Device for the joint acquisition of electromyographic signals and echographic imaging

Abstract

The characteristics of the presented invention make possible the acquisition of surface electromyographic signals and echographic imaging from the same portion of muscle. A two-layered structure of silicone rubber provides support for both electrodes and connections, allows for the minimisation of echoes that could be produced at the interface with the skin, prevents the formation of air bubbles and makes the electrode transparent to ultrasounds.

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- ultrasound transparency
- electromyography
- biopotential
- muscular tissue
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Device for the joint acquisition of electromyographic signals and echographic imaging

Description

The joint analysis of the electric activity generated by the muscle during a contraction and of muscular structures via echographic imaging is currently limited to different muscular regions. Indeed, the joint acquisition of echographic imaging and surface electromyographic signals from the same portion of muscle would require the placement of an echographic probe above the recording electrodes. In such a case, the image of the muscular tissue would be deformed by the acoustical characteristics of the materials constituting the electrodes, while the gel used between the echographic probe and the skin would generate short circuits within the sampling electrodes of the surface electromyographic signal. In traditional systems, echographic imaging is recorded in different moments or from separate portions of muscle. The characteristics of the invented device make possible a joint analysis of electrophysiological parameters and echographic images from the same portion of tissue without having large distortions of either ultrasonographic images and electromyographic signals.

Applications

The joint acquisition of electromyographic signals and ultrasound images on the skin could be used primarily in sports medicine, study of ergonomics and clinical neurophysiology. In these sectors, applications are multiple: starting from investigations on the postural control to diagnosis of myopathies and neuropathies. In particular, the device can substantially increase the diagnostic sensitivity for the early screening of amyotrophic lateral sclerosis. Indeed, a promising clinical application for the presented invention might concern the study of fasciculation potentials, which have proven to be a distinctive characteristic of various neurogenic disorders. Their occurrence is often identified from either electromyography or ultrasound images. However, both techniques have disadvantages for the screening of fasciculation. By combining the high sensitivity provided by ultrasound imaging with the possibility of discriminating fasciculation occurrences in the morphology of surface potentials detected from a large muscle region, the ultrasound electromyographic system of electrodes might contribute markedly to this field of application.

Advantages

The innovative characteristics are related to the materials employed. A two-layered structure made of silicone rubber gives support for both electrodes and connections, minimizing the echoes which could be produced at the interface with the skin. A first layer of material confers mechanical consistence to the structure, a second softer one provides adherence between the device and the skin, preventing the formation of air bubbles that would disturb the echographic imaging.