FiberWire® vs Dynacord™ Orthopedic Sutures: A Performance Comparison

Arthrex Orthopedic Research

Background

Braided polyethylene-based and polyblend sutures are ideal for most orthopedic soft-tissue repairs due to their high resistance to tensile loads.[1] The purpose of this study was to evaluate the tensile strengths and stiffnesses of the FiberWire suture and the competitive suture, Dynacord (DePuy Synthes).

Materials and Methods

A series of pull tests were conducted to evaluate the tensile properties of FiberWire suture and the competitive suture, Dynacord. Both straight-pull and knot-pull tests were performed to allow for the evaluation of tensile properties under various clinically relevant conditions.

The following steps for sample preparation were performed for both the straight-pull and knot-pull tests. Each test required six samples of FiberWire suture and six samples of Dynacord.

FiberWire and Dynacord samples were submerged in 1x PBS and stored in a 37°C environmental chamber for 48 hours.

The sample being tested was clamped according to USP standards.[2] Due to the elastic nature of the Dynacord suture, no preload was applied to either test group. However, care was taken to ensure no slack in the suture was present before load application. The samples for the knot-pull test were prepared according to USP standards.[2] Due to the elastic nature of the Dynacord suture, no preload was applied to either test group, but care was taken to ensure there was no slack in the suture before load application.

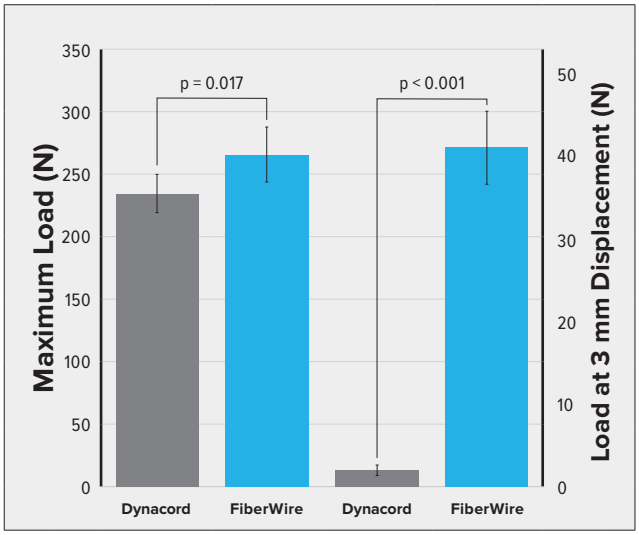
The following steps for load application and data analysis were performed for both the straight-pull and knot-pull tests post-setup.

A tensile load was applied at a rate of 5 mm/s, and the sample was pulled to failure. The maximum load (N), displacement at maximum load (mm), load at 3 mm displacement (N), yield load (N), and mode of failure were recorded for further analysis.

Results

The straight-pull test revealed a statistically significant difference in the maximum load and load at the preset point of 3 mm displacement between the FiberWire and Dynacord suture groups (Figure 1).[3] The common mode of failure for both groups was suture breakage.

Figure 1. Maximum load and load at 3 mm displacement results – straight-pull test[3]



The straight-pull test also revealed a statistically significant difference in stiffness between the FiberWire and Dynacord suture groups (Figure 2).[3] The mean stiffness, load at 3 mm displacement, and maximum load were greater for the FiberWire suture group compared to the Dynacord suture group (Table 1).[3]

Table 1. Results of straight-pull test[3]

Suture Type	Maximum Load (N)	Load at 3 mm Displacement (N)	Stiffness (N/mm)	Displacement at Maximum Load (mm)
Dynacord	232.29 ± 16.10	2.00 ± 0.49	0.27 ± 0.04	85.78 ± 2.37
FiberWire	262.85 ± 20.64	41.41 ± 4.49	16.77 ± 0.44	22.33 ± 2.61

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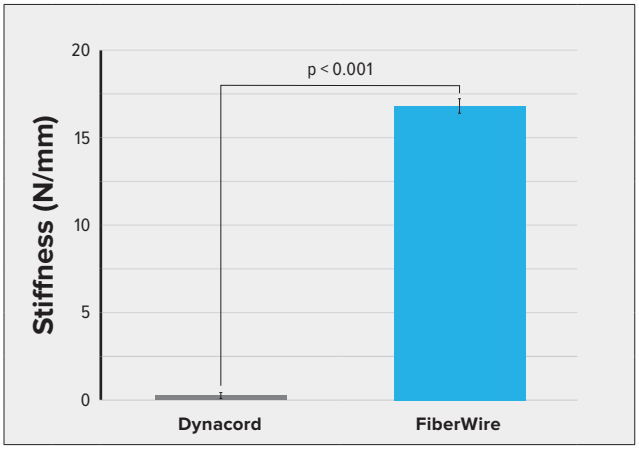
Figure 2. Stiffness results – straight-pull test[3]



The knot-pull test revealed no significant difference in maximum loads between the two suture groups (*P* = .643). However, a statistically significant difference in load at 3 mm displacement was observed (Figure 3).[3] The common mode of failure for both groups was suture breakage at the knot.

Figure 3. Maximum load and load at 3 mm displacement results – knot-pull test[3]

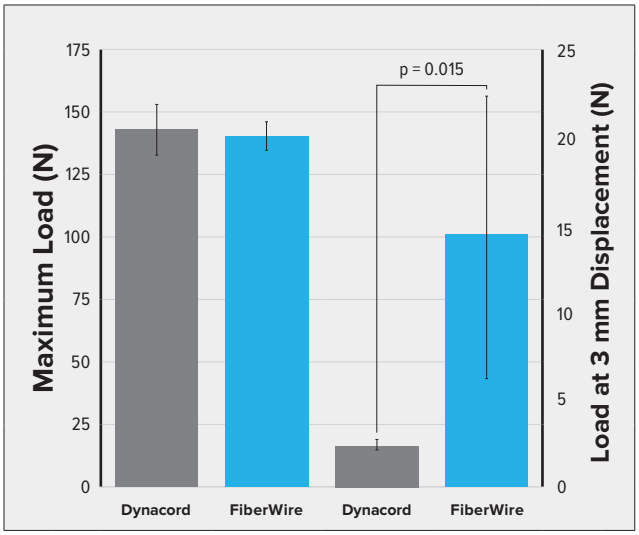


Table 2. Results of knot-pull test[3]

Suture Type	Maximum Load (N)	Load at 3 mm Displacement (N)	Stiffness (N/mm)
Dynacord	142.70 ± 10.41	2.36 ± 0.31	59.41 ± 2.54
FiberWire	140.34 ± 5.87	14.41 ± 8.10	30.77 ± 1.35

The Dynacord suture group had a greater mean displacement at maximum load than the FiberWire suture group for both the straight-pull (Table 1) and knot-pull tests (Table 2).[3]

Conclusion

The results of this testing illustrate that FiberWire suture has superior resistance to tensile loads and stiffness compared to the competitor product, Dynacord. The straight-pull test revealed that FiberWire suture had a significantly greater maximum load capacity and load required to reach 3 mm displacement, which represents the clinical failure of polyblend sutures according to industry standards.[4] Dynacord was extremely elastic in nature compared to FiberWire suture, as shown by the stiffness results, tensile loads required to reach 3 mm of displacement, and mean displacements at maximum load. Although the Dynacord suture claims to apply self-tension and prevent slippage, the maximum load capacities in the knot-pull test were very similar, and no statistically significant difference was observed. In both the straight-pull and knot-pull tests, only small loads were required to reach Dynacord clinical failure compared to the FiberWire suture. These test results demonstrated that the more elastic Dynacord may be more likely to fail than FiberWire suture under clinical conditions.

References

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