Changes of Articular Cartilage after Immobilization in a Rat Knee Experimental Model

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Introduction: Joint immobilization causes not only a limitation of motion but also degeneration or atrophy of the articular cartilage. The amount of mechanical stress and the preserved motion of the joint are of major importance for maintaining the integrity of articular cartilage (1). Though a large number of experimental studies regarding the articular cartilage after immobilization have been reported, changes in a joint cavity after joint immobilization have not been fully clarified (2, 3). However, evaluation area varied among the previous reports. In this study, we chose three areas from each condyle of the femur and tibia to evaluate the changes that occurred in the articular cartilage after immobilization.

Materials and Methods: Animals: Adult male Sprague-Dawley rats weighing from 380 to 400 g were used. Their knee joints were immobilized at 150° of flexion by rigid internal but extra-articular fixation for various periods (4). Sham operated animals had holes drilled in the femur and tibia and screws inserted but none of them were plated. One hundred twenty rats (3 days, 1, 2, 4, 8, and 16 weeks) were prepared for histological evaluation. We chose 3 areas (non-contact area, transitional area, and contact area) from each condyle of the femur and tibia (Figure 1).

Results: The surface of immobilized group became rough and a protrusion was observed (Figure 1A). Degenerative changes of the articular cartilage were most significant in the contact area (Figure 2A).

Discussion: The changes of articular cartilage became obvious as early as one week after immobilization. These changes may be due to a lack of mechanical stress or a lack of joint fluid circulation during immobilization. Although we do not know the reversibility of these changes of articular cartilage, early mobilization is preferable to avoid these cartilage changes.