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Tendon Repairs at the Wrist Utilizing a Novel Tendon Stapler Device: An Efficiency and Biomechanical Study Across Different Experience Levels

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HYPOTHESIS

We hypothesized a novel tendon stapler device (TSD), the CoNextions Tendon Repair System, would exhibit decreased repair time and superior biomechanical force profiles when compared to standard core suture for primary tendon repairs.

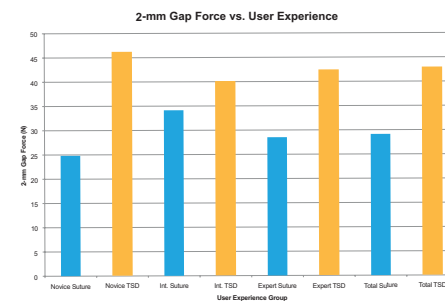
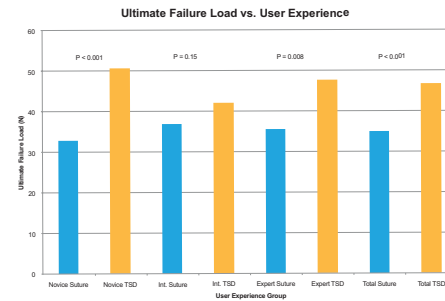
METHODS

Participants included a novice, intermediate, and expert at tendon repairs. Comparisons were performed on 6 left and 6 right matched human cadaver arm (12 total) finger and wrist extensors and flexors. Novice and intermediate participants received suture repair training from the expert, and all participants received equal TSD training. Suture repairs were performed with a 3.0 braided polyester modified Kessler with a horizontal mattress. TSD repairs were done on matched donor arms with a single simple polypropylene 5.0 stitch to approximate the tendon ends prior to device deployment. Repairs were timed by a nonparticipating data recorder. Immediately after repair, biomechanical testing was performed to compare tensile strength (2mm gap force) and ultimate failure loads with mode of failure noted. Statistical analyses utilized one-way ANOVA, Tukey pairwise comparisons, two-sided independent samples t-test, and Fisher's exact test.

RESULTS

In total, 228 tendon repairs were analyzed. Suture tendon repair times were significantly lower for expert (3.25 minutes) than intermediate (4.08 minutes) and novice (4.46 minutes) ($p < 0.01$). TSD mean repair times were 1.32, 1.31, and 1.28 minutes for expert, intermediate, and novice groups respectively with no difference between groups. Tendon repairs performed with the TSD were significantly faster ($p < 0.01$) across all experience groups. Tensile strength to a 2mm gap and ultimate failure load were statistically higher in the TSD group for the expert and novice participants ($p < 0.01$), and directionally higher for the intermediate ($p = 0.09$). There was no difference in gap and ultimate tensile strength between participants using the TSD device. Compared to the TSD, the suture method had significantly higher proportions of material failures (knot or suture failure) and a lower proportion of pull-through failure ($p < 0.01$).

- Compared to standard suture repair, the TSD repair is more efficient and produces strongest tendon repairs among users of varying experience.
- This device has the potential to be extremely helpful in scenarios where multiple tendon repairs are required, such as spaghetti wrists and hand replantation or transplantation.
- Forthcoming studies will explore how the TSD performs in in-vivo.



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