Shock wave therapy in peripheral nerve repair

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Introduction:
De-focused low energy extracorporeal shock wave therapy has been used in various clinical and experimental models. Reports showed a significant increase of angiogenesis following shock wave application. The aim of our study was to investigate the effects of shock wave therapy on peripheral nerve regeneration, applied after a nerve grafting procedure.

Methods:
Seventy-two Sprague Dawley rats underwent mid-thigh sciatic nerve transection at two different levels creating an 8mm nerve graft. The nerve graft was rotated 180 degrees and epineurial coaptation was performed immediately. All animals were randomly assigned to three experimental groups: Group 1 - Shock wave therapy (300 impulses, 3 Hz) was applied through the closed wound over the graft using an ultrasound gel as a conductive and protective layer immediately after wound closure; Group 2 - Shock wave therapy was applied 2 days after surgery (assessments were carried out 1 week, 3 weeks, and 3 months after surgery); Group 3 - Control (nerve graft without shock wave therapy). Serial functional tests (BBB locomotor rating scale, Inclined plane test, Toe spread test, Sensory- and Proprioceptive placing tests) were performed at weekly intervals during the period between the 3rd and 12th week after the grafting procedure. At weeks 3 and 12, electrophysiological assessment was commenced. Additionally, at weeks 1, 3 and 12 histological samples were examined. Neural collagenic connective tissue and the number of vessels were evaluated.

Results:
The shock wave groups showed a significantly better functional recovery. The sensory function in the shock wave groups reached their maximum (1.0 out of 1.2 mean points) 8 weeks after surgery. I n the control group, sensory performance reached a maximum (0.7 out of 1.2 mean points) 12 weeks after surgery. The motor performance showed a significant improvement in all shock wave groups at all intervals. In all shock wave treated groups the histological examination indicated an increase of the vessel count and a slight decrease of neural collagenic connective tissue within the nerve graft at all intervals, corroborated to the control group. Moreover, electrophysiologic assessment illustrated the positive effect of the therapy on the regeneration of the sciatic nerve.

Discussion:
It seems that improvement of angiogenesis may result in enhanced functional recovery. Further research for better understanding is necessary.

Conclusion:
In a rat sciatic nerve graft repair model, shock wave therapy improves functional recovery, probably due to an increase of neural angiogenesis.