**Infrared Thermography in Detecting Pressure Injury**

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**Introduction**

Detecting and diagnosing early stage PI's or deep tissue pressure injury (DTPI) remains a challenge, especially among patients with darker skin tone. Infrared thermography (IRT) has been used to predict wound healing and PI outcomes.1 However, little is known about the use of thermographic images to detect presence of early stages PI or suspected DTPI (intact skin) on heel and/or sacrum.

**Aim**

To explore the diagnostic capacity of using infrared thermography device in assessing skin temperature among Stage I pressure injuries and/or suspected deep tissue pressure injuries (DTPI) with intact skin.

**Methodology**

**Study sample**

All hospitalised adult patients who had PI (Stage I) or suspected DTPI and fit the inclusion and exclusion criteria were recruited (Table 1).

**Study design**

- Cross-sectional study
- Inpatient wards, Singapore General Hospital (SGH)
- March to April 2018
- 1 case matched to 3 controls (age group, gender, race and PI sites)
- Thermal images taken using portable CAT S60 Thermal Imaging Rugged Smartphone (Figure 1).
- Data collected from case and control patients:
  1) Demographic data → age, gender, BMI, skin tone (Figure 2)
  2) Clinical data → Braden scale score, co-morbidities, body temperature
  3) Environment factors → ambient temperature, humidity

**Results**

- A total of 17 cases and 51 controls were recruited.
- Mean temperature difference in PI sites and non-injury sites of cases were significant (Table 3). Figure 3 shows thermal images of sacral PI site vs non-PI site within same case patient. An elevated skin temperature was observed on PI site.
- Comparing cases to controls, mean difference in temperature was non-significant, even after adjusting for body temperature and ambient temperature (Table 3).

**Table 1: Inclusion and exclusion criteria**

<table>
<thead>
<tr>
<th>Inclusion criteria</th>
<th>Exclusion criteria</th>
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<tbody>
<tr>
<td>Above 21 years old</td>
<td>Blistered, broken skin or wound over the sacral or heel area</td>
</tr>
<tr>
<td>Case: patient with stage I or suspected DTPI on the sacral or heel (intact skin)</td>
<td>Medicated plaster placed over heel or sacral</td>
</tr>
<tr>
<td>Control: patient with no PI i.e. intact skin over sacral or heel</td>
<td>Medically unstable</td>
</tr>
<tr>
<td></td>
<td>Fever patients</td>
</tr>
<tr>
<td></td>
<td>Restless and uncooperative</td>
</tr>
<tr>
<td></td>
<td>Patients with only one heel</td>
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</tbody>
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**Table 2: Site of thermal images captured**

<table>
<thead>
<tr>
<th>Case patient</th>
<th>Control patient</th>
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<tbody>
<tr>
<td>PI and non-PI site</td>
<td>Either heel or sacral based on matching variables</td>
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<tr>
<td>Left PI heel vs Right non-PI heel</td>
<td></td>
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<tr>
<td>Sacral PI site vs 10cm adjacent of the non-PI site of sacrum</td>
<td></td>
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<tr>
<td>A wound care nurse verified the PI</td>
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**Discussion**

- Elevated temperature in tissues and skin may indicate early PI development.
  - Prolonged loading results in an increase in skin surface temperature and erythema on the skin of sacral and heel.2,3
  - Surface skin temperature may vary due to blood redistribution and body fat (BF) %. BMI showed no difference between case and control.
  - Recommendations for future studies: (1) longitudinal study with longer follow-up; (2) bigger sample size; (3) darker skin tones for further validate use of IRT; and (4) consider body fat percentage and skin parameters.

**Conclusion**

Utilizing IRT technology at bedside may aid in diagnosing early stage PI and suspected DTPI (intact skin) among patients with Type II and III skin tone. More research is still needed to determine if IRT can be used to assist nurses in detecting early stage PI among patients with darker skin tone.

**References**


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**Figure 1.** Using CAT S60 Thermal Imaging Rugged Smartphone

**Figure 2.** Skin Tone Reference using Fitzpatrick Skin Types Scale

**Figure 3.** Thermal images of patient’s sacral PI obtained using the CAT S60 Thermal Imaging Rugged Smartphone