biomechanical testing of repaired tendon

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Abstract

This protocol was used for biomechanical testing of repaired tendon.

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Protocol

Step 1.

All tendon were kept wet with phosphate buffered saline during procedure.

The proximal tendon segment was secured with sandpaper and a triangle-toothed grip and the distal phalanx was secured in a custom grip. Distance between grips was 60mm. A random texture was applied to the surface of the tendons using Verhoeff's stain for tracking.

Tendons were preconditioned to a preload of 1 N followed by five triangle wave cycles between 0-1 mm at a rate of 0.3mm/s. Then tendons were pulled in uniaxial tension at 0.3 mm/s until failure on a material testing machine (5866; Instron Corp., Norwood, MA), and strain was tracked optically using video (60Hz) of the test. Failure mode (i.e., suture pullout, suture breakage, or knot failure) was recorded.

Load and strain data were synchronized and used to generate load displacement and load strain curves.The maximum load (N), load to create a 2 mm gap (N), stiffness (N/mm) (the slope of the linear portion of the load–deformation curve), strain at 20 N (%), yield force (N) and a modified version of resilience (N strain) (the area under the load–strain curve up to the yield point) were determined using a custom-written code in MATLAB (Natick, MA). Load to create a gap of 2 mm (a threshold level that leads to decreased repair strength and increased adhesions) between tendon stump ends was calculated by tracking the displacement between points ± 2 mm from the repair site with code in MATLAB.