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Optical sensors make MRI scans safer

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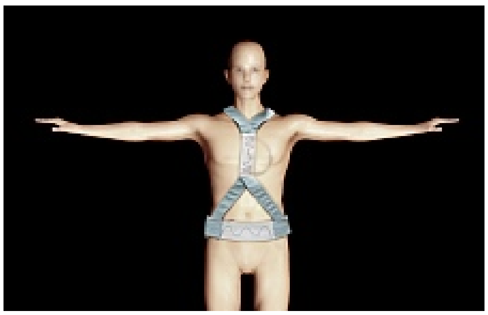

3D representation of a harness fitted with optical sensors. Picture provided by OFSETH

(PhysOrg.com) -- Magnetic resonance scans will be safer for children and other patients needing anaesthesia, thanks to new kinds of optical sensors developed by a team of European researchers.

Magnetic resonance imaging (MRI) is a powerful, non-invasive way of obtaining detailed internal images of the human body. Unlike x-rays, MRI does not use ionising radiation but probes the inside of the body with strong magnetic fields. It has become an indispensable aid to diagnosis and treatment.

But for some people, the experience of MRI can be upsetting. The patient must lie motionless for as much as an hour or more within the tunnel of the MRI machine. Children, especially, can find the experience frightening and the solution is to calm them with sedative or anaesthetic drugs.

"Anaesthesia for MRI examination uses the same drugs as anaesthesia for any surgical procedure," says Dr Mathieu Jeanne of the Centre Hospitalier Régional Universitaire de Lille, one of the partners in the OFSETH project. "Even if spontaneous respiration can be preserved most of the time during anaesthesia, it is constantly at risk of being impaired by anaesthetic drugs or by upper airway obstruction."

As the anaesthetist cannot accompany the patient, it is essential that the patient be monitored remotely from the neighbouring control room. Unfortunately, the magnetic fields can interfere with electrical equipment, meaning that conventional electronic sensors cannot be used while patients are having their scan. There is also a risk of burns from electric currents induced in metal components by the strong magnetic field.

Optical solution

One solution, being pursued by the EU-funded OFSETH project, is to use optical sensors and optical fibres. With no metal parts, optical sensors transmit information in the form of light pulses and are not affected by magnetic fields.

OFSETH is developing wearable textiles that incorporate optical monitoring systems. The partners are concentrating on systems suitable for children between 1 and 5 years old that will monitor breathing, heart rate and the amount of oxygen in the blood.

"The light-guiding properties of an optical fibre can change depending on its surrounding environment," explains Dr François Narbonneau of Multitel, an independent research centre based in Mons which is coordinating the project. "By measuring the constraints applied to an optical fibre or by analysing modifications of the signal properties transmitted in an optical fibre, it is possible to measure a lot of parameters."

Optical fibres are sensitive to being bent or stretched as this affects the amount of light they transmit. To monitor breathing, the researchers wove a plastic optical fibre into an elastic bandage to be placed around the chest or abdomen. It expands and contracts as the patient breathes and two types of sensor detect the strains in the fibre and so monitor the breathing rate.

The team have also designed a non-invasive blood oxygen sensor that compares the absorption of red and infrared light to gauge how much oxygen is present in the blood. The sensor fits on a finger-tip and detects reflected light from the skin. It measures pulse rate as well.

Although other non-electronic devices can be used to measure vital functions, they can be cumbersome and expensive. And while optical technology is already in use for MRI monitoring, the patient often needs to be switched between two or three different systems as they are moved between different parts of the hospital.

Woven into textiles

The system developed by OFSETH avoids the need for such changes by incorporating the sensors into a garment worn by the patient. Plastic optical fibres are particularly suitable for such applications as they can be woven into the fabric.

"The main innovation is to use optical fibre sensors embedded into textile during the fabrication process for medical applications," says Narbonneau. "The key idea is to provide a garment which allows monitoring of the patient from arrival at the hospital until departure without changing or disconnecting the monitoring system."

All the hardware components are now ready and the next phase is to integrate them into a prototype garment which will then be tested in clinical trials. The project is due to finish in August 2009.

The ten partners contributed their expertise on healthcare, optical sensing and textile technology to make the project a reality. The lessons learned can be applied to a much wider range of applications. For example, the team is already planning to use the same sensors to create baby clothes that can be used at home to guard against sudden 'cot deaths'.

Provided by ICT Results

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