Introduction: The rabbit model is commonly used to study carpal tunnel syndrome (CTS). It has been proposed that mechanical failure of the subsynovial connective tissue (SSCT) in the carpal tunnel may play a role in the etiology of CTS, but the material properties of the rabbit SSCT are unknown. The purpose of this study was to develop a method to measure the shear properties of the rabbit SSCT.

Materials and Methods: A total of 6 rabbit cadavers with a mean weight of 4.6 kg (range, 3.6 to 5.4 kg) were used. The forefeet, with intact carpal tunnels, including the flexor digitorum superficialis (FDS) tendons and surrounding SSCT, were obtained immediately after sacrifice. FDS tendons were exposed at the antibrachial level with the carpal tunnel intact. The third FDS tendon was divided 5 mm proximal to the proximal edge of the flexor retinaculum, and the proximal end of the third FDS tendon was sutured with 2-0 Vicryl. The Vicryl suture was used to connect the tendon to a load cell. On the distal side, the third FDS tendon was exposed 5 mm distal to the carpal tunnel. The specimen was held on a custom specimen holder (Figure 1). The second and forth digits were also fixed on the specimen holder, while the third digit was left free. The specimen holder with the specimen was mounted on a custom-made micro-tester for mechanical evaluation. The testing device consisted of a linear servo motor (model MX 80, Parker Hannifin Corp., Irwin, PA) and a load cell (model MDB-5, Transducer Techniques, Temecula, CA). Throughout testing, the specimen was kept moist by spraying phosphate buffered 0.9% saline solution.

Results: For the six specimens tested in this study, the mean excursion to full flexion was 7.08 mm (SD 0.77). The mean force at full flexion was 317 mN (SD 166). The percent maximum force at full flexion was 54.5% (SD 19.4). The mean energy absorbed at full flexion was 0.29 mJ (SD 0.31). The mean excursion needed to reach 5% of the maximum force was 3.04 mm (SD 0.99).

Discussion: This study describes a method to measure the shear properties of the rabbit SSCT attached to the third FDS tendon. We believe that these data will be useful to help design future studies of CTS pathology in the rabbit model. The FDS tendon excursion during full flexion is important as a measure of the physiological limit of motion to which the intact FDS and its SSCT can be exposed. This parameter may be important in establishing acute injury models of CTS, as well as in looking at changes over time in models of chronic SSCT injury as a possible etiology of CTS. The excursion needed to reach 5% of the maximum force might be useful in establishing some sort of “safe harbor”, again in chronic and repetitive models of CTS.


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