

FiberTape® Cerclage Mechanical Properties

Arthrex Research and Development

Objective

The purpose of this study was to define the mechanical properties of a FiberTape cerclage construct in a clinically relevant testing setup. Additionally, these results were benchmarked against 18 ga stainless steel wire (characteristic of monofilament, metal wires commonly used in cerclage procedures).

Methods and Materials

Samples were secured around a pair of semicircular fixtures spaced 2 mm apart (Figure 1). The combined outer diameter of the fixtures was approximately 10 cm, simulating the approximate circumference of the proximal humerus. FiberTape constructs were looped twice around the fixture and secured using one tensioned racking hitch, one tensioned half-hitch, and two manually tensioned, alternating half-hitch knots. The 18 ga wire was secured by twisting the wire tails 7 times using a pair of pliers. The FiberTape and stainless steel constructs achieved an initial tension of $739 \pm 247\text{N}$ and $388 \pm 26\text{N}$, respectively.

Testing was carried out using an INSTRON ElectroPuls Dynamic Testing System (INSTRON, Canton, MA). Five samples per group were cycled 50N to 500N for 50 cycles with a subsequent pull to failure. Total cyclic displacement, as well as cyclic displacement at cycles 1 and 50 were calculated using the resulting load vs displacement curve of each sample. Cyclic displacement was defined as the unrecoverable movement experienced by each sample over the course of cycling. The mode of failure and maximum load was recorded for each sample. T-tests were run to determine if outcome metrics differed significantly between the groups.

Results

Average \pm standard deviation testing metrics for FiberTape construct and stainless steel cerclage groups are presented in Table 1.

Conclusions

A FiberTape cerclage construct produced half of the displacement and 4 times as much ultimate load compared to 18 ga stainless steel wire cerclage. Therefore, a FiberTape cerclage construct offers a viable alternative to 18 ga stainless steel wire for cerclage procedures, with regards to strength and cyclic stability.

Table 1. Test Results Summary

Group	FiberTape Construct	18 ga Stainless Steel Construct	P-value
Displacement @ Cycle 1 [mm]	0.15 ± 0.05	0.39 ± 0.04	$P < .001$
Displacement @ Cycle 50 [mm]	0.31 ± 0.12	0.61 ± 0.05	$P = .003$
Total Cyclic Displacement [mm]	0.32 ± 0.17	0.75 ± 0.07	$P = .009$
Maximum Load [N]	4359.66 ± 463.23	935 ± 143.31	$P < .001$

Figure 1. A Complete Test Setup

