

(様式4)

学 位 論 文 の 内 容 の 要 旨

(橋 本 章 吾) 印

(学位論文のタイトル)

Extracorporeal Shockwave Therapy Accelerates the Healing of a Meniscal Tear in the Avascular Region in a Rat Model

(半月板無血行野損傷に対する体外衝撃波療法の治癒促進効果について)

(学位論文の要旨)

BACKGROUND: The treatment of meniscal tears in the avascular region remains a clinical challenge. Extracorporeal shock wave therapy (ESWT) is a minimally invasive, safe, and effective therapy for various orthopedic disorders. However, the therapeutic effect of ESWT on meniscal tears has not been reported.

PURPOSE: The purpose of the present study is to evaluate the therapeutic effect of ESWT in the treatment of meniscal tears.

STUDY DESIGN: Controlled laboratory study.

METHODS: Twelve-week-old male Wistar rats were divided into three groups (Normal, ESWT [-], and ESWT [+]). We made a full-thickness 2-mm longitudinal tear in the avascular region in the latter 2 groups. At one week after surgery, the ESWT (+) group received 800 impulses of shockwave at 0.22 mJ/mm² energy flux density in a single session. We performed a pathological examination to evaluate meniscal healing (n=10 for each group), and immunohistochemistry to analyze the expression of bromodeoxyuridine (BrdU) and CCN family member 2 (CCN2) at 2, 4, and 8 weeks after ESWT (n=5 for each group). The CCN2, Sry-type high mobility-group box 9 (SOX 9), Vascular Endothelial Growth Factor (VEGF-a), Aggrecan, collagen type 1 alpha 2 (Col1a2) and collagen type 2 alpha 1 (Col2a1) levels at the site of the meniscal tear at 4 weeks after ESWT were quantitatively evaluated by a real-time PCR (n=5 for each group).

RESULTS: The meniscus healing scores in the ESWT (+) group were significantly higher than those in the ESWT (-) group at 4 and 8 weeks. The ratio of BrdU-positive cells and CCN2-positive cells were the highest in the ESWT (+) group among the three groups. In the ESWT (+) group, the real-time PCR revealed that the levels of CCN2, SOX9, Aggrecan and Col2a1 were upregulated. All significant data were $p < 0.05$.

CONCLUSION: ESWT promoted the healing of meniscal tears in the avascular area. ESWT stimulated proliferation of meniscus cells and the upregulation of cartilage-repairing factors such as CCN2, with the upregulation of the cartilage-specific extracellular matrix expression.

Clinical Relevance: ESWT may be an effective therapeutic option that promotes meniscal healing in the avascular region.