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Fabric based electrode array for muscle stimulation

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Functional Electrical Stimulation (FES) is widely used in rehabilitation to activate muscles artificially. When precisely controlled, it allows intense practice of functional tasks and the resultant sensory feedback promotes cortical reorganization, facilitating rehabilitation. FES electrode arrays have been shown to provide greater muscle selectivity and reduced fatigue compared to the large individual electrode pads used in commercial FES devices. Current FES arrays are realized on a plastic substrate which is not comfortable to wear. This work presents a novel screen printed FES array on polyester/cotton that is suitable for everyday wear in clothing. The fabric FES array was fabricated by printing four functional layers: 1) An interface layer to create a smooth surface on the fabric for subsequent printing; 2) a conductive silver layer to form the conductive path; 3) an encapsulation layer over the conductive tracks to provide protection and electrical insulation; 4) a carbon loaded silicone rubber layer over the conductive pads to form a good connection to the skin. The fabrication of the FES array was evaluated on two types of polyester/cotton fabric. Although both fabrics maintained very good flexibility after FES array printing, the thinner fabric has better performance when compared to the thicker one. A range of postures (pinching, pointing, and hand opening) have been achieved by stimulating an optimised selection of electrode elements. The fabric FES array can be integrated into clothing, for example as an arm band/cuff or sleeve, to form a wearable FES device suitable for rehabilitation of neurological disorders such as stroke, head injury and multiple sclerosis.

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Interventional radiology and the morbidly adherent placenta

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Morbidly adherent placenta comprises placenta accreta, placenta increta and placenta percreta, conditions where there is failure of the placenta to separate normally after birth. This leads to a failure of the uterus to contract and is associated with major haemorrhage. In Western society the incidence has risen 10-fold in the last four decades and in the UK is responsible for 39% of peripartum hysterectomies. The risk factors for the development of a morbidly adherent placenta include previous caesarean section, maternal age > 35 and parity > 3. From 2007, the UK Confidential Enquiries into Maternal and Child Health have recommended that Interventional Radiology (IR) should be considered in the management of morbidly adherent placenta. The arguments for using IR in this setting are reduced blood loss, improved surgical field, preservation of future fertility and decreased morbidity from massive transfusion. Opponents of IR point out that the technique is associated with significant morbidity: popliteal artery thrombosis, vaginal necrosis, leg paraesthesia, fever, abdominal pain, iliac artery thrombosis with lower limb ischaemia, pseudo-aneurysms, arterial rupture, rectal or bladder ischaemia and secondary haemorrhage. More recently fetal compromise has been described as a consequence of IR. Whilst exposure to ionizing radiation for the mother has been discussed and is usually recorded little attention has been paid to the radiation exposure of the fetus and it is unclear as to what could be regarded as a safe dose and how to predict the likely dose of the fetus.

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