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Early controlled mobilization using dart-throwing motion with a twist for the conservative management of an intra-articular distal radius fracture and scapholunate ligament injury: A case report

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ABSTRACT

This case describes an early controlled mobilization (ECM) approach that uses dart-throwing motion (DTM) with a twist orthoses as an alternative to immobilization for conservative management of a minimally displaced and intra-articular distal radius styloid fracture with an associated scapholunate ligament injury in a 47-year-old female health care administrator (JP). Pain-free active DTM began at day 10 (5 times/d) with a dynamic DTM with a twist orthosis worn during the day from weeks 3 to 6. At 6 weeks, JP had pain-free functional mobility and strength with minimal limitation in household and occupational activities, returning to her normal sporting activities by 3 months. ECM led to rapid return of normal functioning in the short term with no apparent impact on intermediate outcomes at 8 months. This case allows hand therapists to consider a similar ECM approach for the management of similar injuries in their patients.

Level of evidence: Level 5 and case report.

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Introduction

The incidence of a scapholunate (S-L) ligament injury co-occurring with distal radius fractures (DRFx) has been reported to vary from 15% to 55%^{1,2}; however, for injuries involving a high velocity, the incidence has been reported as high as 90% with concomitant shearing-type fractures of the radial styloid.³⁻⁵ Desai et al⁶ recommend early diagnosis of the S-L injury to allow for co-treatment of both the DRFx and S-L injuries acutely. However, current evidence has not demonstrated if acute S-L ligament repair after DRFx results in improved long-term functional outcomes.^{7,8}

Rehabilitation guidelines commonly involve early mobilization of a stable DRFx to include those treated with internal fixation.^{9,10} Desai et al⁶ noted that early mobilization decisions solely based on DRFx management will likely not provide adequate protection to allow time for S-L ligament healing. As such, concurrent management of both injuries often involves hand and wrist immobilization for 6-8 weeks to support S-L ligament healing.¹¹⁻¹⁵

Many researchers recommend early mobilization of incomplete or repaired S-L ligament injuries using a dart-throwing motion (DTM) mobilization strategy.¹⁶⁻²¹ Treatment rationale is based on biomechanical studies showing that the DTM occurs primarily within the midcarpal joint, results in limited proximal row intercarpal bone motion, leads to reduced stresses in the S-L ligament, and incorporates components involved in neuromuscular control.²²⁻²⁹ However, Garcia-Elias et al^{21,30} recommended caution in cases involving complete S-L ligament injury as DTM may not provide adequate protection without additional stabilization or fixation between the scaphoid and lunate bones. Moreover, if the S-L ligament repair involves fixation that crosses the midcarpal joint, then DTM would not be possible while such fixation is in place.¹¹⁻¹⁵

This case report describes an early controlled DTM approach as an alternative to immobilization for the conservative management of a stable minimally displaced, intra-articular, and distal radius (radial styloid) fracture with an associated S-L ligament injury.^{4,5} In this case, early graduated pain-free motion of the hand and wrist as tolerated would be an appropriate consideration given the inherent stability of the radial styloid/DRFx. However, S-L ligament disruption indicates that early motion should be introduced using a DTM strategy to limit stresses to the healing S-L ligament. This case

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describes an early controlled mobilization approach that uses a DTM with a twist (DTMtw) orthosis as an integral element of the early mobilization program. Fabrication of the DTMtw orthosis is described in detail in a related publication and also provides further information about design variations and modifications depending on the acuity and nature of the underlying injury.³¹

Patient information

JP is a 47-year-old right hand dominant woman who is employed as a health care administrator. She frequently participates in many outdoor activities, including skiing, golf, hiking, and bike riding. While skiing, JP fell on an outstretched right hand with her hand and ski pole handle planted into the snow, forcibly twisting and jamming her right hand and wrist into the snow. She felt immediate sharp pain in her right wrist on the radial side and was unable to pick up or hold her ski pole. Initial medical evaluation and treatment included radiographs, a half-plaster slab and compression bandage, and a referral for a hand surgical consultation. JP presented to hand therapy on the fourth day postinjury for an orthosis to provide better support before her hand surgeon consultation at 10 days' postinjury. JP did not report any previous injury or problem in the right hand or wrist.

Clinical findings (day 4)

The hand therapy evaluation did not reveal any associated injuries to the elbow, shoulder, or neck or any loss of sensibility compared with her other hand. JP had significant bruising along the volar-radial wrist and moderate swelling throughout the entire wrist and hand (Fig. 1A). She had full active range of motion for forearm rotation, and all finger and thumb motions, with some localized pain on the radial side of the wrist at end-range supination. Active wrist motion moving into flexion/ulnar deviation/pronation (ie, dart throwing) was limited to approximately 25% of the opposite side and limited to approximately 10% of the opposite side moving into extension/radial deviation/supination (ie, dart cocking) because of sharp and localized pain in the dorsal radial wrist. JP was unable to pinch or grip with any notable force without a sharp localized pain in the same dorsal radial wrist region described previously. Specific limitations in active wrist range of motion (anatomic or planar) and grip/pinch strength were not measured.³²

Diagnostic assessment

Radiographs

The oblique image shows a distal radius (radial styloid/radial fossa) and depressed fracture with a minimal step-off deformity (<2 mm) at the junction of SL fossa on involving less than 50% of the distal intra-articular surface of the radius; consistent with an AO Foundation, B.1 partial intra-articular radial styloid fracture classification (Fig. 2A).^{4,5} Images also showed evidence of a likely grade 3 acute disruption of the S-L ligament,³³⁻³⁵ including increased S-L angle (eg, scaphoid flexed, lunate extended) in the lateral view (Fig. 2B), visible disruption of the proximal row arc, showing a noncongruous arc between the scaphoid and lunate bones in the posterior-anterior view, and bony outlines consistent with a flexed scaphoid and extended lunate in the posterior-anterior view (Fig. 2C).³⁶⁻³⁹ No additional diagnostic imaging was performed to obtain a more refined delineation of the intra-articular radial styloid fracture fragment(s) or the degree of S-L ligament structural disruption.

Therapeutic intervention

The hand surgeon and JP discussed 2 treatment options for the early management plan that would begin on day 10. They discussed the advantages and disadvantages of cast immobilization for an additional 6 weeks (ie, total 8 weeks of immobilization) followed by therapy or follow a hand therapist-guided early controlled DTM mobilization approach for the next 6 weeks. The primary treatment goals for the early mobilization approach were to regain pain-free mobility, strength, and functional use during normal daily household and occupational activities by 6 weeks postinjury. A secondary treatment goal was to continue with a graduated strengthening and return to normal sport and recreational activities by 3 months postinjury. Key treatment components at each stage are described herein.

Day 4-10

JP received a static DTMtw orthosis to be worn at all times except for hygiene purposes (Fig. 1B). The static orthosis was positioned with the hand in a slight dart-throwing posture (eg, slight flexion, ulnar deviation, and pronation) for comfort and to put injured ligaments into a shortened position while at rest.⁴⁰⁻⁴³ The orthosis was fabricated using a rigid thermoplastic material



Fig. 1. JP case report, initial presentation day 4. (A) Notable bruising radial/volar aspect with marked swelling in the hand and wrist. (B) Dart-throwing motion with a twist resting orthosis with compression garments, molded in slight dart throwing (flexion/ulnar deviation/pronation) posture for patient comfort. Taken off for hygiene only.

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