Abstract 475.09 Summary

Senior author: Sean Dukelow, MD, PhD (403) 944- 5930
Hotchkiss Brain Institute, University of Calgary sean.dukelow@albertahealthservices.ca
Calgary, Canada

Underwear Wired to Deliver Tiny Electrical Currents Appears to Prevent Pressure Sores

Innovative technology could help end epidemic of painful sores that often follow immobilizing spinal cord injuries

Smart underwear — called Smart-e-Pants — with a built-in electronic system to deliver tiny electrical currents appears to prevent the development of pressure ulcers in patients with immobilizing spinal cord injury. The underwear uses electrodes that convey intermittent electrical stimulation, contracting the buttock muscles. Pressure ulcers are painful open wounds typically over bony areas of the body. The findings were presented at Neuroscience 2012, the annual meeting of the Society for Neuroscience and the world's largest source of emerging news about brain science and health.

Pressure ulcers cause an increased risk of infection, hospitalization, and death. In the United States alone, 60,000 people each year die from complications related to pressure ulcers. The economic cost is also staggering, estimated at $11 billion annually in the United States and $3.5 billion in Canada.

The mini-muscle contractions generated by the underwear mimics the subconscious fidgeting of able-bodied individuals, stimulating blood flow and redistributing pressure away from the sitting bones. Sean Dukelow, MD, PhD, of the University of Calgary reported that, of the 33 clinical care patients who wore the underwear, none developed pressure ulcers during the two-month study period. The underwear delivered muscle-contracting stimulation for 10 seconds every 10 minutes, 12 hours a day, and four days per week for up to two months.

"Pressure ulcers can be terribly debilitating. Their incidence has not changed since the 1940's, indicating that the current methods of prevention simply are not working," Warwaruk Rogers said. "Our hope is that this innovative, clinically friendly system will eventually make a difference in the lives of millions of people." Researchers plan to follow up with further efficacy studies.

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475.09, Smart-e-Pants: A novel neural prosthetic device for the prevention of deep tissue injury in spinal cord injury and other neurological disorders
R. A. WARWARUK ROGERS, A. AHMETOVIC, D. SCHNEPF, R. SOMMER9, L. KAWASAKI, G. ISSACSON9, V. MUSHAHWAR, M. CHAN, ***S. P. DUKELOW**, Clin. Neurosciences, Hotchkiss Brain Inst., Fac. of Med., Univ. of Calgary, Calgary, AB, Canada; Ctr. for Neurosci., Dept. of Pharmacol., Dept. of Cell Biol., Fac. of Med. and Dent., Univ. of Alberta, Edmonton, AB, Canada; Allen Gray Continuing Care Ctr., Edmonton, AB, Canada; 9Glenrose Rehabil. Hosp., Edmonton, AB, Canada

TECHNICAL ABSTRACT: Pressure ulcers (PU), specifically deep tissue injury (DTI) are a common complication in people with reduced mobility such as those with spinal cord injury. DTI originates in the muscle layer around a bony prominence, resulting from unrelieved loading causing sustained mechanical deformation and ischemia to the underlying tissue. PUs decrease health status, mobility, increase pain, and may require invasive surgical reconstruction procedures of the affected area and can be fatal. Despite advances in pressure relieving strategies, DTI continues to impact patient health negatively and contributes substantial costs to the healthcare system.
In this study, we examined the safety and feasibility of a novel prevention system for DTI: Smart-e-Pants. The Smart-e-Pants system is a neural prosthetic device that involves a stimulator designed to deliver intermittent electrical stimulation (IES) via electrodes placed directly on the skin or through an engineered garment. The electrodes are applied over the motor point of the gluteus maximus muscle. Simulation causes contraction of the gluteus maximus to mimic the subconscious fidgeting movements of able bodied people. Previous studies in animals have demonstrated significant increases in tissue oxygenation and pressure redistribution in response to IES. The aim of the Smart-e-Pants device is to prevent the development of DTI in individuals with spinal cord injury and others with immobility. In the present study the Smart-e-Pants system was tested in a variety of patient care settings. Subjects with immobility (n=23) wore Smart-e-Pants and received IES for 12 hours a day, 4 days per week, for 4 weeks to induce muscle contractions in the gluteus maximus. The system administered stimulation for 10 seconds at 10 minute intervals during periods when subjects wore the garment. We assessed the system for safety and feasibility during periods of garment application and removal by quantifying patient and healthcare staff responses to measures of time demands for application and removal, acceptability for participant and caregiver, skin irritation, and muscle contraction stability. Smart-e-Pants received positive ratings from both patients and healthcare staff. The system was generally safe and the time demands were reasonable for application and removal. No one in the present study developed a PU during the experimental period. Our results suggest that IES may be an acceptable method for the prevention of PU's, but further efficacy studies are necessary.