A Biomechanical Comparison of a Limited Open and Standard Open Technique for Achilles Tendon Rupture Repair

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Introduction/Purpose: The drive to reduce soft tissue complications after Achilles tendon repair has led to increased interest in less invasive techniques. The PARS Achilles Jig System is one option that has gained popularity as an alternative to open repair. For many surgeons, standard open repair consists of a Krackow locking-loop technique. We compared the load to failure of a limited open and open Krackow technique for repair of Achilles tendon ruptures.

Methods: Nine pairs of human cadaver lower limbs were randomized to undergo either a Krackow locking-loop repair with epitendinous weave or a PARS Achilles Jig System Repair. Specimen were loaded to failure on a servo-hydraulic material testing machine. From load-displacement curves, initial linear stiffness, load to failure, and work to failure were calculated.

Results: The average load to failure for Krackow repair (353.8 ± 88.8 N) and PARS repair (313.3 ± 99.9 N) was not statistically different (p = .38). The average work to failure for open repair (6.4 ± 2.3 J) and PARS repair (6.3 ± 3.5 J) was also not statistically different (p = .904). Mean initial linear stiffness of the Krackow repair (17.8 ± 5.4 N/mm) was significantly greater than the PARS repair (11.8 ± 2.5 N/mm) (p = .011). The predominant location of failure for Krackow repair was at the suture itself. In contrast, the PARS repair predominantly failed at the suture-tendon interface.

Conclusion: The results suggest no difference between the Krackow and PARS repairs in terms of ultimate strength or work to failure. The Krackow repair demonstrated a higher initial linear stiffness than the PARS, which may imply a greater ability to withstand gap formation. With less devitalization to surrounding soft tissue and equal repair strength, the PARS system should be considered a favourable option for repair of ruptured Achilles tendons.
Table 1. Biomechanical Outcomes

<table>
<thead>
<tr>
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<th>Open</th>
<th>PARS</th>
<th>P-value</th>
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<tbody>
<tr>
<td>Load to Failure (N)</td>
<td>353.5 (88.8)</td>
<td>313.3 (99.9)</td>
<td>0.38</td>
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<tr>
<td>Work to Failure (J)</td>
<td>6.4 (2.3)</td>
<td>6.3 (3.5)</td>
<td>0.904</td>
</tr>
<tr>
<td>Initial Linear Stiffness (N/mm)</td>
<td>17.8 (5.4)</td>
<td>11.8 (2.5)</td>
<td>0.011</td>
</tr>
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All values expressed as Mean (Standard deviation)

Figure 1. Load to Failure Between Repair Types

Figure 2. Load displacement curve demonstrating the predominant failure mechanism of PARS repair.

Figure 3. Load displacement curve demonstrating the predominant failure mechanism of PARS repair.