The Incidence of Scapholunate and Lunotriquetral Ligament Tears in Distal Radius Fractures: The Effect of Wrist Position and Forearm Rotation During a Fall onto an Outstretched Hand

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Introduction:

Soft tissue injuries are now recognized as a significant problem associated with distal radius fractures. The prevalence of scapholunate (SL) and lunotriquetral (LQ) ligament injuries associated with distal radius fractures are as high as 54% and 20%, respectively.

Purpose:

The purpose of this investigation is to develop a unique in vitro biomechanical 'fall on an outstretched hand' model using several different fall mechanisms (neutral hand position with and without internal and external rotation, radial deviation with and without internal rotation, and ulnar deviation with and without external rotation) to evaluate if hand position and forearm rotation during a fall can influence whether a SL or LT tear occurs in association with a distal radius fracture.

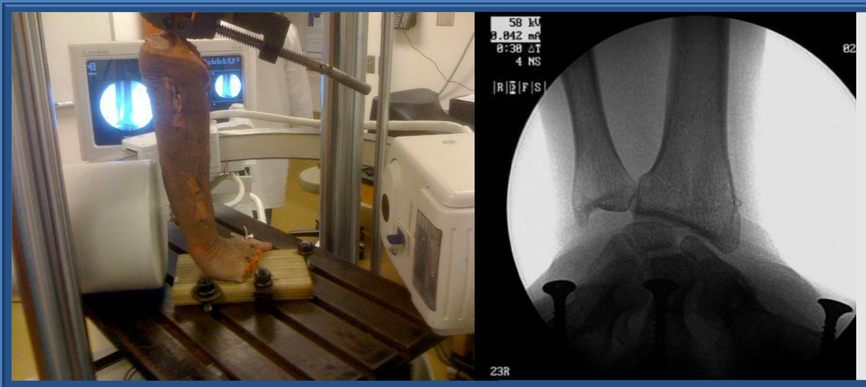


Figure 1: Arms mounted on an MTS at 80° of wrist extension and full pronation

Methods:

Baseline fluoroscopic images, MRI scans, and DEXA bone mineral density measurements of the wrist were obtained for two sets of 24 fresh frozen cadaveric arms. All of the arms were transected 18 cm proximal to Lister's tubercle and then mounted at 80° of wrist extension and full pronation. (Figure 1) In the first set of 24 arms, eight were mounted perpendicular to the MTS table top, eight were radially deviated 10-15°, and eight were ulnarly deviated 10-15°. In the second set of 24 arms, twelve underwent 5 N-m of external forearm rotation, with six of the arms perpendicular to the MTS table top and the other six ulnarly deviated 10-15°. (Figure 2) The last twelve arms underwent 5 N-m of internal forearm rotation, with six of the arms perpendicular to the MTS table top and the other six radially deviated 10-15°. The arms were then loaded on an MTS machine and axially displaced 2.5 cm at a compression rate of 5 cm/sec. Post injury fluoroscopic images and MRI scans of the wrist were obtained and analyzed. (Figure 2)

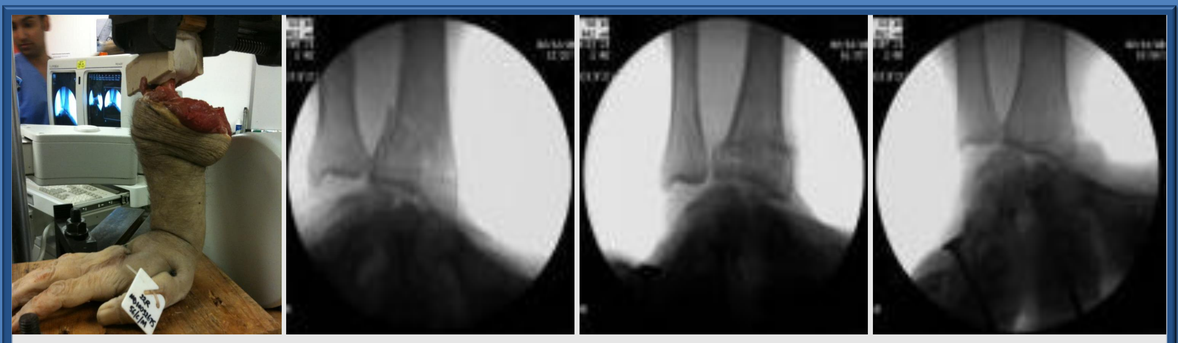
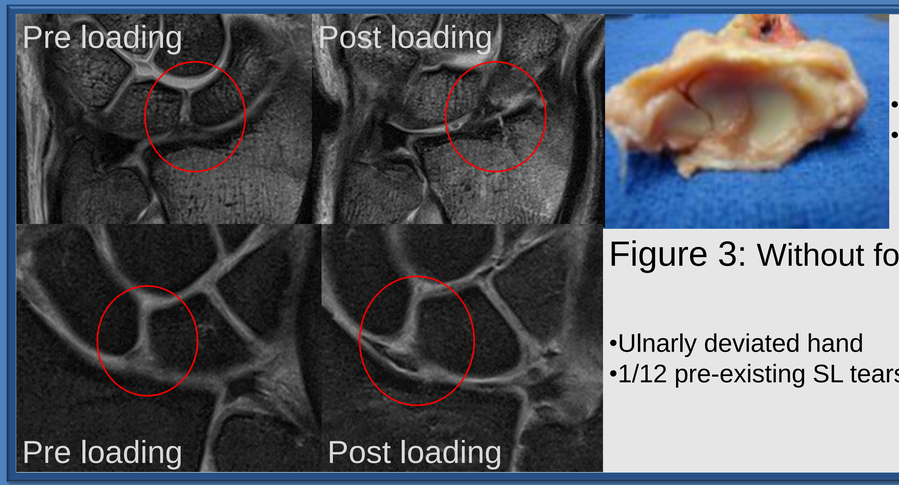


Figure 2: (Color image) 5N·m external forearm rotation ulnarly deviated 10-15° (Fluoroscopy images) Examples of distal radius fractures sustained.

Results:

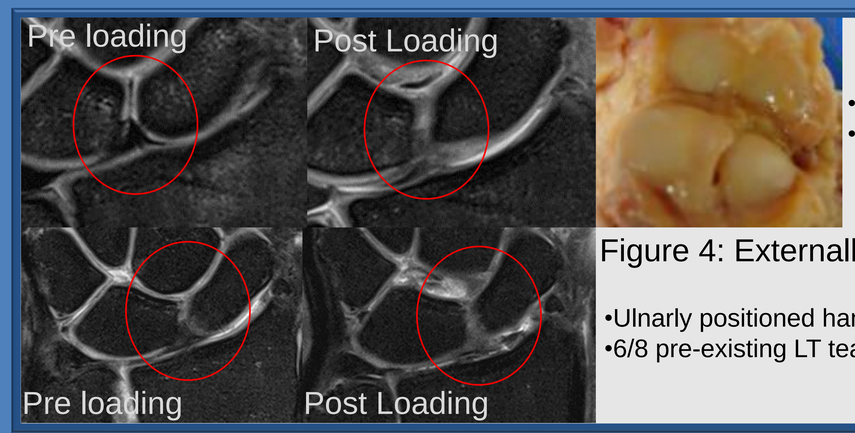
All of the arms sustained a distal radius fracture. Post-stress MRI revealed that 17 (35%) of the arms sustained a SL ligament tear, and 16 (33%) sustained a LQ ligament tear. Of the 24 arms that did not undergo a rotational force, 5 (21%) sustained a SL or LQ ligament tear. (Figure 3) In contrast, of the 24 arms subjected to a rotational force, 18 (75%) were found to have either a SL or LQ tear. (Figure 4)



•Ulnarly deviated hand
•2/8 new SL tears

Figure 3: Without forearm rotation

•Ulnarly deviated hand
•1/12 pre-existing SL tears progressed



•Neutrally positioned hands
•3/6 new SL tears

Figure 4: Externally rotated forearms

•Ulnarly positioned hand
•6/8 pre-existing LT tears progressed

Discussion:

SL and LT ligament tears were found to be associated with distal radius fractures in 75% of arms subjected to a rotational force, whereas only 21% of the arms with a static forearm displayed such an injury. Further investigation is needed to determine if a specific fall pattern is associated with an SL or LQ tear.

Significance:

Practitioners should maintain a high suspicion of SL or LQ injury in patients who sustain a distal radius fracture after a fall onto an outstretched hand, particularly when forearm rotation is involved.

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