

Contact Area and Tendon Pull-Through Force of FiberTape and #2 FiberWire

Arthrex Research and Development

Objective

The purpose of this testing was to determine the footprint size of FiberTape compared to #2 FiberWire, and to compare the pull-through strength of each from human rotator cuff tendon material.

Methods and Materials

Footprint Area Testing: The footprint sizes of FiberTape and #2 FiberWire were determined by draping the suture over a half-inch steel dowel with a piece of Pressurex Super Low Film (Sensor Products LLC, USA) between the suture and the dowel. The dowel was secured to the crosshead of an Instron 8871 Axial Table Top Servohydraulic Testing System (Instron, Canton, MA) with a clevis fixture. Three samples of each suture were loaded to 150N and held there for 12 seconds. The footprint area of each sample was revealed as a color change in the pressure film. The film was scanned and the area of color change was analyzed using Scion Image Software (Scion Corporation).

Tendon Pull-Through Testing: Human subscapular and infraspinatus tendons were used for this testing. Each tendon sample was prepared by passing one strand of FiberTape and one strand of #2 FiberWire through the tendon material in a simple stitch orientation using a Scorpion Suture Passer. The stitches were about 5-10 mm apart from each other and about 8-10 mm from the tendon edge. Mechanical testing was performed using the Instron 8871. The tendon material was secured to the load cell using a custom freezing clamp, and the free ends of one suture type were clamped in a vise attached to the testing surface. The construct was pulled to failure at 33mm/sec. The ultimate load and mode of failure was recorded for each sample. The second type of suture was then clamped in the vise and was tested in an identical manner. The order of testing was alternated for each tendon sample. Differences in the means were analyzed using a paired t-test ($\alpha = 0.05$).

Results

The footprint area results are shown in Table 1, and the scanned image of the pressure film is shown in Figure 1.

The pull-through force of the #2 FiberWire was 149 ± 41 N, and the mode of failure for all samples ($n = 8$) was suture pull-through. The pull-through force of the FiberTape was 189 ± 53 N, and the mode of failure for all samples ($n = 8$) was suture pull-through. The complete results are listed in Table 2. The greater ultimate load of the FiberTape was significantly different than that of #2 FiberWire ($p = 0.032$).

Table 1: Pressure film footprint results

Pressure Film Footprint Area (in ²)		
Sample	FiberWire	FiberTape
1	0.02	0.07
2	0.02	0.06
3	0.02	0.06

Figure 1: Scanned image of the pressure film

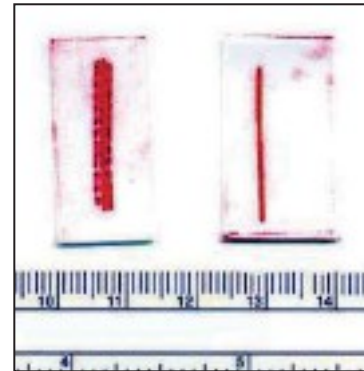


Table 2: Results of the tendon pull-through testing

RC Tendon Pull-Through (N)		
Sample	FiberWire	FiberTape
1	138	170
2	156	114
3	160	189
4	169	252
5	172	200
6	59	118
7	137	239
8	197	233
Average	149	189
St. Dev.	41	53

Conclusion

FiberTape has a broader footprint area than that of #2 FiberWire. The force required to pull FiberTape through tendon tissue is significantly greater than that of #2 FiberWire.