New Technique for Anatomic Reconstruction of the Scapholunate Ligament with Tendon Graft and SwiveLock™ Anchor Fixation: A Biomechanical Cadaveric Study

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INTRODUCTION

This new technique for anatomic reconstruction of the vital dorsal band of SL-ligament may provide secure bone tunnel fixation and obviate the need for prolonged pin fixation and immobilization that has traditionally been required in non-anatomic reconstruction techniques used for chronic static and dynamic scapholunate instability. Dorsal scapholunate ligament reconstruction, using either palmaris longus or extensor indicis proprius tendon graft secured with two Arthrex 3.5mm PEEK SwiveLock™ in one tunnels has similar elongation, stiffness and load to failure properties as the native dorsal scapholunate ligament. Our data supports consistent and reproducible load to failure in reconstructed group and may translate to future clinical applications.

OBJECTIVES

To describe and test a new and potentially more effective technique for the reconstruction of Acute and Chronic Scapholunate Ligament tears.

MATERIALS AND METHODS

8 matched wrist pairs, evaluated radiographically and assigned to Control / Reconstruction groups. Control: all but dorsal band of SL ligament resected. Reconstruction: all three portions SL-ligament divided then reconstructed. In both groups, the scaphoid and lunate were dissected out, pinned with 2 orthogonal K-wires in each bone, and potted in polymethylmethacrylate. A 5N pre-load was applied on load frame, followed by 200 cycles from 5-20N. Load to failure applied at 5mm/s. In initial testing, one control specimen failed during cycling and that pair was excluded from analysis. Data were analyzed using the nonparametric Wilcoxin Test. Accepted significance level of 0.05.

TECHNIQUE

SL interval reduced and lunate guidewire placed in non-articular portion taking care to not exit volar cortex. Lunate tunnel reamed 3mm cannulated drill bit over guide wire to 1.5cm depth

Scaphoid guidewire exiting volar cortex
Small incision volar exit point along guidewire.
Scaphoid tunnel reamed exiting volar cortex
Secure graft in lunate tunnel Arthrex SwiveLock™. Graft advanced through bicortical scaphoid tunnel, tensioned distally while reduction held.

SwiveLock™ advanced in antegrade fashion
Graft in place after final fixation

Tendon woven to FCR with Pulvertaft weave

RESULT

The reconstructed ligament elongated significantly more during cycling than the Control group. Stiffness of the reconstructed ligament was significantly less than the Control group. Load to failure was not significantly different. Mode of failure in the Reconstruction group was by breaking off the radial wall of the lunate (3), pulling out of the lunate (1) or pulling out of the scaphoid (3). The Control group all failed by mids substance tears.

BIOMECHANICAL TESTING

<table>
<thead>
<tr>
<th></th>
<th>Elongation</th>
<th>Stiffness</th>
<th>Load to Failure</th>
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<tbody>
<tr>
<td>Control</td>
<td>Mean ± St Deviation</td>
<td>Reconstruction</td>
<td>Mean ± St Deviation</td>
</tr>
<tr>
<td></td>
<td>0.081 ± 0.042mm</td>
<td>0.589 ± 0.258mm</td>
<td>115.4 ± 63.15 N</td>
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<td>82.07 ± 44.1 N/mm</td>
<td>37.94 ± 10.4 N/mm</td>
<td>70.8 ± 8.1 N</td>
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DISCUSSION/CONCLUSIONS

Simple technique with secure bone tunnel fixation in both lunate and scaphoid. Strong lunate fixation allows graft to be tensioned as scaphoid fixation is placed. Provides an anatomic reconstruction of important dorsal portion of ligament using easily harvested autograft tendon. Distal graft can be easily tenodesed into FCR to tighten palmar STT ligaments. (similar to Brunelli technique). Could guard against excessive scaphoid flexion during period of healing without significantly affecting ROM

Future Applications: Additional biomechanical in situ testing of reconstruction under cyclical ROM and physiological loading will provide further information regarding durability of this technique. Clinical trials utilizing this technique will be helpful to assess short/long term outcomes.

This new technique for anatomic reconstruction of the vital dorsal band of SL-ligament may provide secure bone tunnel fixation and obviate the need for prolonged pin fixation and immobilization that has traditionally been required in non-anatomic reconstruction techniques used for chronic static and dynamic scapholunate instability. Dorsal scapholunate ligament reconstruction, using either palmaris longus or extensor indicis proprius tendon graft secured with two Arthrex 3.5mm PEEK SwiveLock™ in one tunnels has similar elongation, stiffness and load to failure properties as the native dorsal scapholunate ligament. Our data supports consistent and reproducible load to failure in reconstructed group and may translate to future clinical applications.