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Original Research

Flexor Carpi Radialis Tendon Insertion Onto the Trapezial Ridge: An Anatomic Description

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Purpose: The flexor carpi radialis (FCR) tendon is often involved in surgical procedures of the hand and wrist. The FCR tendon may be mobilized from the trapezium during distal radius fracture fixation, for tendon transfer, and during carpometacarpal joint procedures. There is a paucity of literature describing the anatomy of the FCR insertion onto the trapezial ridge. We analyzed the insertional characteristics of the FCR onto the trapezium.

Methods: Forty-two fresh-frozen cadaveric wrists were dissected using the extended FCR approach through the FCR tendon sheath. The length of the fibrous portion of the FCR insertion onto the trapezial ridge was measured from proximal to distal using a digital caliper.

Results: FCR insertion onto the trapezium was present in all specimens. The mean length of the FCR insertion was 11.8 ± 4.14 mm. The character of the tissue quality varied across specimens.

Conclusions: These results demonstrate the commonality of the FCR fibers that insert onto the trapezium. The length and tissue quality of this insertion varied across specimens.

Clinical relevance: Understanding the complex anatomy of the hand and wrist facilitates surgical planning and intraoperative techniques. The FCR tendon insertion onto the trapezium is an important component of exposure for the volar approach to the distal radius and surgical management of thumb carpometacarpal joint arthritis.

The flexor carpi radialis (FCR) tendon is an important anatomic structure of the wrist and distal forearm. It is often involved in surgical procedures and can be used as a reliable, consistent landmark to guide surgeons in their approaches to the volar wrist and forearm.

The FCR muscle flexes and radially deviates the wrist. The median nerve in the proximal forearm provides innervation. The FCR muscle originates on the medial epicondyle of the humerus as part of the common flexor tendon. The FCR inserts onto the trapezium, the second metacarpal base, and the third metacarpal. A previous anatomic study determined that approximately 75% of tendons insert onto the base of the second metacarpal, with the remainder inserting onto the third metacarpal.[1] The trapezium has a groove on its palmar and medial aspect, and the most superficial edge of this groove is called the trapezial ridge.[2] It is here where fibers from the FCR insert onto the trapezium.

To our knowledge, the trapezial insertion of the FCR is not well described in the literature and is frequently overlooked.[3–5] Several studies have detailed the anatomy of the FCR but neglect to describe its insertion on the trapezial ridge.[1,6] Bishop et al[1] discussed the anatomy of the FCR tendon, tendon sheath, tunnel

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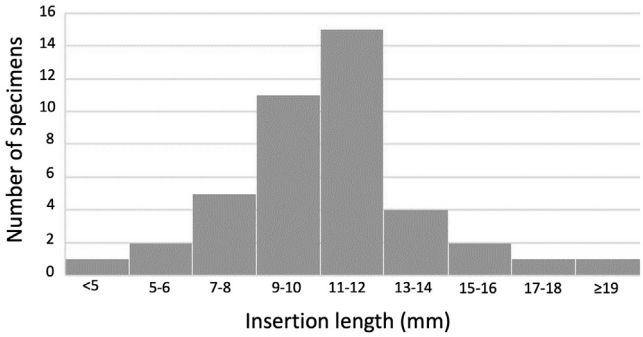

Figure 1. Histogram distribution for measured length of the FCR tendon insertion onto the trapezial ridge.

boundaries, and adjacent structures. Additionally, the authors reported that 90% of the specimens contained the insertion of the FCR tendon onto the trapezial ridge; however, the insertion is not described in detail. Currently, the literature lacks adequate details on the characteristics of the FCR tendon insertion onto the trapezial ridge.

Our purpose was to describe the insertion of the FCR tendon onto the trapezial ridge and to quantify the dimensions of the insertion. We hypothesize that the FCR tendon insertion would be present in all specimens yet variable in character.

Methods

Forty-two fresh-frozen cadaveric specimens were dissected by 2 fellowship-trained hand surgeons using the extended FCR approach through the FCR tendon sheath, as described by Orbay et al.[7,8] There were 29 (69%) female specimens with a mean age of 66 years (range, 52–83 years) and a mean bodyweight of 159 pounds (range, 132–221 pounds). The FCR was exposed from the distal third of the forearm across the wrist just proximal to its insertion on the second metacarpal base. The FCR sheath was opened to expose the tendon. This dissection was performed distal to the trapezium. Opening the FCR tendon sheath exposed its insertion onto the trapezium. Care was taken during this exposure to not disturb the FCR insertion onto the trapezium to maintain continuity between specimens for data collection.

The length of the FCR insertion on the trapezial ridge was measured from proximal to distal using a digital caliper. This measurement comprised the fibrous attachments to the trapezium. Minor expansion or fanning of the tissue was not included in the measurement. The measurements were collected at 3 separate times by 3 fellowship-trained hand surgeons. Surgical loupes were used to evaluate the characteristics of the tissue.

Results

The FCR insertion onto the trapezial ridge was present in all 42 specimens, with a mean length of 11.75 ± 4.14 mm (Fig. 1). The insertion varied in length and appearance among the specimens (Fig. 2). In 12 specimens, the insertion had an appearance similar to Sharpey fibers. The tissue was fibrous, embedded, and adherent to the bone. The remaining 30 specimens had a tissue quality that varied from wispy fibers with focal defects to more robust fibers with no absent tissue.

Discussion

Tendons are mechanical links that contribute to stability and force transmission. The tendon attachment to the bone—the enthesis—is described as fibrous or fibrocartilaginous, depending on the tissue characteristics.[9,10] These structures facilitate force transmission and, thus, the motion. The biomechanical properties of a tendon attachment are directly related to the surface area of the insertion. Larger insertions are capable of withstanding higher forces.[11]

The FCR tendon is nestled in the trapezial groove. This region of the trapezium is an attachment point for the FCR tendon. The osteotendinous junction was substantial, variable in size, and present in all specimens. A previous study demonstrated that fibers with the visual appearance of Sharpey fibers may in fact, be fibrous attachments that possess a similarly robust quality.[10] We observed a nearly complete trapezial tunnel in 13 (31%) specimens, and these specimens had a greater length of insertion. This is an observational finding with no accompanying quantifiable data.

In 1994, Bishop et al[1] described the anatomic characteristics of the FCR tendon. The authors reported the presence of an FCR attachment to the trapezium in 90% of specimens, with most of these measuring "one by two millimeters in width."[1] This description represents a bidimensional measurement—length and width. We measured a single dimension, the length of insertion that yielded a mean value of 11.75 mm, which is considerably greater than the values reported by Bishop et al.[1] Additionally, we identified the presence of the FCR attachment to the trapezium in all (100%) specimens. With the variable quality of tissue, the measured length of insertion often did not include the entirety of the tissue expansion. We aimed for consistency in solely measuring the fibrous portion of the insertion.

We do not expect the FCR insertion onto the trapezium to have the robust quality of the FCR insertion onto the second metacarpal. There is a reasonable expectation for force transmission to occur through the trapezium insertion given our results, which demonstrate a mean length of insertion of 11 mm. We did not evaluate the FCR attachment onto the second metacarpal because this was outside the scope of the current work. Therefore, a comparative discussion between these entheses is not feasible.

The FCR tendon is frequently involved in surgical procedures. It is an anatomic guide for volar distal radius exposure, used as a tendon interposition graft in carpometacarpal (CMC) joint arthroplasty and in tendon transfer. The release of the FCR insertion onto the trapezium facilitates tendon length and tension during interposition arthroplasty. Additionally, this release allows the FCR tendon to be retracted more ulnarly, which enables wide exposure of the wrist during the volar approach to the distal radius. When performing implant arthroplasty of the thumb CMC joint, some surgeons will tenotomize the FCR tendon to prevent impingement of the implant onto the tendon. Performing this tenotomy distal to the trapezium insertion prevents proximal migration of the tendon. This knowledge is critical during trapeziectomy for the protection of the FCR. As these fibers are not often described, they may be neglected during surgical procedures. Understanding the insertional anatomy of the FCR tendon provides value when the mobilization of the tendon is required for surgical exposures and when harvesting the tendon for use as an interposition graft or in tendon transfer procedures.

This study has limitations related to the use of cadaveric forearms—specifically, the limited sample size and the inherent variability between specimens. We measured the fibrous portion of the FCR insertion. Interpretations of tissue composition may vary across surgeons, which will impact the measurements. We attempted to control this by using 3 observers performing measurements at 3 separate time points. The mean value that is reported is meant to reduce the common errors associated with human measurement. The scope of the current work was limited to

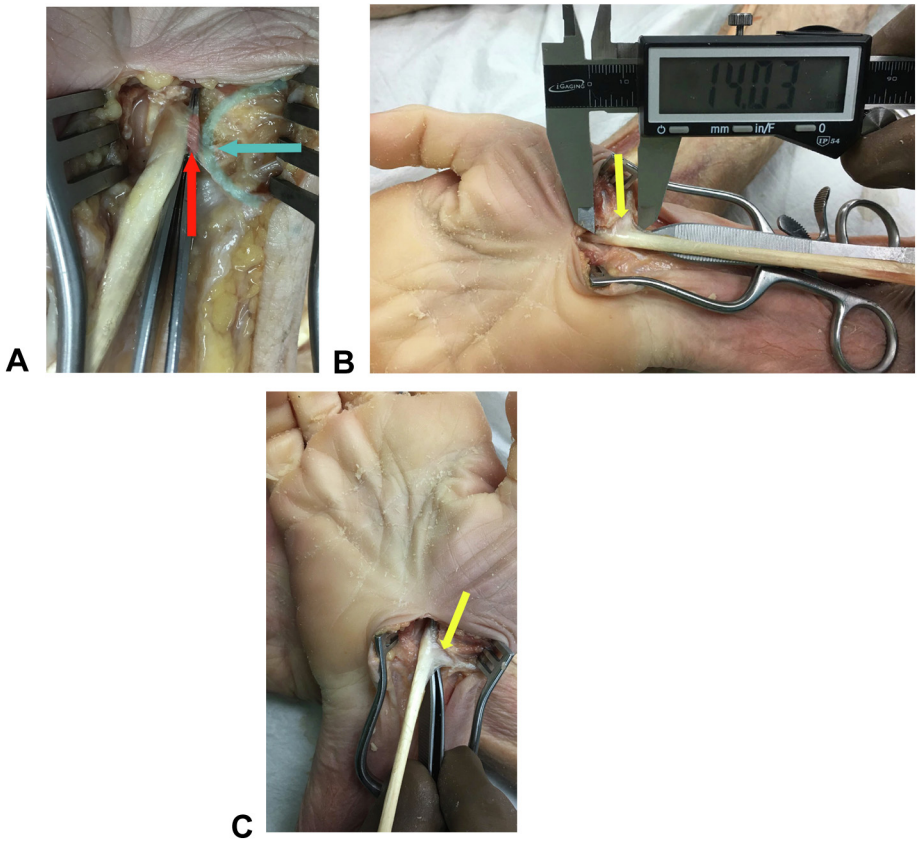

Figure 2. The FCR tendon insertion displays variable characteristics, from **A** thin wispy fibers (red arrow; blue arrow showing the trapezial ridge) to **B, C** thick robust fibers (yellow arrow).

the insertion of the FCR onto the trapezium. Further anatomic study of the FCR insertion onto the second and third metacarpals would provide a comparative value for the current findings.

Our anatomic study demonstrates that the FCR tendon has a consistent insertion onto the trapezial ridge. The dimension and quality of the insertion vary across specimens, with some demonstrating robust characteristics. These results are an important component of understanding the complex anatomy of the hand and wrist.

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