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Disposable catheter breakthrough, a world first

A unique low cost disposable solid-state catheter that can measure swallowing pressure has been developed by a University of South Australia research team using intelligent manufacturing processes that eliminate the infection risks posed by existing catheters.

Believed to be the first of its kind in the world, the catheter is one of the new products being developed in the emerging field of bio micro-electro-mechanical systems, or BioMEMS, which have applications in the biomedical field.

The new catheter has many advantages over existing catheters, according to UniSA research fellow Dr Hung-Yao Hsu, who is developing the catheter with industry partner, the Women's and Children's Hospital (WCH).

"Current catheters rely on the transmission of pressure via water filled lumina to transducers external to the body. Each lumen is like a garden hose with water running through. If the outlet of the hose is blocked suddenly, the pressure inside will build up and generate a pressure wave back to the tap end of the hose where it can then be sensed. The working principle behind the existing water perfusion catheter is the same as the watering hose. Because fluid is always flowing, patients sometimes feel uncomfortable and turn their bodies over, which increases the risk of inhaling fluid into their airway," Dr Hsu said.

"Existing catheters also need to be recalibrated before each use, but posture changes, movement and fluctuation in the flow rate can cause variations in pressure, which mean that the accuracy of measurement cannot be guaranteed. In addition, dampening of the pressure signal leads to under-recording of peak swallowing pressures, so rapid pressure changes are not be picked up instantaneously and the signal may be missed, which could result in a wrong diagnosis being made.

"Another significant disadvantage of the catheters is that they are expensive and are often reused to cut medical costs. This carries a risk of transmitting disease between patients," Dr Hsu said.

"The new catheter uses solid-state sensors to measure the pressure of swallowing and eliminate the risk of fluid getting into the airway. These sensors are very responsive to pressure changes and give accurate, high resolution real-time readings. And while most catheters on the market only measure pressure, the new catheter is multifunctional, capable of recording a range of measurements," Dr Hsu said.

"In addition, it is estimated that the new catheter will be about ten times cheaper than current models, and is designed for single use only, eliminating the risks associated with reuse."

Dr Hsu said that after more than two years of hard work and dedication, the catheter has passed the validation of a major milestone, with the design concept being verified through rigorous tests in laboratories and in-vivo tests on humans.

Working with Dr Hsu were Dr Taher Omari and his team at WCH, who provided the catheter specifications and medical consultancy to help with the design of the disposable catheter and conducted in-progress tests and the final in-vivo tests to verify the design.

Sensor samples for this research were provided free of charge from The Silicon Microstructures Inc in California, USA.

The catheter project is moving towards commercialisation and Dr Hsu expects the first disposable catheter to be launched in two years' time.

"The new catheter will have important outcomes for improved health and comfort of patients, as well as significant savings in the cost of health care, both nationally and internationally," Dr Hsu said.

UniSA researchers working with Dr Hsu include Dr Alex Hariz and a team of research assistants and students, with support from BioMEMS group members Professor Grier Lin, Professor Malcolm Haskard and Associate Professor Dennis Mulcahy.

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