General Orthopaedics / complications / basic science / technology

Destraction and recovery of the neuromuscular junction after application of extracorporeal shock wave therapy

Authors: Ochiai, Nobuyasu; Saisu, Takashi; Takaso, Masashi; Takahashi, Kazuhisa; Ohtori, Seiji; Tomonori, Kenmoku

Abstract

INTRODUCTION
It is known that free nerve endings are degenerated after application of shock waves. We therefore hypothesized that the application of shock waves to muscle induces dysfunction of neuromuscular transmission at neuromuscular junctions. We investigated the changes in neuromuscular transmission in response to the application.

OBJECTIVES
Sixtyfive Sprague-Dawley rats were used in this study.

METHODS
Two thousand shock waves at an energy flux density of 0.18 mJ/mm2 were applied to right calf muscle. neuromuscular junctions of gastrocnemius muscles were evaluated using rhodamine--bungarotoxin on the day of treatment (n = 5). Amplitude and latency of the compound muscle action potentials were measured on the day and at 1, 2, 4, 6, and 8 weeks after treatment (n = 10, each group). The decrement ratio was calculated as the ratio of the amplitude or latency on the treated side to the amplitude or latency on the control side to compare among individuals. Statistic analysis were used by a Wilcoxon signed-rank test. Significance was defined as $p < 0.05$.

CONCLUSION
In this study, we established that shock wave application induced degeneration of acetylcholine receptors. Compared with the control muscles, the compound muscle action potentials amplitude of the treated muscles was significantly decreased immediately after treatment. And our result implied that nerve regeneration after the shock wave treatments occurred gradually from 4 weeks to 8 weeks without delaying latency. We conclude that these results explain the effectiveness of Extracorporeal Shock Wave Therapy in treatment for impaired limb muscle coordination that was caused by the transient dysfunction of nerve conduction at neuromuscular junctions.