Arthrex Tape-Style Sutures vs Competitor Products: A Biomechanical Study

Arthrex Orthopedic Research

Background

Flat-braided tape-style sutures are an alternative to traditional round sutures that provide a larger contact area with the tendon or tissue during repair.[1] The purpose of this study was to compare the strength and tensile properties of Arthrex's SutureTape and FiberTape® sutures to comparable sutures from leading competitor manufacturers.[3]

Materials and Methods

A series of pull tests were conducted to compare the tensile properties of Arthrex's SutureTape and FiberTape suture to several competitors' tape-style sutures. These tests included straight-pull and knot-pull tests to evaluate tensile properties under various clinically relevant conditions. The Arthrex and competitor products evaluated in this study are shown in Table 1.

Table 1. Arthrex and competitor products evaluated in this study

Company	Suture Size	Product
Arthrex	1.7 mm	FiberTape
	2.0 mm	
	1.3 mm	SutureTape
	1.7 mm	
ConMed	1.3 mm	HiFi® Ribbon
	2.0 mm	HiFi Tape
DePuy Synthes	2.5 mm	PERMATAPE™
	2.5 mm	DYNATAPE™
Smith & Nephew	2.0 mm	ULTRATAPE
Stryker	1.2 mm	XBraid$_{TT}$
	1.4 mm	
	2.0 mm	
	2.2 mm	

Straight-Pull Test: Sample Preparations

The suture being evaluated was laid out with its mid-section against a ruler. The suture was marked with a permanent marker to prepare samples according to USP standards.[3]

Knot-Pull Test: Sample Preparations

A 5 mm Allen key was secured to a tabletop vise, and a precut[2] PVC tube was fit to the end of the Allen key. The middle of the suture was aligned with the PVC tube, and a surgeon's knot was tied.

The PVC tube was pulled off the Allen key, and the suture was laid against a ruler with the knot at the 2.5-in mark. The suture was marked with a permanent marker to prepare samples according to USP standards.[3]

Test Setup and Load Application

The following steps for test setup and load application were performed for both the straight-pull and the knot-pull test following sample preparations.

A pneumatic clamp was secured to the load cell/actuator of the Instron (model 5544). Bluehill software was opened and used to calibrate the 2 kN load cell.

A prepared suture sample was placed in the grooves of the top pneumatic clamp with the mark at the closure interface. Images of the straight-pull and knot-pull test setups are shown in Figures 1 and 2, respectively.

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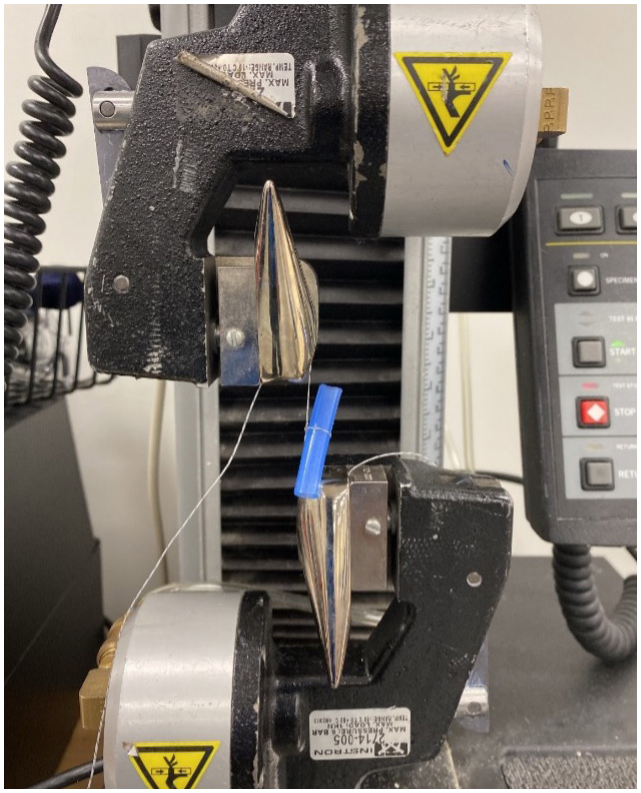
Figure 1. Straight-pull test setup

Figure 2. Knot-pull test setup

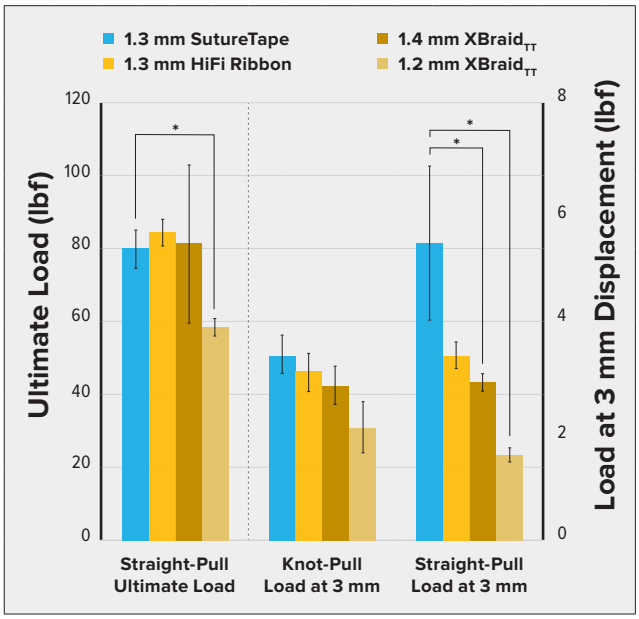


A manual preload ranging between 1-5 N was applied. Once the preload reached the desired range, tensile load-to-failure testing was performed at a rate of 12 in/min. Data was recorded at 500 Hz. The maximum load and load at 3 mm displacement were recorded for further analysis.

Results

Arthrex's 1.3 mm SutureTape outperformed all comparable competitor products with respect to load at 3 mm displacement in both the straight-pull and the knot-pull test.[2] No statistically significant difference was observed between the straight-pull ultimate load of 1.3 mm SutureTape and the straight-pull ultimate loads of 1.3 mm HiFi ribbon (ConMed) or 1.4 mm XBraid$_{TT}$ (Stryker) (Figure 3).

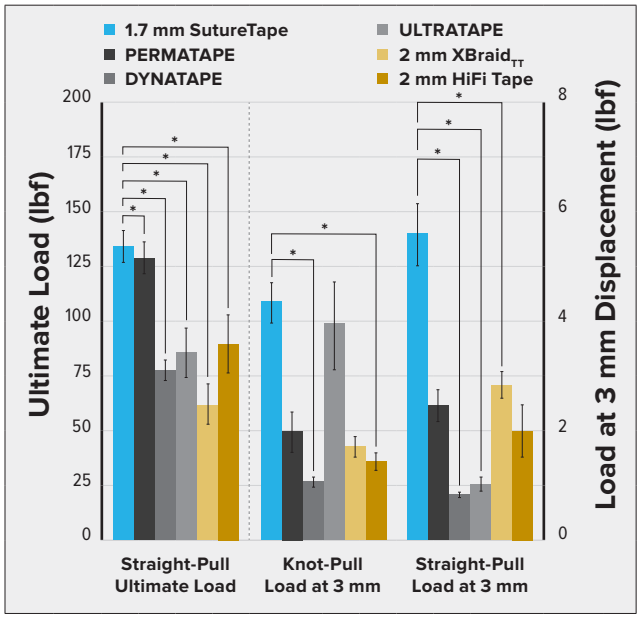
Figure 3. Straight-pull ultimate load, knot-pull load at 3 mm displacement, and straight-pull load at 3 mm displacement comparison for 1.3 mm SutureTape vs comparable competitor products with statistically significant differences shown (*)



Arthrex's 1.7 mm SutureTape outperformed all comparable competitor products with respect to straight-pull ultimate load. A statistically significant difference was observed between the straight-pull ultimate load of 1.7 mm SutureTape and the straight-pull ultimate loads of all comparable competitor products.[2]

Knot-pull and straight-pull loads at 3 mm displacement were greater for 1.7 mm SutureTape than for all comparable competitor products.[2] Due to non-normally distributed data, a nonparametric ANOVA on ranks was used for comparison (Figure 4).

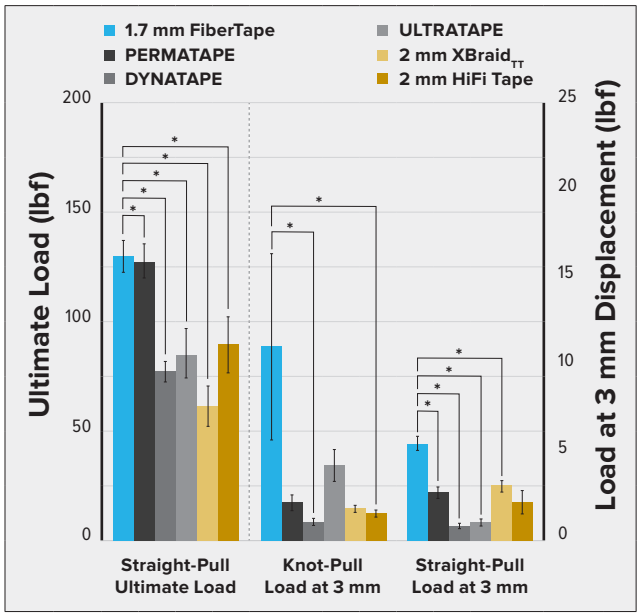
Figure 4. Straight-pull ultimate load, knot-pull load at 3 mm displacement, and straight-pull load at 3 mm displacement comparison for 1.7 mm SutureTape vs comparable competitor products with statistically significant differences shown (*)



Arthrex's 1.7 mm FiberTape® suture outperformed all comparable competitor products with respect to straight-pull ultimate load. A statistically significant difference was observed between the straight-pull ultimate load of 1.7 mm FiberTape suture and the straight-pull ultimate loads of all comparable competitor products.[2]

Knot-pull and straight-pull loads at 3 mm displacement were greater for 1.7 mm FiberTape suture than for all comparable competitor products.[2] Due to non-normally distributed data, a nonparametric ANOVA on ranks was used for comparison (Figure 5).

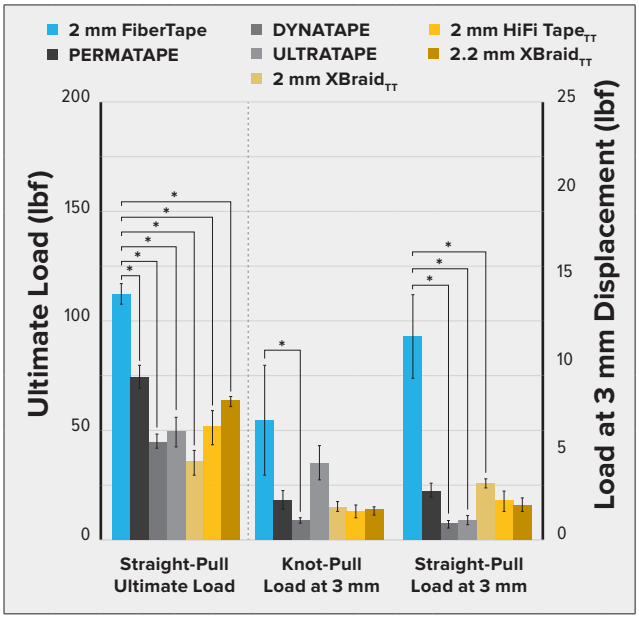
Figure 5. Straight-pull ultimate load, knot-pull load at 3 mm displacement, and straight-pull load at 3 mm displacement comparison for 1.7 mm FiberTape suture vs comparable competitor products with statistically significant differences shown (*)



Arthrex's 2 mm FiberTape suture outperformed all comparable competitor products with respect to straight-pull ultimate load. A statistically significant difference was observed between the straight-pull ultimate load of 2 mm FiberTape suture and the straight-pull ultimate loads of all comparable competitor products.[2]

Knot-pull and straight-pull loads at 3 mm displacement were greater for 2 mm FiberTape suture than for all comparable competitor products.[2] Due to non-normally distributed data, a ANOVA on ranks was used for comparison (Figure 6).

Figure 6. Straight pull ultimate load, knot-pull load at 3 mm displacement, and straight-pull load at 3 mm displacement comparison for 2 mm FiberTape suture v. comparable competitor products with statistically significant differences shown (*)



Conclusion

All Arthrex products that were evaluated in this study had greater straight-pull and knot-pull loads at 3 mm displacement, which represents the clinical failure of polyblend sutures,[4] than their respective competitor products. 1.7 mm SutureTape, 1.7 mm FiberTape® suture, and 2 mm FiberTape suture had significantly greater straight-pull ultimate loads than competitor products while 1.3 mm SutureTape had a straight-pull ultimate load that was similar to that of the competitor products. The results of this testing illustrate that a Arthrex tape-style suture can withstand greater tensile loads and may be less likely to fail than their comparable competitor products.[2]

Reference

1. Huntington L, Coles-Black J, Richardson M, Sobol T, Caldow J, Chuen J, Ackland DC. The use of suture-tape and suture-wire in arthroscopic rotator cuff repair: a comparative biomechanics study. *Injury*. 2018;49(11):2047-2052. doi: 10.1016/j.injury.2018.09.004
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4. Ravalin RV, Mazzocca AD, Grady-Benson JC, Nissen CW, Adams DJ. Biomechanical comparison of patellar tendon repairs in a cadaver model: an evaluation of gap formation at the repair site with cyclic loading. *Am J Sports Med*. 2002;30(4):469-473. doi:10.1177/03635465020300040301

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