Surgical Techniques for the Treatment of Carpal Ligament Injury in the Athlete

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KEYWORDS

• Scapholunate injury • Lunotriquetral injury • Scaphotrapezial-trapezoidal injury
• Carpal ligament injury • Wrist injury in athletes

KEY POINTS

- Appropriate treatment of ligamentous wrist injuries in athletes is highly individualized, sport-specific, and variable. Dogmatic algorithms are often difficult to follow and open discussion with the athlete, family, and, occasionally, the coaching and training staff should be pursued.
- A trial of immobilization for acute or chronic predynamic injuries is often the first step if the sport allows, followed by surgical intervention and repair if needed.
- Acute dynamic or static injuries should be treated as soon as possible, even if that entails forfeiting the current season.
- Subacute or chronic injuries may be treated with reconstruction or salvage, depending on the timing in the athlete's season and career, and on whether arthrosis is present.

INTRODUCTION

Scapholunate dissociation, resulting from scapholunate interosseous ligament (SLL) injury, is the most common form of carpal instability.[1] The SLL complex is composed of 3 main anatomic segments, including dorsal (strongest), volar, and proximal or membranous components. Important surrounding structures include the scaphotrapezial trapezoidal (STT), scaphocapitate (SC), and radioscaphocapitate (RSC) ligaments, which further stabilize the wrist in the extremes of motion. The scaphoid is under constant flexion deforming forces based on its normal orientation. The triquetrum is pushed into extension by the hamate via their shared helicoid shaped articulation. The lunate, or the intercalated segment in between the scaphoid and triquetrum, is linked to both through shared intrinsic interosseous ligaments. In normal anatomic conditions, the flexion forces and extension forces within this proximal row

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of carpal bones are balanced out. The disruption of a major linkage, such as disruption of the SLL, allows unopposed flexion of the scaphoid and unopposed extension of the triquetrum. The lunate, or intercalated segment, in this case is still coupled to the triquetrum and is pulled into extension as well, creating the classic dorsal intercalated segmental instability (DISI) pattern visible on lateral radiographs. When considering the overall stability of the wrist, however, the SLL should be viewed as a unit functioning in conjunction with secondary stabilizers.[2] These stabilizers must either be injured with the initial trauma (or gradually attenuate under the increased stress associated with loss of the SLL support) for the carpal bones to shift into abnormal positions and postures. However, this shifting places abnormal stress on the surrounding joints, and ultimately leads to the scapholunate advanced collapse (SLAC) pattern, characterized by progressive predictable arthritis starting at the radioscaphoid joint.[3,4]

Athletes of almost any discipline involving violent contact with other players or the ground (eg, football, basketball, soccer, and baseball) are prone to injury of the SLL. Though less well understood, chronic lower energy repetitive insults may also result in SLL damage. Most commonly, the ligament is injured from wrist hyperextension associated with a fall onto an outstretched hand.

Patients suffering such an injury often experience acute dorsal and radial wrist pain with decreased range of motion and weakened grip strength.[5] The sensation of "clunking" or instability may be present or can be reproduced on physical examination using the Watson scaphoid shift test. Pain with this maneuver and/or the sensation of the scaphoid subluxating dorsally over the dorsal lip of the radius that can be felt or heard should raise suspicion for SLL injury.[6]

Not uncommonly, SLL injuries (especially when gross carpal instability and shifting are not present) are minimalized as wrist sprains and undertreated for weeks or years. Enthusiastic athletes, in particular, may not risk hindering their athletic participation by seeking medical attention. Many, therefore, present with subacute (4 weeks–6 months) or chronic (>6 months) injuries. Treatment algorithms at this stage become more controversial because there is a paucity of prospective data to demonstrate the exact progression of the disease process and the natural history of SLL injury is not completely understood.[1]

Depending on the degree and chronicity of primary and secondary ligamentous damage, SLL injuries may be categorized as static, static reducible, dynamic, or predynamic. Imaging studies are often the key to this determination and subsequent treatment options. Static changes are visible with plan radiographs and reducibility can be grossly determined if the scapholunate interval reduces with radial deviation. Dynamic instability is demonstrated when widening of the intercarpal space is visible only with provocative stress of the joint space induced with clench fist or ulnar deviation views.[1,4,5] Predynamic SLL changes can only be demonstrated by focal tenderness on examination, MRI, or arthroscopic inspection. Scapholunate gapping of greater than 3 to 4 mm in the posteroanterior view is considered potentially abnormal and, on the lateral view, a scapholunate angle greater than 70° indicates a DISI deformity. Comparison to the contralateral wrist should confirm a lack of symmetry.[1,5,7]

Ideally, injuries should be recognized as soon as possible because treatment of acute SLL injury offers the best chance of return to full motion and activity. With this in mind, early surgical intervention is at the mainstay of treatment regardless of an athlete's position or timing, with the focus on restoring anatomic alignment and biomechanics to reestablish stability, minimize the development of arthrosis, and maximize flexibilty.[8]