediatric Burn Centre, Brisbane. Exclusion criteria included non English speaking, cognitive impairment or current involvement with Department of Child Safety.

### 2.2. Ethics

This study received approval from the Children's Health Services Queensland Human Research Ethics Committee (HREC/13/QRCH/28).

### 2.3. Recruitment

Treating physicians/nursing staff of all children meeting the inclusion/exclusion criteria determined eligibility for enrolment in the study. With parent/caregivers permission, an investigator aligned with the study discussed the study with the parents/caregivers and gained informed consent. In

addition, if the child was over eight years of age, child assent was also sought.

### 2.4. Measurement techniques

All participants had their burn wounds measured by two techniques: Visitrak™ and 3D photography. Randomisation of treatment order was undertaken by the use of sealed, opaque, identical and serially numbered envelopes prepared by an independent party.

Both wound measurement techniques required two phases – actual wound measurement at bedside and analysis of wound area.

#### 2.4.1. Visitrak™ method

Visitrak™ wound measurement system involves mapping the wound onto a tracing grid sheet, which is then retraced onto the Visitrak™ digital pad which automatically calculates the area calculations. Visitrak™ is a valid tool for wound measurement that has been shown to have excellent intra and inter-operator reliability [6].

#### 2.4.2. Photographic method

The 3D LifeViz™ camera is held above the wound. Dual beam pointers are lined up visually which ensures that each image is taken at a distance of 60 cm. The image is directly transferred to a laptop. Dermapix® software can then be utilised to trace the wound and area is automatically calculated.

### 2.5. Outcome measures

The following measures were taken for each participant using both wound measurement devices.

1. Wound area – measured in cm<sup>2</sup>.
2. Preferred technique – following wound measurement using both techniques, patients and caregivers were asked which wound assessment they preferred.
3. Preferred technique – following wound measurement using both techniques, investigators were asked which wound assessment they preferred.
  - a. For Visitrak™ tracing versus image capture using the 3D camera (at patient bedside).
  - b. Wound measurement (mapping the area on the Visitrak™ grid versus calculating wound area using the 3D image with the use of Dermapix®).
4. Ease of use – investigators were asked to rate the ease of using each measurement device at the bedside using a 5 point Likert scale where 1 = extremely easy, 2 = very easy, 3 = somewhat easy, 4 = not very easy and 5 = not at all easy.
5. Time taken for wound tracing at the bedside and post processing (analysis) was measured via a stopwatch.
6. Pain was measured at three time points – before the first measurement technique, between measurement techniques and following the second measurement technique. Caregivers were asked to report their children's level of pain using a 0–10 visual analogue scale (VAS) [7]. The Faces, Legs, Activity, Cry and Consolability scale (FLACC) [8] was used by nursing staff to determine the distress of the child. If the

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