INTRODUCTION
Deep tissue injury is a term proposed by NPAUP to define a unique form of pressure injury. Damages due to long-endured, unrelieved pressure or shearing forces underneath the intact skin often cause these pressure injuries. There is limited evidence regarding the magnitude of this health problem in the various sectors. According to Kottner J., Dassen T., & Lahmann N. (2010), pressure ulcer prevalence including grades 1-4 and deep tissue injuries ranged from 4.3% (95% CI 3.8-4.9) to 7.1% (95% CI 6.2-8.0) in nursing homes. Furthermore, deep tissue injuries are more common in the heels. Nurses must be aware that deep tissue injuries exist in clinical practice, and immediate management of these is vital for a positive outcome.

DEEP TISSUE PRESSURE INJURY (DTPI) DEFINITION FROM NPAUP 2016
Deep Tissue Pressure Injury: Persistent, non-blanchable deep red, maroon or purple discoloration. Intact or non-intact skin with localized area of persistent non-blanchable deep red, maroon, purple discoloration or epidermal separation revealing a dark wound bed or blood filled blister. Pain and temperature change often precede skin color changes. Discoloration may appear differently in darkly pigmented skin. This injury results from intense and/or prolonged pressure and shear forces at the bone-muscle interface. The wound may evolve rapidly to reveal the actual extent of tissue injury, or may resolve without tissue loss. If necrotic tissue, subcutaneous tissue, granulation tissue, fascia, muscle or other underlying structures are visible, this indicates a full thickness pressure injury (Unstageable, Stage 3 or Stage 4). Do not use DTPI to describe vascular, traumatic, neuropathic, or dermatologic conditions.

ABSTRACT
A patient who sustained a fall and a left femoral neck fracture became bed bound and developed a deep tissue injury on her left heel. The application of a new pressure measurement technology, called PressureAlert®, followed by the application of an offloading device Heelift® Glide the deep tissue injury improved. No further skin breakdown occurred and skin was maintained intact preventing potential risk of infection. Within three months the DTPI was visibly improved and healed.

CASE STUDY
An 88-year-old patient, a Catholic sister residing at the Order’s infirmary, who was diagnosed with severe dementia in 2011 developed an unidentified injury in her left heel after a serious health declining event.

Due to her advanced dementia, she was admitted to a secure facility. However, this did not stop her from doing what she loved most, walking the hallways daily. In 2013 she sustained a fall, causing a fracture dislocation of her left shoulder, followed by a second fall two months later causing a subdural hematoma. In 2014, she was again hospitalized, due Transient-Ischemic-Attacks (TIA) and atrial fibrillation. Her mental and physical health progressively and rapidly deteriorated and she was placed into hospice care. Despite all her health problems, her health improved and she was again discharged from the hospice site to the Infirmary in March 2016. She was further diagnosed with hypertension and hyperthyroidism.

On July 1, 2016, she fell again and sustained a left femoral neck fracture that was treated at her local hospital with a hemiarthroplasty. She was discharged eleven days later and transferred to a nearby nursing home for further rehabilitation. On admission to the nursing home July 12, 2016, she had limited mobility, was incontinent and required total care, with a Braden Scale score of 10-12 (high risk for pressure injuries).

A left heel 5 cm x 5 cm ‘blister’ was noted, a heel cup style dressing was applied, and the following photographs were obtained (Picture 1,2).
On July 15, due to the low Braden Scale score and the high risk for pressure ulcers the patient was referred to a consultant to assess for the need and use of PressureAlert technology (PA).

The innovative PressureAlert system (PA) enables healthcare providers to prevent and treat pressure injuries. It utilizes patented technology to monitor the amount of pressure and time a patient is on a particular high risk area of the body. When it finds that a patient is applying too much pressure for too long at that area, it informs the patient and or caregiver that it must be alleviated.

As shown below, three components make up the solution. A dressing containing a wireless pressure sensor sends information to a tablet located close to the patient. The tablet receives the sensor information and applies proprietary algorithms to monitor and alert the patient and or caregivers when a critical pressure/time threshold has been reached. The information is also sent to the cloud so that caregivers can remotely monitor from a connected device and the patient clinical history can be analyzed.

The PressureAlert low friction/shear foam dressing was applied to both heels and the sacrum and set to alarm when pressures over 32mmHg were maintained for a period of one hour. An alarm was set for the caregivers to reposition patient when threshold reached.

The left heel pressure injury was then diagnosed as a Deep Tissue Pressure Injury (DTPI). The wound was painful on touch, with a soft feeling on palpation and no open skin noted. Poor bilateral pedal pulses were noted (Picture 4).

Pictures were again taken (Pictures 5,6).

On July 21st, an offloading device (the Heelift Glide offloading boot) was added to the treatment plan for the heels (Picture 7).

Pictures were then again taken (Picture 8).
PressureAlert was discontinued on July 30, since the patient was spending a significant amount of time in a wheelchair and became increasingly mobile as her health improved.

However, the Heelift Glide offloading devices were used 24 hours a day to manage the left heel DTI, and to prevent a new pressure injury on the right heel (Pictures 9, 10).

On August 10, the left heel DTI revealed a gradual demarcation with black eschar covering the area (Picture 11).

A week later, after continuous use of offloading 24 hours a day and site check every shift, with no additional local treatment, but much improved nutrition, her left heel lesion was fully demarcated and the eschar reduced to 3.5cm x 3.5cm (Picture 12).

On August 25, further demarcation was present with dry clean borders and no pain on touch (Picture 13).

Further shrinkage of the eschar is noted two weeks later.
No additional topical treatments such as lotions or creams were used during this time (Pictures 14,15).

The eschar had started to come loose and was less than 3cm x 3.5 cm. The skin remained intact and not broken. The complete offloading can be appreciated in the heel views through the opening in the Heelift Glide (Picture 16,17).
DISCUSSION

The diagnosis and onset of a DTPI is often missed, and in this case was classified initially as a blister on the heel. Furthermore, the documentation of the DTPI progression when patients move to different care settings is frequently missed.

The application of the PressureAlert technology assisted in limiting the amount of pressure on the heels and sacrum, minimizing any further damage.

The use of an offloading device around the clock (with the exception of frequent leg/heel checks every shift, and during patient bathing times) was key to further decreasing damage to the heels.

SUMMARY

This case is valuable in demonstrating some of the challenges in clinical practice in the discovery and proper diagnosis of DTPIs. For this reason, most often the root cause of DTPIs are unknown.

Traditional solutions such as every two-hour turning and repositioning are necessary for those at risk for skin breakdown. However, patients often roll back into their favorite positions, often onto already compromised areas. The PressureAlert can alert the caregiver when these incidences occur and can be immediately rectified. The Heelift Glide provides a zero heel contact interface with any surface the patients may be lying or sitting in.

This case study has shown that prevention and management strategies implemented to address the root cause of any pressure ulcer should remove or limit the pressure to the bony prominence. The use of the PressureAlert technology and offloading devices are key to patient’s positive outcome.

REFERENCES