Mechanical and Biomechanical Comparison Testing of 1.3 mm SutureTape

Arthrex Research and Development

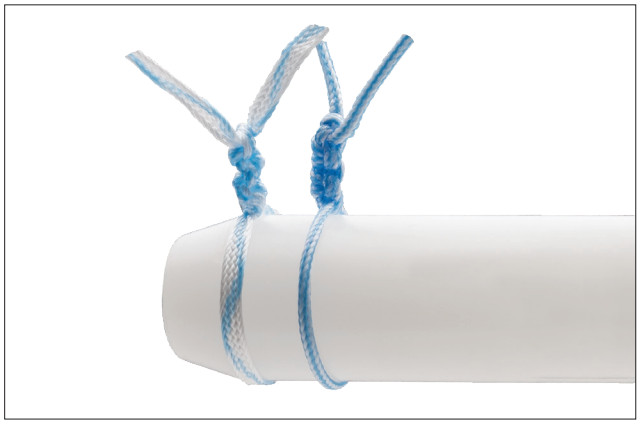
Objective

Determine the knot security and tissue pull-through characteristics of 1.3 mm SutureTape, and compare the results to #2 FiberWire® suture.

Methods and Materials

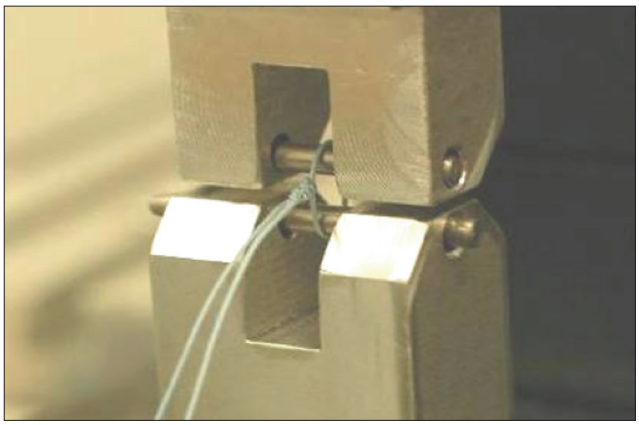
Knot Security Testing: Six samples each of 1.3 mm SutureTape and #2 FiberWire suture were used to create six-throw surgeon's knots (alternating half-hitches) over a ⅜ in dowel (Figure 1). All samples were prepared by Stephen S. Burkhart, MD.

Figure 1. Six-throw surgeon's knot tied over a ⅜ in dowel with 1.3 mm SutureTape (left) and #2 FiberWire suture (right).



Mechanical testing was performed using an INSTRON® 5544 Electromechanical Dynamic Testing Machine with a 2 kN load cell secured to the cross-head. Custom fixtures with 3.95 mm dowel pins were secured to the testing surface and crosshead (Figure 2). A pull-to-failure test was performed at 12 in/min, and load and displacement data were recorded at 500 Hz. The failure load and maximum load at 3 mm displacement were determined for each sample.

Figure 2. Knot security test setup.



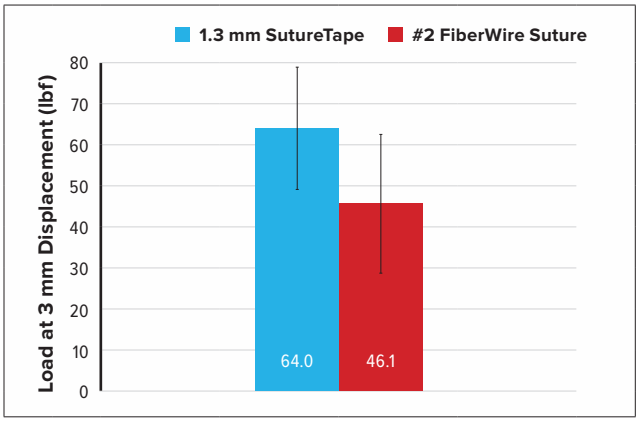
Tissue Pull-Through Testing: Matched pairs of male shoulders (59 ± 8 yrs) were dissected, leaving the glenoid and labrum attached. One sample of each suture type was passed under the labrum in a simple stitch configuration at the 5:00 and 7:00 positions of the glenoid "clock face" for each glenoid sample. Biomechanical testing was performed using an E10kN INSTRON ElectroPuls™, with a 1 kN load cell secured to the crosshead. Glenoid samples were mounted to the testing surface on a three-degrees-of-freedom fixture, allowing the sample to be positioned such that the sutures were pulled perpendicular to the labrum and parallel to the glenoid face. The suture tails were secured in a pneumatic clamp (Figure 3). A pull-to-failure test was conducted at 12 in/min, and load and displacement data were recorded at 500 Hz.

Figure 3. Tissue pull-through test setup.

Results

Knot Security Testing: Both suture sample groups had average failure loads above 60 lbf, and there was no significant ultimate load difference between the two groups (*P* = .219). However, the load at 3 mm displacement for the 1.3 mm SutureTape (64.0 ± 13.4 lbf) was significantly larger than the #2 FiberWire® suture (46.1 ± 16.6 lbf) (*P* = .026). The load at 3 mm displacement is shown graphically in Figure 4.

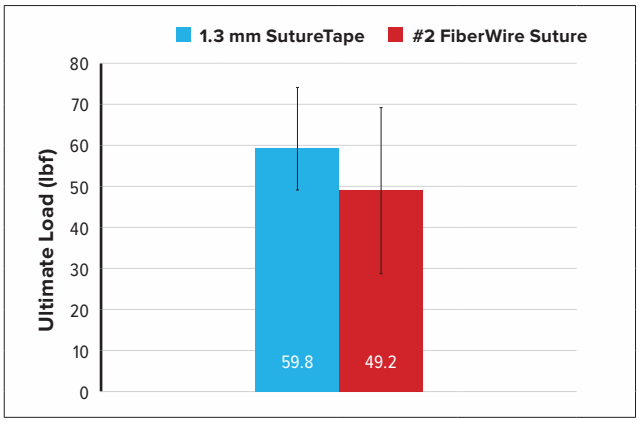
Figure 4. Load at 3 mm displacement.



The ultimate failure loads of the 1.3 mm SutureTape samples occurred between 2 mm and 3 mm displacement, while the failure loads of the #2 FiberWire suture samples occurred between 3 mm and 11 mm displacement, further demonstrating the superior knot security of the 1.3 mm SutureTape.

Tissue Pull-Through Testing: The tissue pull-through ultimate load of the 1.3 mm SutureTape and #2 FiberWire suture samples was 59.8 ± 13.9 lbf and 49.2 ± 19.6 lbf, respectively. The difference between the groups was not significantly different (*P* = .219). The results are shown graphically in Figure 5.

Figure 5. Tissue pull-through ultimate loads.



Conclusion

The 1.3 mm SutureTape demonstrated significantly superior knot security when compared to #2 FiberWire suture. Also, though not significant, the average tissue pull-through ultimate load was 21% greater than that of the #2 FiberWire suture.

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