Mechanical and Biomechanical Comparison Testing of 1.3 mm SutureTape

Arthrex Orthopedic Research

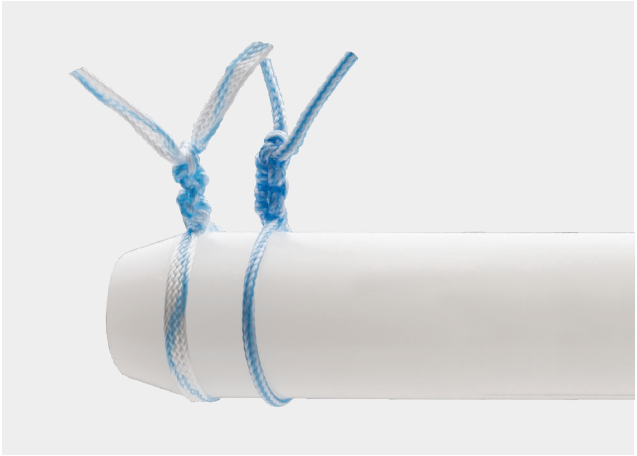
Objective

This study aimed to 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

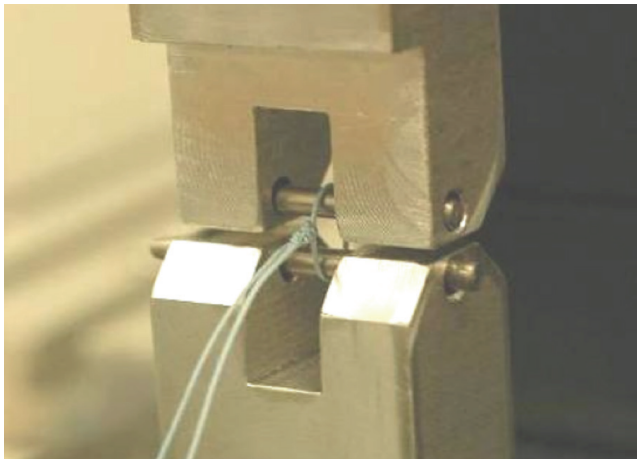
Knot Security Testing: Six samples each of 1.3 mm SutureTape and #2 FiberWire suture were used to create 6-throw surgeon's knots (alternating half-hitches) over a ⅜-in dowel (Figure 1). All samples were prepared by Stephen S. Burkhart, MD.

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



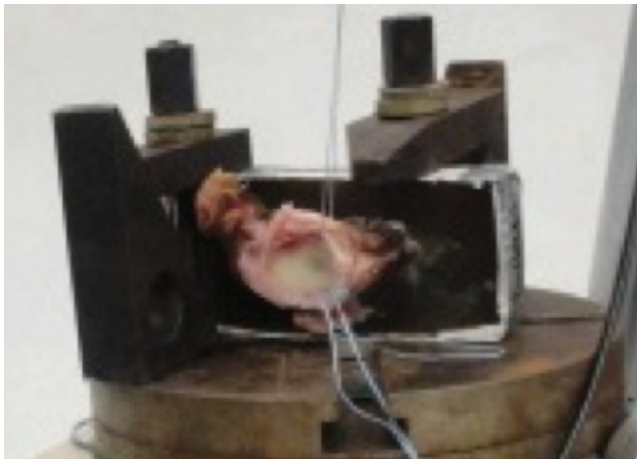
Mechanical testing was performed using an Instron 5544 Electromechanical Dynamic Testing Machine with a 2 kN load cell secured to the crosshead. Custom fixtures with 3.95 mm dowel pins were secured to the testing surface and crosshead (Figure 2). A pull-to-failure test was performed at 12 in/min, and 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 years) 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-o'clock and 7-o'clock positions of the glenoid for each sample. Biomechanical testing was performed using an Instron ElectroPuls E10000, with a 1 kN load cell secured to the crosshead. Glenoid samples were mounted to the testing surface on a 3-degrees-of-freedom fixture, allowing the sutures to be 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.

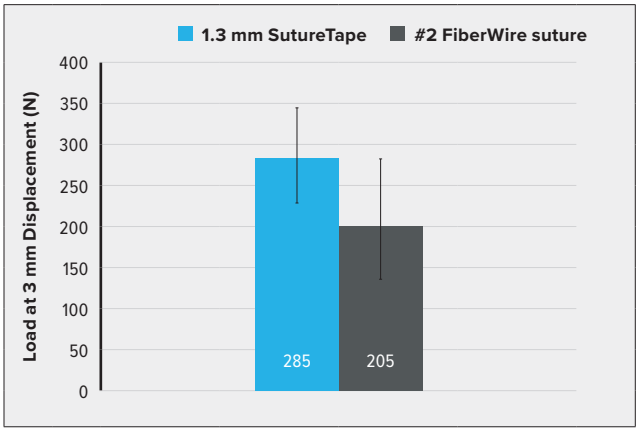
Figure 3. Tissue pull-through test setup



Results

Knot Security Testing: Both suture sample groups had average failure loads above 265 N, 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 (285 ± 60 N) was significantly larger than that for the #2 FiberWire® suture (205 ± 71 N) (*P* = .026). This data is shown graphically in Figure 4.

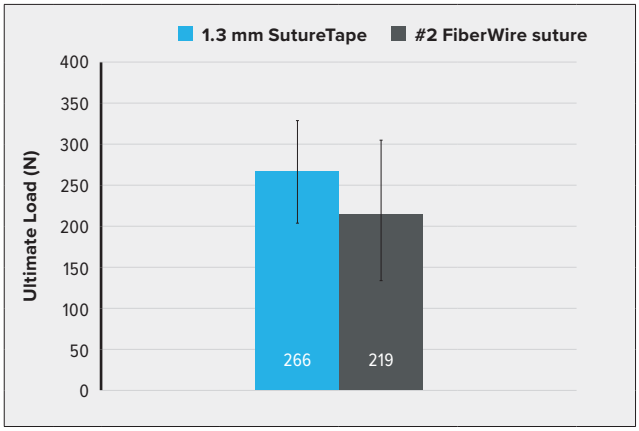
Figure 4. Load at 3 mm displacement (mean ± SD, n = 6)



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

Tissue Pull-Through Testing: The ultimate load of the 1.3 mm SutureTape samples was 266 ± 62 N, and the ultimate load of the #2 FiberWire suture samples was 219 ± 49 N. The difference between the groups was not statistically significant (*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 better knot security at load at 3 mm displacement when compared to the #2 FiberWire suture (*P* = .026). Additionally, the average tissue pull-through ultimate load of the 1.3 mm SutureTape was 21% greater than that of the #2 FiberWire suture, although this difference is not statistically significant.

This biomechanical evaluation was performed in the course of internal product testing.[1,2]

References

1. Arthrex, Inc. Data on file (APT-02799). Naples, FL; 2015.
2. Arthrex, Inc. Data on file (APT-02800). Naples, FL; 2015.

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