Increased elasticity of capsule in a rat knee contracture model assessed by scanning acoustic microscopy

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Objectives: The mechanical property of immobilized joints is not well understood. The present study was designed to investigate the tissue elasticity of the anterior and posterior capsules in a rat knee contracture model using scanning acoustic microscopy (SAM).

Material and Methods: Adult male Sprague-Dawley rats weighing from 380 to 400 g were used. Their knee joints were immobilized at 150° in flexion with a plastic plate and metal screws for various periods (1, 2, 4, 8 and 16 weeks). Sham operated animals had holes drilled in the femur and tibia and screws inserted but none of them were plated. The rats were fixed with 4% paraformaldehyde and the specimens were decalcified in EDTA. Standardized serial sections of the medial midcondylar region of the knee were made. A new concept SAM using a single pulsed wave instead of continuous waves was applied to measure the sound speed of the anterior and posterior capsules, comparing it with the corresponding light microscopic images.

Results: The sound speed of the posterior capsule increased significantly in the 8- and 16-week experimental group compared with that in the control group. The sound speed of the anterior capsule showed no statistical difference between the experimental and the control groups at any period of immobilization.

Conclusions: Our data suggest that the increased elasticity of the posterior capsule are one of the main causes of limited extension after a long period of immobilization in using SAM, which is a powerful tool for evaluating the elasticity of targeted tissues.