An Antenna for Early Detection of Deep Pressure Ulcers

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Pressure ulcers are gaping wounds where the skin, fat and muscles are damaged all the way to the bone. People who use a wheelchair for daily mobility or who are confined to bed because of illness such as the elderly, patients with spinal cord injury, stroke, or patients undergoing long surgeries, are at risk of developing pressure ulcers (National Pressure Ulcer Advisory Panel, http://www.npuap.org). These wounds take a very long time to heal and need special care. Canada spends more than $3.5 billion on treating them each year!

Nurses try hard to prevent pressure ulcers. They carefully check the skin of patients to make sure pressure ulcers are not developing. But, many pressure ulcers develop deep in the tissue, close to the bone, and work their way out (Stekelenburg, et al, 2006. Journal of Applied Physiology, 100(6), 1946-1954). By the time the nurses can see them on the skin, all the tissue below had died (Fig. 1). Deep pressure ulcers usually develop around the bones we sit on and the ones we lie on in the buttocks (Solis, L.R., 2007. Journal of Applied Physiology, 102(5), 1992-2001). These pressure ulcers can be deadly; even superman (the actor Christopher Reeve) passed away from complications related to a pressure ulcer.

Deep pressure ulcers can be detected using MRI or ultrasound. But, these methods are very expensive and cannot be used every day. Also, the images have to be shown to a specialist (radiologist) before we can know if a pressure ulcer is present. We have developed a wearable antenna and a scoring system that allows nurses to test how healthy the tissue deep below the skin is. If nurses see that a pressure ulcer is developing deep in the tissue, they can take action quickly and consult a doctor to ensure that the ulcer does not get bigger. This can improve the quality of life of people and save healthcare large amounts of money. This presentation shall include the design, simulation, fabrication and characterization of the antenna using phantoms. The results of antenna test on several human volunteers are also included.

Figure 1. Final stage of a pressure ulcer.