EFFECT OF MENISCAL REPAIR AND HYALURONAN TREATMENT ON CARTILAGE DEGENERATION OF THE FEMUR AND TIBIA IN THE RABBIT

INTRODUCTION
The surgical repair of traumatic tears of the meniscus may enhance tissue remodeling, help to maintain the stability of the knee joint, and prevent osteoarthritic changes. After repair of the experimentally lacerated meniscus, treatment by intra-articular injections of hyaluronic an (HA) has been shown to enhance meniscal remodeling [2]. HA treatment also appears to slow the degeneration of cartilage following experimental transection of the anterior cruciate ligament [3]. Clinical experience indicates cartilage damage leads to degeneration of the apposing and surrounding articular cartilage. We hypothesized that meniscal injury may have similar deleterious effects on the articular cartilage of the tibial plateau and femoral condyle, and that administration of HA may attenuate this effect. The objectives of this study were to determine the extent of degeneration of the femorotibial articular cartilage surfaces in the rabbit knee, and the effect of HA treatment on the cartilage after meniscal repair, using digital video image analysis after Indian Ink staining [1].

METHODS

Rabbit Repair Model. Bilateral meniscal injury and repair were performed on thirteen NZW rabbits. In nine of the rabbits, a 5-7 mm longitudinal incision was made in the peripheral region (PR) of the medial meniscus of each knee. In four rabbits, a 4-5 mm longitudinal incision was made in the central region (CR) of the medial meniscus of each knee [2]. In all rabbits, the lesion was repaired with two horizontally-placed nylon sutures, and the central region (CR) of the medial meniscus of each knee [2]. In all rabbits, the lesion was repaired with two horizontally-placed nylon sutures, and the central region (CR) of the medial meniscus of each knee [2]. In all rabbits, the lesion was repaired with two horizontally-placed nylon sutures, and the central region (CR) of the medial meniscus of each knee [2]. In all rabbits, the lesion was repaired with two horizontally-placed nylon sutures, and the central region (CR) of the medial meniscus of each knee [2]. In all rabbits, the lesion was repaired with two horizontally-placed nylon sutures, and the central region (CR) of the medial meniscus of each knee [2]. In all rabbits, the lesion was repaired with two horizontally-placed nylon sutures, and the central region (CR) of the medial meniscus of each knee [2]. In all rabbits, the lesion was repaired with two horizontally-placed nylon sutures, and the central region (CR) of the medial meniscus of each knee [2]. In all rabbits, the lesion was repaired with two horizontally-placed nylon sutures, and the central region (CR) of the medial meniscus of each knee [2]. In all rabbits, the lesion was repaired with two horizontally-placed nylon sutures, and the central region (CR) of the medial meniscus of each knee [2]. In all rabbits, the lesion was repaired with two horizontally-placed nylon sutures, and the central region (CR) of the medial meniscus of each knee [2]. In all rabbits, the lesion was repaired with two horizontally-placed nylon sutures, and the central region (CR) of the medial meniscus of each knee [2]. In all rabbits, the lesion was repaired with two horizontally-placed nylon sutures, and the central region (CR) of the medial meniscus of each knee [2]. In all rabbits, the lesion was repaired with two horizontally-placed nylon sutures, and the central region (CR) of the medial meniscus of each knee [2]. In all rabbits, the lesion was repaired with two horizontally-placed nylon sutures, and the central region (CR) of the medial meniscus of each knee [2]. In all rabbits, the lesion was repaired with two horizontally-placed nylon sutures, and the central region (CR) of the medial meniscus of each knee [2].

RESULTS
Peripheral Repair. In the PR 12 and PR 24 groups, the tibial plateaus of the PBS-treated samples showed a significantly lower reflectance (more degenerate) score when compared to NL (p < 0.01). In contrast, the HA-treated samples were not detectably different (p > 0.90). ANOVA comparison of the PBS and HA-treated PR tibiae showed a significantly higher reflectance (less degenerate) score with HA treatment (p < 0.05), and no interaction effect for time after injury (p > 0.50). The difference images at 12 weeks revealed that the PBS-treated tibiae were more degenerate than the normal and HA-treated tibiae in both the LTP and MTP, approximately in the region of cartilage underlying the menisci (Fig. 2A, C). ANOVA comparison of the PBS and HA-treated PR femora did not show a difference in ink staining (p > 0.40).

Central Repair. There was no detectable difference between either the PBS or HA-treated CR 24 samples and the NL group (e.g., Fig. 1, p > 0.90). Also in the CR 24 group, there was no detectable difference between the PBS and HA-treated tibiae (p > 0.90) or femora (p > 0.75).

DISCUSSION
The similar light reflectance (ink staining) of the normal and HA-treated tibiae, together with the mild decrease in light reflectance (increased ink staining) of the PBS-treated tibiae, suggest that HA has a protective effect on articular cartilage after injury and repair of the meniscus in the peripheral region. The use of a digital video image acquisition and analysis method allowed quantitation of the effect (Fig. 1), and localization of the area of cartilage damage (Fig. 2).

The susceptibility of articular cartilage to degeneration after meniscal injury appeared to depend on the location of the injury (i.e., in the peripheral versus central region). In addition, with either peripheral or central meniscus injury, there was no detectable effect on the cartilage of the femoral condyle. It remains to be determined whether these patterns of cartilage response reflect differences in biomechanical or biological factors, and how HA may modulate the degenerative process.

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REFERENCES