THE EFFECT OF HYALURONAN INJECTION INTO BONE TUNNEL ON ENHANCEMENT OF HEALING OF TENDON BONE JUNCTION.

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Introduction:
Healing of tendon bone junction has a large importance for results in knees with ligament reconstruction, especially in knees with anterior cruciate ligament reconstruction. Progression of healing of tendon bone junction would develop stability of the knee and let patients recover earlier. The effect of hyaluronan on enhancement of proliferation and preservation of articular cartilage had documented, and the effect of hyaluronan on healing of meniscus had also reported in rabbit model. The purpose of this study was to assess the effect of hyaluronan, which includes the effect on proliferation of cartilage, on enhancement of healing of tendon bone junction.

Materials and Methods:
Twenty-one mature Japanese white rabbits, each weighing approximately 3000 g, were utilized in this study. Patellar tendon of rabbit was used for the model of this study. Central patellar tendon was incised longitudinally into two halves and tibial attachment of medial half of patellar tendon was resected from tibial bone. Tibial bone tunnel of the 2.4mm diameter was created with the drill. The proximal hole of the bone tunnel was located at 2mm proximally from the tibial tuberosity. The 2mm distal end of the medial half of patellar tendon was sutured with 3-0 non-absorbable sutures by means of glove suture technique as Krackow described, and this 2mm distal end of the medial half was pulled into bone tunnel passing the 3-0 sutures through the tunnel. Pull-out fixation was performed using a screw, which was placed 5mm distally from the distal hole of the tunnel. The procedure was performed bilaterally. Bone tunnel and tendon bone junction was filled with hyaluronan on right knee, and contralateral knee was left alone without hyaluronan as a control. Nine each rabbits were harvested at 3, 6, 12 weeks and evaluated histologically, histochemically and biomechanically. Sections were stained for routine histological evaluation of HE stain and they were stained for type I, type II, and type III collagen by immunohistological analysis in histochemical evaluation (n=6, 2 each in 3 groups). Biomechanical evaluation was performed using Instron 1185 materials testing machine (n=15, 5 each in 3 groups). The excised patella-patellar tendon-tibia complex was loaded at a rate of 20mm/sec., and maximum loads to failure and linear stiffness were measured.

Results:
Histologically, proliferation of chondrocyte-like cell at wide range of bone tunnel in hyaluronan group, but proliferation of chondrocyte-like cell at only proximal end of the bone tunnel in control group were observed. With histochemical assessment, proliferation of type II collagen was obviously seen at 12 weeks following surgery. Biomechanically, maximum loads to failure at 3 weeks following surgery were 93.0 N in hyaluronan group and 70.0 N in control group, which is statistically significantly different between hyaluronan group and control group. Maximum loads at 6 and 12 weeks following surgery were 142.2 N and 210.6 N in hyaluronan group, and 139.3 N and 162.0 N in control group. Linear stiffness at 6 and 12 weeks following surgery were 48.2 N/mm and 55.4 N/mm in hyaluronan group, and 38.7 N/mm and 54.3 N/mm in control group. The difference between hyaluronan group and control group became less apparent at 6 weeks, and there were no statistically significant difference of maximum loads and linear stiffness between hyaluronan and control groups at 6 and 12 weeks.

Discussion:
Healing potential of bone tendon junction was enhanced by hyaluronan at early times following surgery. Enlarged attachment area between bone and tendon by proliferation of chondrocyte-like cell in hyaluronan group would increase maximum load of failure. Proliferation of chondrocyte-like cell and enlarged attachment area between bone and tendon were also expected for prevention for bone tunnel enlargement following anterior cruciate ligament reconstruction. Hyaluronan would be effective for better results in knees with ligament reconstruction.

References:

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