DENERVATED MUSCLE UNDERGOING ELECTRICAL STIMULATION: DEVELOPMENT OF MONITORING TECHNIQUES BASED ON MEDICAL IMAGE MODELLING

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ABSTRACT

Muscle tissue composition accounting for the relative content of muscle fibres and intramuscular adipose and loose fibrous tissues can be efficiently analyzed and quantified using images from spiral computed tomography (S-CT) technology and the associated distribution of Hounsfield unit (HU) values. Muscle density distribution, especially when including the whole muscle volume, provides remarkable information on the muscle condition.

We analyze the content of fat, connective tissue, normal muscle and dense fibrous connective tissue in spinal cord injured patients undergoing electrical stimulation treatment using 3-D modelling and segmentation tools. The results show in a novel way and quantitatively the muscle restoration and growth induced by electrical stimulation; the amount of normal muscle fibres increases from 45\% to 60\% of the whole volume while connective tissue and fat reduce respectively of 30\% and 50\%.

Moreover the effectiveness of the FES treatment using surface electrodes is evaluated calculating the density distribution along rectus femoris cross sectional areas. The results show that muscles undergoing FES restore in certain areas and decline in others depending on patient anatomy and surface electrodes positioning.

Keywords: Functional electrical stimulation, Segmentation, Numerical methods, spinal cord injury.
REFERENCES


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