

Selection of Tendon Grafts for Distal Radioulnar Ligament Reconstruction and Report of a Modified Technique

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Purpose To investigate the graft length necessary to complete a distal radioulnar ligament reconstruction and assess the suitability of several tendon graft sources.

Methods We measured the graft length needed to complete the distal radioulnar ligament reconstruction in 7 fresh-frozen cadaver specimens. The pure tendon lengths of 7 tendon graft sources were measured: palmaris longus, extensor indicis proprius, slips of extensor digiti minimi and abductor pollicis longus, and portions of flexor carpi ulnaris, flexor carpi radialis, and extensor carpi ulnaris. A modified technique that allows for a shorter length of graft is also described, and the suitability of each graft source for this technique was assessed.

Results The mean graft lengths needed to complete the original and modified reconstructions were 138 mm and 89 mm, respectively. The average length of the tendon graft when measured as pure tendon was: palmaris longus (127 mm), slip of extensor digiti minimi (112 mm), extensor indicis proprius (100 mm), partial flexor carpi radialis (87 mm), slip of abductor pollicis longus (69 mm), partial flexor carpi ulnaris (67 mm), and partial extensor carpi ulnaris (67 mm). The palmaris longus was too short for the original technique in the majority of specimens but was sufficient to complete the modified technique in every specimen that had a palmaris longus. Six specimens also had an extensor indicis proprius of suitable length for the modified technique.

Conclusions The length of donor graft required for the modified reconstruction was significantly less than that needed for the original reconstruction. Three specimens had no donor tendons sufficiently long to complete the original technique if a pure tendon graft were used, whereas the modified technique could be completed in all specimens.

Clinical relevance Many tendon graft sources in the upper extremity are of insufficient length to complete the distal radioulnar ligament reconstruction as described. A modified technique using suture anchors may be a useful alternative in such cases. (*J Hand Surg Am.* 2014;39(10):2027–2032. Copyright © 2014 by the American Society for Surgery of the Hand. All rights reserved.)

Key words Distal radioulnar ligament, distal radioulnar joint, reconstruction, tendon graft, cadaver.

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BECAUSE OF THE MINIMALLY constrained architecture of the sigmoid notch, the surrounding soft tissues of the distal radioulnar joint (DRUJ) provide stability.^{1,2} In cases of chronic DRUJ instability, distal radioulnar ligament (DRUL) reconstruction may be necessary when the components of the triangular fibrocartilage complex are beyond repair. A number of tendon graft-based reconstructions have been developed over the last 30 years, but most have been met with only limited success.³ Adams and Berger have popularized a technique that replicates both orientation and function of the palmar and dorsal distal radioulnar ligaments.^{4,5} In their reconstruction, a tendon graft is threaded through the distal radius via a dorsal-to-volar bone tunnel. Both graft ends are then passed through an oblique tunnel in the distal ulna, wrapped around the ulnar neck, and tied together as a half-hitch (Fig. 1). This technique effectively recreates both the palmar and dorsal portions of the DRUL with a single graft, emulating the varying levels of tension provided by each throughout the pronation-supination arc.⁶ The effectiveness of this reconstruction has been examined in 14 patients, with all patients reporting at least an 85% recovery of strength and motion. Stability was completely restored in 12 of the 14, which allowed for return to previous work, sports, and avocations without restrictions.⁵

The senior author (S.W.W.) has found this reconstruction useful and effective but has noted a technical limitation that has also been acknowledged by Adams et al.⁷ We have encountered occasions in which the tendon graft length was too short to loop around the ulna, requiring us to use a suture anchor to secure the graft (Fig. 1). In this cadaveric investigation, we sought to determine the length of graft needed to complete both the original and our modified technique for this DRUL reconstruction. Additionally, we evaluated the length of alternative local tendon grafts because the palmaris longus is not consistently present.⁸ We hypothesized that the majority of graft sources would not have sufficient length to perform the DRUL reconstruction as originally described and that a greater number of graft sources would be suitable for the modified technique.

MATERIALS AND METHODS

Specimens

Seven fresh-frozen cadaveric upper limbs were thawed overnight and allowed to reach room temperature. Bone tunnels were created in the distal radius and ulna of each of the specimens, in accordance with the protocol described by Adams and Berger (Fig. 1).⁵

Seven tendons were harvested in each forearm, including the palmaris longus (PL) (when present), extensor indicis proprius (EIP), one slip of the abductor pollicis longus (APL), one slip of the extensor digiti minimi (EDM), and portions of flexor carpi ulnaris (FCU), flexor carpi radialis (FCR), and extensor carpi ulnaris (ECU) tendons. These tendons were chosen because they are expendable and are commonly used in reconstructions or tendon transfers.

Tendon grafts

All tendon grafts were harvested with the use of an Acuflex Closed Tendon Stripper (Smith & Nephew; Memphis, TN) with the specimens at room temperature and not desiccated. The distal end of the PL tendon was exposed by a transverse incision made 2 cm proximal to the distal wrist flexion crease, and the tendon was divided in the proximal palm at the point of the tendon's flare into its aponeurosis.^{9,10} To extract the slip of EDM, the distal portion of the tendon was exposed by a transverse incision over the fifth metacarpophalangeal joint.¹¹ The ulnar slip was identified and separated from the extensor digitorum communis at a secondary incision just distal to the dorsal portion of the ulnar styloid. The EIP tendon was similarly harvested by isolating it from the extensor digitorum communis through a transverse incision over the second metacarpophalangeal joint and a transverse incision at the distal radius.⁸ For both the EIP and EDM, the tendons were identified proximal to the extensor retinaculum and isolated from nearby tendons before a tendon stripper was used to free the tendon from its muscle.

For the portion of FCU, a transverse incision was made over the tendon near the wrist flexion crease. The tendon was divided into 2 equal portions, whereupon one was cut from its insertion on the pisiform. A tendon stripper was used to extend this division proximally, whereupon another transverse incision down to the level of the tendon was made parallel and 4.5 cm proximal to the first incision. The tendon slip was then withdrawn proximally through the second incision, and the remainder extracted with a tendon stripper via the second incision.¹²

The partial FCR tendon was also harvested by means of multiple small transverse incisions on the distal forearm. The tendon was initially exposed at the wrist and split in half longitudinally just proximal to the scaphoid tubercle. The portion was followed proximally with a tendon stripper, and multiple transverse incisions were made through which the tendon was removed and stripped until it was freed from its muscle.¹³

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