



Abstract

Electrical Stimulation Causes Activation of c-Src and Focal Adhesion Kinase in Fibroblasts [†]

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Abstract: Stimulation of the skin and muscles in the field of acupuncture and moxibustion has been shown to increase local blood flow and metabolism or maintain the body in a sustained healthy state. However, little is known about cellular structural changes in response to the electrical stimulus or how the localization of specific proteins is regulated by such stimulation. Cultured fibroblasts were subject to periodic electrical stimulation for 0 min (the unstimulated control), 2 h, 5 h, and 20 h. After 2 h, cell stress fibers and focal adhesions became enlarged, and the stress fibers exhibited an increase in thickness. Within 20 h of periodic stimulation, both the stress fibers and focal adhesions gradually became larger and thicker. An anti-phosphotyrosine antibody (PY-20) was used to stain the cells after electrical stimulations, which showed the increased staining of focal adhesions. They also exhibited the increased staining of the active form of a focal adhesion kinase (FAK) (pY397) and c-Src (pY418), indicating that electrical stimulation had affected certain proteins associated with signal transduction. An ELISA analysis showed that 20 h of electrical stimulation gradually increased the amount of the active form of c-Src until it was approximately tripled, whereas 5 h of electrical stimulation approximately doubled the amount of the active form of FAK, this being the maximum reached. These findings indicate that electrical stimulation stimulates the activity of c-Src and FAK signaling proteins and alters the structure of the actin cytoskeleton and focal adhesions.

Keywords: electrical stimulation; Src; FAK; focal adhesion kinase; cell adhesion; cytoskeleton; stress fiber; focal adhesion



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