Achilles Tendon Lengthening: Biomechanical Comparison of a Novel Repair Device to Standard Suture Techniques

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Background: Achilles tendon contractures occurring in children with developmental abnormalities or after trauma cause fixed plantarflexion deformity and impair gait. These contractures often necessitate surgical intervention when conservative measures fail. Achilles lengthening using a Z lengthening technique is commonly performed. The CoNextions tendon repair system, which has gained popularity in hand and wrist tendon repair, offers a novel approach to Achilles lengthening, potentially improving repair outcomes and reducing operating time compared to traditional figure-of-eight suturing techniques.

Objective: This study aims to evaluate the biomechanical performance of the CoNextions device in comparison to standard figure-of-eight suturing techniques during tendon lengthening.

Methods: Cadaveric tendon specimens were harvested from one donor, including Achilles, quadriceps, patellar, and hamstring tendons. A total of 24 tendon specimens were prepared to approximate pediatric Achilles size. Z lengthening was performed, followed by repair using either figure-of-eight with No. 2 Ethibond or the CoNextions device. Repair time was recorded. Specimens underwent biomechanical testing to determine ultimate force, failure force, yield force, stiffness, and energy to failure.

Results: The CoNextions device demonstrated superior biomechanical properties, with greater ultimate force (38.71 N vs. 22.19 N, $p = 0.010$), failure force (37.18 N vs. 20.80 N, $p = 0.008$), yield force (34.12N vs. 20.32 N, $p = 0.014$), stiffness (5.58 N/mm vs. 3.58 N/mm, $p = 0.006$), and energy to failure (228.31 mJ vs. 126.19 mJ, $p = 0.039$). Repair time was significantly shorter with CoNextions (29.0 seconds vs. 116.29 seconds, $p < 0.001$).

Conclusion: The CoNextions device showed promising biomechanical advantages over traditional figure-of-eight suturing techniques for Achilles tendon lengthening. Future studies should explore clinical applications and long-term outcomes to validate these findings in pediatric populations.

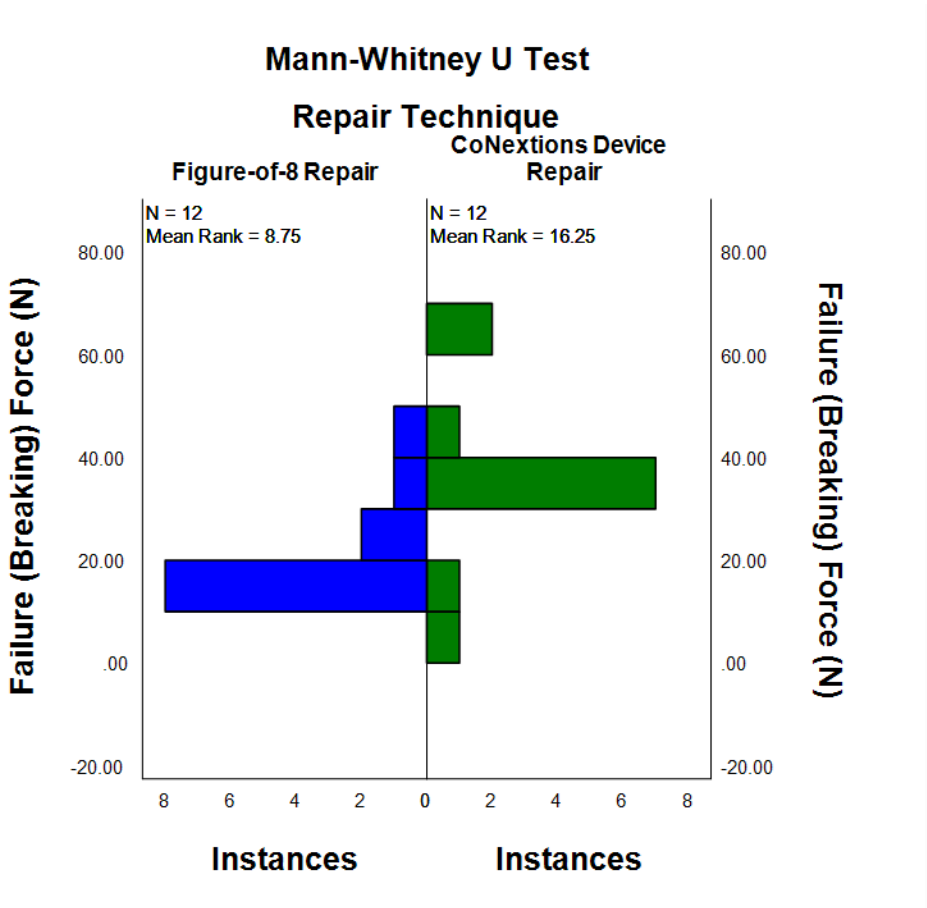

Figure 1. The average failure (breaking) force for the CoNextions repair was 37.18 N (SD = 15.90 N). The average failure force for the figure-of-eight repair was 20.80 N (SD = 10.21 N) (U = 117.000, p = 0.008).

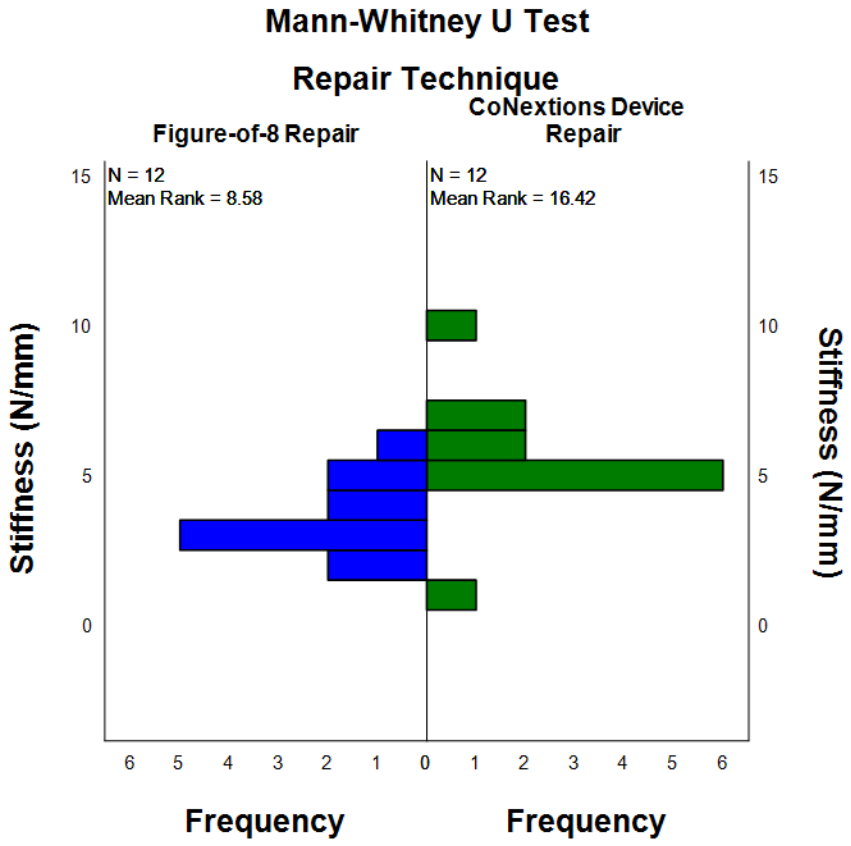

Figure 2. The average stiffness for the CoNextions repair was 5.58 N/mm (SD = 2.07 N/mm), but the stiffness for the figure-of-eight repair was 3.58 N/mm (SD = 1.24 N/mm) (U = 119.000, p = 0.006).