

## The biomechanical effects of electrical stimulation on degenerative-like changes intervertebral disc

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**INTRODUCTION:** Low back pain (LBP) is associated with intervertebral disc (IVD) degeneration. Electrical stimulation (ES) has been found to be effective in relieving LBP, but the effects of the ES on degenerative changes of the IVD are not clear. Thus, the aim of this study is to investigate the biomechanical effects of ES on IVDs with degenerative-like changes induced via static compression.

**METHODS:** 27 male adult Sprague-Dawley rats (3-4 months old) were used. Two stainless steel pins were inserted into 8<sup>th</sup> and 9<sup>th</sup> caudal vertebrae of the rat. After three days rest, they were randomly divided into 3 groups (sham, control and ES groups). The sham group was allowed to rest without external loading while static compression of 11N was applied for one hour daily via the inserted pins to the caudal 8-9 discs in the control and ES groups [1] between days 4 and 17. ES was then applied to the rats in the ES group for 3 weeks between days 17 and 38 via two acupuncture needles inserted at the 8-9 disc level and an electro-stimulation device (IC-4107, Ito Co., Tokyo, Japan). The ES intensity was adjusted until visible muscle contraction was observed [2], and the ES frequency was 100Hz. Three 20-minute sessions of ES were applied weekly once every two days [3]. *In vivo* biomechanical properties of range of motion (ROM), angular laxity and compliance were measured before (Day 3) and after compression (Day 17) and after ES application (Day 38).

**RESULTS:** The changes in ROM and angular laxity from day 3 are shown in figures 1 and 2, respectively. Both ROM and laxity decreased significantly between days 3 and 17 in all groups, but the decreases between days 17 and 38 were only significant in the control group. No significant changes in ROM and laxity were found in ES group from day 17 to 38. The angular compliance decreased throughout the experiment in all groups and no significant difference between groups was observed.

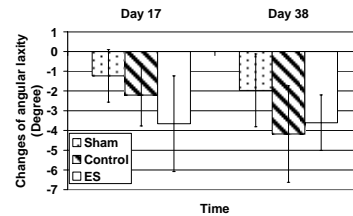


Fig. 1: The changes of angular laxity at days 17 and 38

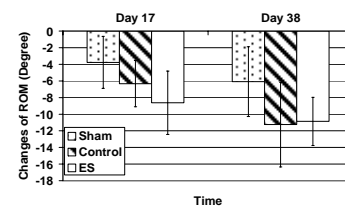


Fig. 2: The changes of ROM at days 17 and 38

**DISCUSSION & CONCLUSIONS:** Moderate daily static compression and ES application resulted in changes in the biomechanical properties of the IVD *in vivo*. The decrease in ROM is similar to the effect seen in human IVDs at the initial stages of disc degeneration. ES application has been found to induce biomechanical changes in the IVD, which can prevent further changes induced by the daily static compression.

**REFERENCES:** <sup>1</sup> T.S. Ching, H.K. Chow, Y.D. Yao et al (2003) The effect of cyclic compression on the mechanical properties of the intervertebral disc: An *in vivo* study in a rat tail model. *Clin. Biomech.* **18**: 182-89. <sup>2</sup> C.K.N. Yeung, M.C.P. Leung, D.H.K. Chow (2003) The use of electro-acupuncture in conjunction with exercise for the treatment of chronic low-back pain. *J. Altern. Complement Med.* **9**:479-90. <sup>3</sup> T.R. Lehmann, D.W. Russell, K.F. Spratt (1983) The impact of patients with nonorganic physical findings on a controlled trial of transcutaneous electrical nerve stimulation and electroacupuncture. *Spine* **8**:625-34.

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