

In Vivo Length Changes of Scapholunate Interosseous Ligament at Wrist Full Extension and Forearm Rotation

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OBJECTIVES

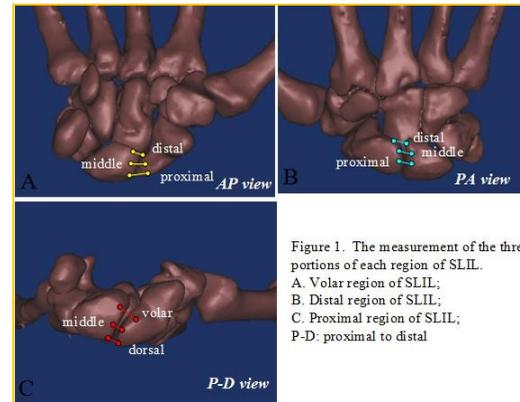
The SLIL has a critical role in maintaining the proper kinematic relationship between the scaphoid and the lunate. When one falls on an outstretched hand, wrists are usually at positions of extension with maximal pronation or supination. We hypothesize that the length of the SLIL changes significantly at wrist full extension and during forearm rotation. Therefore, we examine changes in the length of the SLIL during wrist full extension and forearm rotation. We also investigate the changes in the length of SLIL at full extension with maximal pronation and full extension with maximal supination in vivo.

METHODS

This study involved three groups, full extension group, rotation group, and extension with maximal rotation group. Each group had six volunteers. They were evaluated with history, examination, and biplanar radio graphs to exclude upper limb pathology. All of the subjects were right handed.

(1) Collection of CT images at Different positions: The hand of each volunteer was placed in a custom-designed non-metallic supporting frame before undergoing CT scanning. A high-speed, 16-slice spiral computed tomography scanner was used.

(2) 3-dimensional Reconstruction: We used data from the CT scans to reconstruct 3-D images and measure with analytic software (Mimics 10.0; Materialise, Leuven, Belgium). We defined the three regions of the SLIL according to their known bone insertions and marked the origin and insertion of these ligaments on the surfaces of the bone reconstructions. Each of the three different regions of the SLIL was further divided into three portions for measurement (Fig. 1). At each wrist position, the shortest paths of the SLIL were modeled and measured directly.



RESULTS

1. Changes in the length of SLIL at wrist full extension : From the neutral position to full extension, the length of the v-SLIL and volar, middle portions of the p-SLIL increased significantly. Furthermore, from full extension to full extension with 10° radial deviation, the lengths further increased. No significant differences were noted in the lengths of the dorsal portion of the p-SLIL or any portion of the d-SLIL during wrist full

2. Changes in lengths of the SLIL during forearm rotation: The lengths of the v-SLIL and middle, proximal portions of the v-SLIL increased significantly at maximal pronation compared with neutral position. No significant differences in the lengths of the SLIL were found when the wrist position was changed from neutral position to 30° of forearm pronation or at either 30° or 60° of forearm supination (Fig 3).

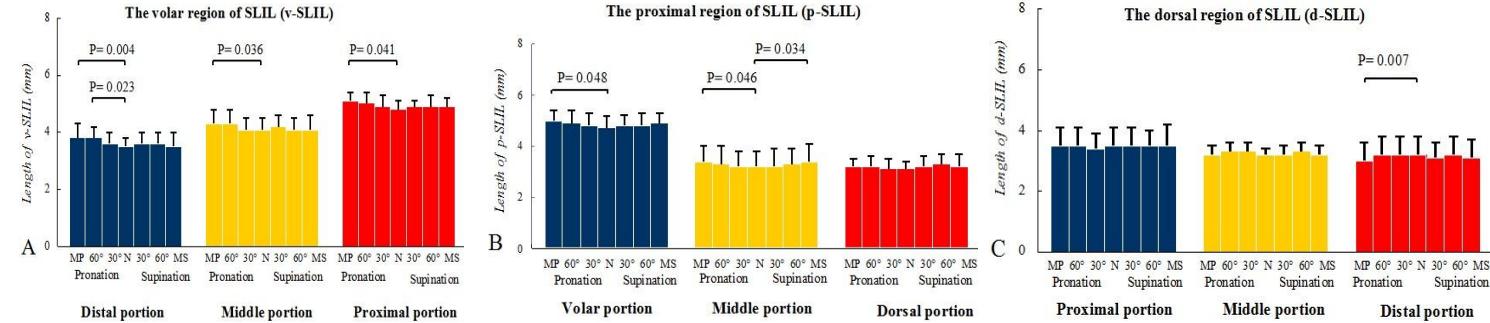


Figure 3. Lengths of the three regions of SLIL during forearm rotation. A. Length of the v-SLIL; B. Length of the p-SLIL. C. Length of the d-SLIL. MP: Maximal pronation MS: Maximal supination.

3. Changes in the lengths of SLIL at wrist full extension with forearm maximal rotation: The length of the v-SLIL and the volar, middle portions of the p-SLIL at full extension with forearm maximal pronation/supination increased significantly compared with neutral position. No significant differences were found in the length of the dorsal portion of the p-SLIL or any portion of the d-SLIL among the three positions.

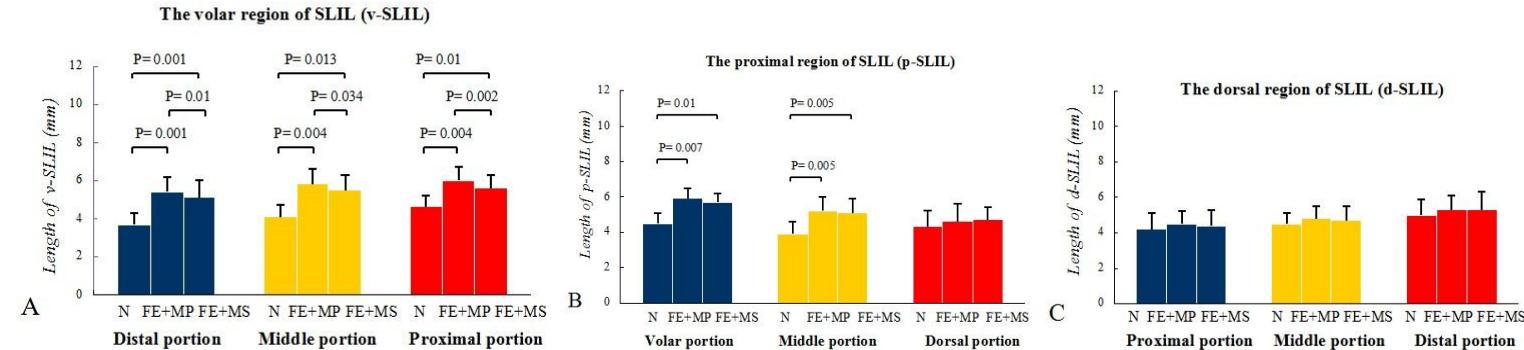


Figure 4. Lengths of the three regions of SLIL at wrist full extension with forearm maximal rotation. N: Neutral; FE+MP: Full extension with forearm maximal pronation; FE+MS: Full extension with forearm maximal supination.

DISCUSSION AND CONCLUSIONS

Scapholunate injuries are the most frequent intercarpal ligament injuries in the wrist. During wrist full extension and full extension with radial deviation, or with forearm maximal rotation, all portions of the volar SLIL and most of the proximal SLIL were elongated relative to neutral length. At forearm maximal pronation, all portions of the volar SLIL and most of the proximal SLIL were elongated relative to the neutral length, and at forearm maximal pronation/supination, the distal portion of dorsal SLIL was shortened. Based on our findings, it is clear that wrist full extension placed great strain on the volar SLIL and proximal SLIL and may result in these regions tearing first.

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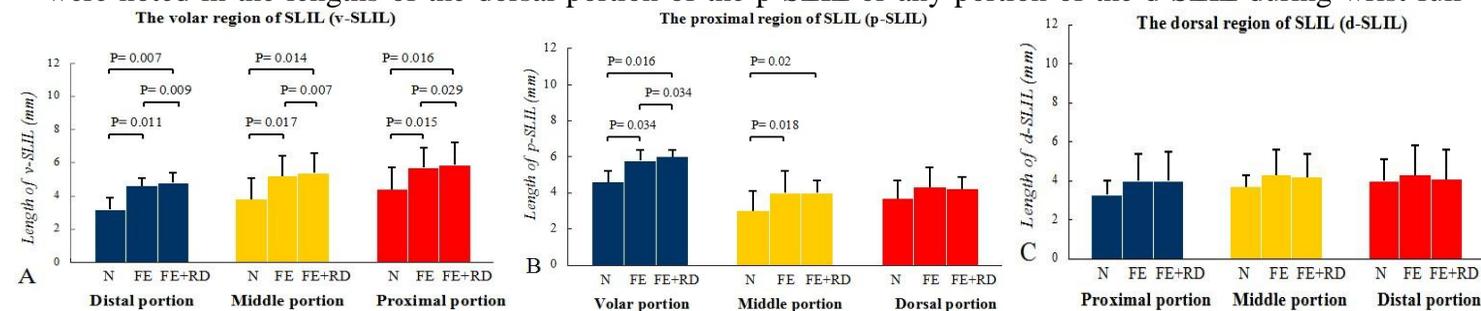


Figure 2. Lengths of the three regions of SLIL during wrist full extension. N: Neutral; FE: Full extension; FE+RD: Full extension with radial deviation.