Sequential scapholunate and volar beak ligament reconstructions with flexor carpi radialis tendon grafts

KP Iyengar, HE Matar, M Durrani, YC Loh

Southport and Ormskirk Hospital NHS Trust, UK

ABSTRACT

The flexor carpi radialis tendon is considered by many the workhorse tendon in hand and wrist surgery. Some have expressed concerns about altering the mechanics of the wrist by sacrificing part or all of the flexor carpi radialis tendon. We present an interesting case of sequential scapholunate and volar beak ligament reconstructions using a flexor carpi radialis tendon autograft where a slip of tendon was harvested twice within three years, achieving a satisfactory clinical outcome at five years following the initial surgery.

KEYWORDS

Eaton – Littler ligament reconstruction – Flexor carpi radialis tendon graft – Modified Brunelli procedure – Scapholunate instability – Thumb carpometacarpal joint instability

Accepted 7 March 2017

CORRESPONDENCE TO

Hosam Matar, E: hematar@doctors.org.uk

The most common cause of carpal instability is injury to the scapholunate ligament.^{1,2} Left untreated, it can account for wrist dysfunction and abnormal joint mechanics, and it may lead to degenerative changes.³ In order to prevent this, various techniques have been described to treat chronic, complete scapholunate ligament injuries.⁴ Surgical stabilisation has been achieved by the modified Brunelli procedure for scapholunate instability with good clinical outcomes.^{5–7}

Trapeziometacarpal (TMC) joint stability derives predominantly from the ligamentous integrity provided by the anterior oblique ligament, also known as the beak or volar ligament. It has traditionally been thought of as the primary static stabiliser, preventing dorsal translation of the thumb metacarpal.^{8,9} However, this view has recently been debated, with more emphasis on the dorsoradial ligament as being the main restraint to dorsal subluxation of the TMC joint.^{10–12} Reconstruction methods to address both of these are well described. Eaton and Littler have published a technique for volar beak ligament reconstruction of the TMC joint using a slip of flexor carpi radialis (FCR) tendon.^{8,13}

We have devised a modified Eaton–Littler technique, which simultaneously reinforces the anterior oblique ligament and the dorsoradial ligament to achieve global stability.¹⁴ We present an interesting case of sequential scapholunate and volar beak ligament reconstructions using a FCR tendon graft where a slip of tendon was harvested twice within three years, with satisfactory clinical outcomes at five years following the initial surgery.

Case history

An 18-year-old right hand dominant landscape gardener presented with a 4-month history of dorsal left wrist pain following an ice skating injury. Clinical examination of his left wrist revealed tenderness over the scapholunate joint with a positive scaphoid shift test (Watson test). Plain radiography with a six-shot series of the left wrist revealed scapholunate diastasis (Terry-Thomas sign) and a dorsal intercalated segmental instability pattern with no obvious fractures in the carpal bones. Magnetic resonance arthrography suggested partial tear of the scapholunate ligament. Diagnostic left wrist arthroscopy confirmed a scapholunate ligament injury and Geissler grade IV carpal instability.¹⁵ A successful modified Brunelli procedure was later performed using a slip of FCR tendon; recovery was uneventful. At the one-year follow-up appointment, the wrist was pain free with dorsiflexion of 45° and palmarflexion of 35°. Grip strength returned to 70% of the opposite wrist and the patient was discharged from clinic.

Three years later, he sustained a new injury when a heavy pallet he was lifting slipped, causing a hyperextension injury to his left thumb. Clinical examination revealed a well healed scar from his modified Brunelli procedure with no tenderness over the left scapholunate joint. There was, however, tenderness over the volar aspect of the thumb TMC joint. Provocative stress tests for the TMC joint were positive, as was a diagnostic intra-articular injection of 2% plain lidocaine. Diagnostic arthroscopy of the TMC joint

Table 1 Clinical outcomes at five years after initial surgery

Outcomes	Left side	Unaffected (dominant) side
Dorsiflexion	45°	60°
Palmarflexion	40°	75°
Radial deviation	15°	35°
Ulnar deviation	30°	45°
Pronation	80°	80°
Supination	80°	90°
Grip strength	23.3kgf	60.0kgf
Pinch strength	8.0kgf	13.0kgf

Table 2 Patient reported outcome measures at five years after initial surgery

Outcome measures	Score
Michigan hand outcomes questionnaire	64%
General score (overall hand function)	74%
Work score	65%
Pain score	30%
Appearance score	56%
Satisfaction	71%
QuickDASH	20.5
Patient related wrist evaluation	36.5*
Modified Mayo wrist score	65 (fair function)

*maximum: 100; minimum: 0

confirmed a tear of the volar beak ligament. A modified Eaton–Little reconstruction of the volar beak and radiodorsal ligament was performed using a slip of FCR tendon for the second time. The patient had an uneventful recovery, and at the final follow-up visit at two years (five years since initial surgery), he had returned to full activities and employment in a watch repair shop, with a satisfactory clinical outcome (Tables 1 and 2, Figs 1 and 2).

Discussion

Traumatic wrist instability continues to pose a treatment challenge but advances have led to improved patient outcomes. Early diagnosis is facilitated by magnetic resonance arthrography and wrist arthroscopy, which help to dictate management. Improved outcomes have been reported with ligament reconstructions and stabilisation. The modified Brunelli procedure is a soft tissue procedure that aims to recreate the stabilising forces of the scapholunate ligament using a slip of FCR tendon graft passed from volar to dorsal via an osseous tunnel in the distal pole of the scaphoid.^{5–7} Similarly, the well established Eaton–Little ligament reconstruction also uses a strip of FCR tendon obtained through an extra-articular drill hole in the thumb metacarpal base and secured to the FCR tendon, reconstructing both the volar oblique and the dorsoradial ligaments.^{8,15}

Figure 1 Plain radiography of the wrist at five years after initial surgery **Figure 2** Clinical photographs at five years after initial surgery

The FCR tendon is considered by many the workhorse tendon in hand and wrist surgery. Some authors have expressed concerns about altering the mechanics of the wrist by sacrificing part or all of the FCR tendon. In a cadaveric study, Werner *et al* investigated the effect of partial or complete FCR harvest on wrist motion, and concluded that patients may experience a decrease in wrist strength with wrist motion (wrist flexion–extension, radioulnar deviation and circumduction).¹⁶ The motion least likely to be affected by such surgery is the dart throwing motion, when the force on the remaining FCR is minimised.

Clinically, however, harvesting FCR tendon slips has not been reported to cause major impairment of wrist motion or function. Indeed, the use of the entire width of the FCR tendon for ligament reconstruction tendon interposition

arthroplasty does not seem to impair wrist function.^{17,18} Our patient was managed as per our routine practice for such injuries. A slip of FCR tendon was harvested twice from his left wrist in sequential fashion within a three-year period to treat two different traumatic injuries. His clinical outcome at five years following the initial surgery is satisfactory, with outcome scores similar to those in the published literature.^{2,5,6,7}

Conclusions

Sequential scapholunate and TMC joint instabilities were treated with ligament reconstructions using ipsilateral slips of FCR tendon. The clinical outcome at five years following the initial surgery was good. The FCR tendon was harvested twice without any detrimental effect on wrist function.

References

1. Glickel SZ, Millender LH. Ligamentous reconstruction for chronic intercarpal instability. *J Hand Surg Am* 1984; **9**: 514–527.
2. Gajendran VK, Peterson B, Slater RR, Szabo RM. Long-term outcomes of dorsal intercarpal ligament capsulodesis for chronic scapholunate dissociation. *J Hand Surg Am* 2007; **32**: 1,323–1,333.
3. Kitay A, Wolfe SW. Scapholunate instability: current concepts in diagnosis and management. *J Hand Surg Am* 2012; **37**: 2,175–2,196.
4. Pappou IP, Basel J, Deal DN. Scapholunate ligament injuries: a review of current concepts. *Hand* 2013; **8**: 145–156.
5. Van Den Abbeele KL, Loh YC, Stanley JK, Trail IA. Early results of a modified Brunelli procedure for scapholunate instability. *J Hand Surg Br* 1998; **23**: 258–261.
6. Nienstedt F. Treatment of static scapholunate instability with modified Brunelli tenodesis: results over 10 years. *J Hand Surg Am* 2013; **38**: 887–892.
7. Ellanti P, Sisodia G, Al-Ajami A *et al*. The modified Brunelli procedure for scapholunate instability: a single centre study. *Hand Surg* 2014; **19**: 39–42.
8. Eaton RG, Littler JW. Ligament reconstruction for the painful thumb carpometacarpal joint. *J Bone Joint Surg Am* 1973; **55**: 1,655–1,666.
9. Imaeda T, An KN, Cooney WP, Linscheid R. Anatomy of trapeziometacarpal ligaments. *J Hand Surg Am* 1993; **18**: 226–231.
10. Strauch RJ, Behrman MJ, Rosenwasser MP. Acute dislocation of the carpometacarpal joint of the thumb: an anatomic and cadaver study. *J Hand Surg Am* 1994; **19**: 93–98.
11. Van Brenk B, Richards RR, Mackay MB, Boynton EL. A biomechanical assessment of ligaments preventing dorsoradial subluxation of the trapeziometacarpal joint. *J Hand Surg Am* 1998; **23**: 607–611.
12. Edmunds JO. Current concepts of the anatomy of the thumb trapeziometacarpal joint. *J Hand Surg Am* 2011; **36**: 170–182.
13. Eaton RG, Lane LB, Littler JW, Keyser JJ. Ligament reconstruction for the painful thumb carpometacarpal joint: a long-term assessment. *J Hand Surg Am* 1984; **9**: 692–699.
14. Iyengar K, Gandham S, Nadkarni J, Loh W. Modified Eaton–Littler's reconstruction for traumatic dislocation of the carpometacarpal joint of the thumb – a case report and review of literature. *J Hand Microsurg* 2013; **5**: 36–42.
15. Geissler WB. Arthroscopic management of scapholunate instability. *J Wrist Surg* 2013; **2**: 129–135.
16. Werner FW, Short WH, Palmer AK, Sutton LG. Wrist tendon forces during various dynamic wrist motions. *J Hand Surg Am* 2010; **35**: 628–632.
17. Tomaino MM, Coleman K. Use of the entire width of the flexor carpi radialis tendon for the ligament reconstruction tendon interposition arthroplasty does not impair wrist function. *Am J Orthop* 2000; **29**: 283–284.
18. Naidu SH, Poole J, Horne A. Entire flexor carpi radialis tendon harvest for thumb carpometacarpal arthroplasty alters wrist kinetics. *J Hand Surg Am* 2006; **31**: 1,171–1,175.