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A Study of Inter - Tendinous (Juncturae Tendinum) Connections between the Four Tendons of Extensor Digitorum Communis (EDC)

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Original Research Article

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Abstract: Extensor digitorum communis arises from the lateral epicondyle of the humerus by the common extensor tendon, the adjacent intermuscular septa and the antebrachial fascia. It divides distally into four tendons, this tendons pass in a common synovial sheath with the tendon of extensor indicis, through a tunnel under the extensor retinaculum. The tendons run over the dorsum of the hand, one to each finger. The tendon to the index finger is accompanied by extensor indicis, which lies ulnar (medial) to it. On the dorsum of the hand, adjacent tendons are bonded by three variable intertendinous connections (juncturae tendinum), which are inclined distally and radially. The digital attachments enter a fibrous expansion on the dorsum of the proximal phalanges to which lumbrical, interosseous and digital extensor tendons all attached. This study puts in a sincere effort to study the intertendinous connections (juncturae tendinum) between the four tendons of Extensor digitorum communis. 80 upper limb specimens of human cadaver were used to study the type of intertendinous connections or juncturae tendinum (JT) between the four tendons of Extensor digitorum communis which are seen in 2nd, 3rd and 4thintermetacarpal spaces. The special findings are photographed; all the findings are tabulated and analyzed statistically. Statistically the differences between the right and left hand for the above mentioned tendons and juncturae tendinum were insignificant (*p* value >0.05). Type 1 JT is most common in 2nd IMS, Type 2 is common in 3rd IMS and Type 3r and Type 3y are found in 4th IMS.

Keywords: Extensor digitorum communis, juncturae tendinum (JT), inter – tendinous connections.

INTRODUCTION

According to Gray's Anatomy[1]Extensor digitorum communis arises from the lateral epicondyle of the humerus by the common extensor tendon, the adjacent intermuscular septa and the antebrachial fascia. It divides distally into four tendons, this tendons pass in a common synovial sheath with the tendon of extensor indicis, through a tunnel under the extensor retinaculum. The tendons run over the dorsum of the hand, one to each finger. The tendon to the index finger is accompanied by extensor indicis, which lies ulnar (medial) to it. On the dorsum of the hand, adjacent tendons are bonded by three variable intertendinous connections (juncturae tendinum), which are inclined distally and radially. The digital attachments enter a fibrous expansion on the dorsum of the proximal phalanges to which lumbrical, interosseous and digital extensor tendons all attached.

The juncture tendinum (JT) helps the EDC tendons to work together [2-5]. They prevent independent movements of the medial four fingers; while EDC contracts to extend the fingers [1]. They also mask tendon damages by bridging the four tendons of EDC. JT can be used in the repair of dorsal digital aponeurosis. The arrangement of the extensor tendons of forearm, hand and also JT vary gretlly [6-9]. The extensor digitorum tendons emerge through the fourth dorsal compartment onto the dorsum of the hand, where they are joined together distally by a varying pattern of oblique interconnections, the juncturae tendinum. These typically pass in a distal direction from middle finger to index finger and from ring finger to middle and little fingers. Proximal lacerations to the middle finger extensor tendon may result in only partial loss of extension because of these tendinous interconnections. At the level of the metacarpophalangeal joint, each extensor tendon is held in a central position over the dorsum of the joint by a flat fibrous extensor expansion. The expansion extends onto the dorsum of the proximal phalanx of each digit. It forms a movable hood, which moves distally when the metacarpophalangeal joint is flexed, and proximally when it is extended (in which position it is most closely applied to the joint).

Each extensor tendon blends with the extensor expansion along its central axis, and is separated from the metacarpophalangeal joint by a small bursa. The expansion is triangular in shape, with its base proximal. It receives the conjoined tendons of the intrinsic muscles. The expansion is almost translucent between its margins and the extensor digitorum tendon. Transverse fibres (the sagittal bands) pass to the volar plate and transverse metacarpal ligaments. They separate the phalangeal attachment of the dorsal interosseus from the rest of the muscle, and the palmar interosseus from the lumbrical muscle. Injuries to the sagittal bands can lead to subluxation of the extensor tendon.

According to Cunningham's[2]four separate tendons of EDC pass on to the dorsum of the hand but are linked together by oblique strips of tendinous material, the conexus intertendinous also known as juncture tendinum proximal to the metacarpophalangeal (MP) joint. These connections force the tendons of this muscle to work together. The index and little fingers each have an additional extensor tendon EIP and EDM respectively. These fuse with the corresponding tendon of EDC distal to the juncture tendinum and so are able to extend the MP joint of these fingers when the corresponding joints of the middle and ring fingers are flexed. The convers cannot happen because the middle and ring fingers receive only a tendon from EDC.

This study puts in a sincere effort to study the intertendinous connections (juncturae tendinum) between the four tendons of Extensor digitorum communis.

Aims and Objectives

To study the type of inter tendinous (Juncturae tendinum) connections between the four tendon of EDC.

MATERIALS AND METHODS

Source of data

For this study we used total 80 disarticulated upper limbs of unknown sex. The cadavers were belonged to the south Indian people. Out of 80 limbs 38 are of right side and 42 are of left side. The limbs are selected from the Department of Anatomy, Kanachur Institute of Medical Sciences,Mangalore. Age of the cadavers/specimens is also unknown.

Materials

The JT were defined as short bands of connective tissue between two adjacent tendons. They were classified into 3 types according to Von Schroeder *et al*.[10]. Type 1 was the thinnest of all and consisted of a filamentous band (Fig.2 and 3), Type 2 was thicker than Type 1 but thinner than Type 3 (Fig.3) and Type 3 was the thickest, and appears like a tendinous band. Type 3 was subdivided into Type 3y (Fig.2) and 3r (Fig.3) according to the shape. When a tendon split into two equal halves that inserted into two tendons of adjacent digits, one slip was defined as a y juncturae, the other as a continuation of the base tendon. The base tendon was defined as the muscle belly from which it is originated. The r-subtype was a more oblique juncturae stemming from a base tendon. We documented JT in 2nd, 3rd, and 4thintermetacarpal spaces (IMS) by fine dissection.

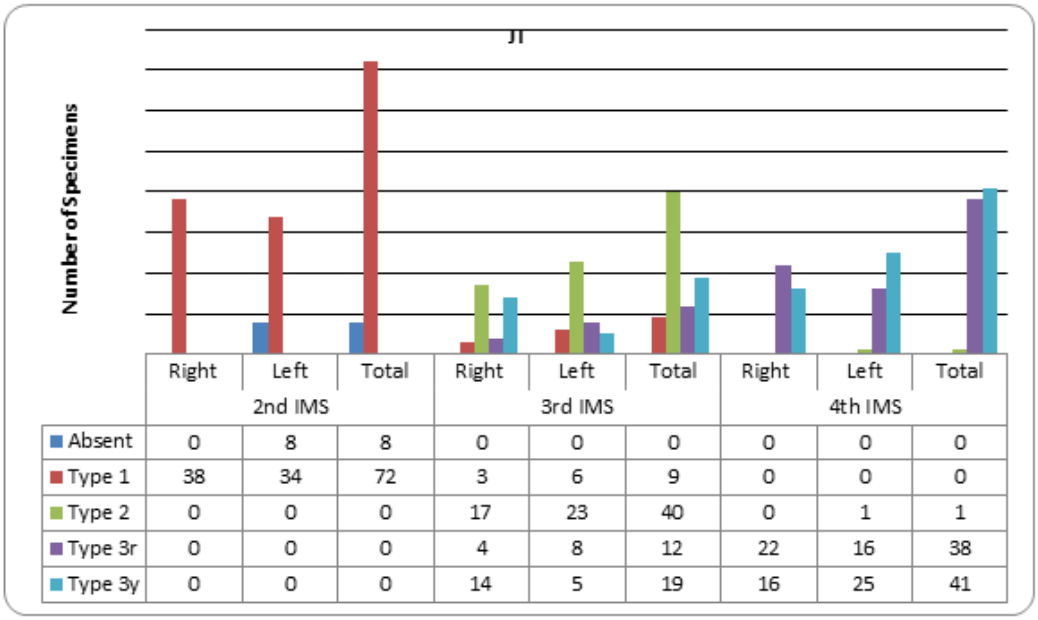
Variations in the arrangement of the tendons and absence of the muscles or tendons in this region were recorded and photographed. All parameters were tabulated and then analyzed statistically. The Fisher's exact test [20] was used to compare the differences between the right and left limbs. If p value is less than 0.05 it was considered significant.

RESULTS

Table-1: Arrangement of Juncturae Tendinum in 2nd, 3rd and 4thIntermetacarpal Spaces

Type of JT	2nd IMS			3rd IMS			4th IMS		
	Right	Left	Total	Right	Left	Total	Right	Left	Total
Absent	0 (0%)	8 (19.1%)	8 (10%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Type 1	38 (100%)	34 (80.9%)	72 (90%)	3 (8%)	6 (14.3%)	9 (11.25%)	0 (0%)	0 (0%)	0 (0%)
Type 2	0 (0%)	0 (0%)	0 (0%)	17 (44.7%)	23 (54.8%)	40 (50%)	0 (0%)	1 (2.4%)	1 (1.25%)
Type 3r	0 (0%)	0 (0%)	0 (0%)	4 (10.5%)	8 (19%)	12 (15%)	22 (57.9%)	16 (38.1%)	38 (47.5%)
Type 3y	0 (0%)	0 (0%)	0 (0%)	14 (36.8%)	5 (11.9%)	19 (23.75%)	16 (42.1%)	25 (59.5%)	41 (51.25%)

(Number of specimens=80)



	2nd IMS			3rd IMS			4th IMS		
	Right	Left	Total	Right	Left	Total	Right	Left	Total
Absent	0	8	8	0	0	0	0	0	0
Type 1	38	34	72	3	6	9	0	0	0
Type 2	0	0	0	17	23	40	0	1	1
Type 3r	0	0	0	4	8	12	22	16	38
Type 3y	0	0	0	14	5	19	16	25	41

Graph-1: Bar Chart showing distribution of JT in 80 specimens

Table -2: *p* values of JT in Inter Meta-Carpal Space (IMS)

2nd IMS	0.0057588
3rd IMS	0.0634063
4th IMS	0.1161612

Fig-1: Dorsum of the left hand showing Type 1and Type 3y JT in IMS

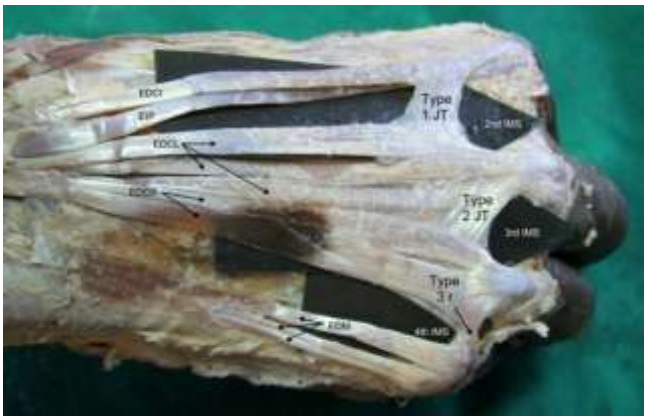


Fig-2: Dorsum of the left hand showing Type 1, Type 2 and Type 3r JT in IMS

DISCUSSION

Table-3: Comparison of previous studies data with our data of JT

IMS	Hirai *et al* [4] (N=548)	Zilber S Oberlin [8] (N=50)	Godwin & Ellis [7] (N=50)	El-Badawi [6] (N=181)	Prameela Das *et al* [3] (N=100)	Agarwal P & Tirthani G [11] (N=120)	Our Study (N=80)
2nd	69%	82%	80%	36.5%	87%	18.33%	90%
3rd	97%	98%	70%	74.6%	100%	96.66%	100%
4th	56%	100%	30%	28.7%	100%	87.5%	100%

Variations in the JT

Presence and absence of JT in 2nd, 3rd and 4th IMS was almost similar to studies [3, 8]. The arrangement of JT in 2nd and 3rd IMS was accordance with study conducted by [3], but in 4th IMS type 3y (51.25%) was higher than type 3r (47.5%). In study conducted by [3] type 3r (73%) higher than type 3y (11%). Different types of JT have clinical importance. The thicker type of JT can substitute for absence or weakness of some tendons [10]. If there is no EDCS, the vast majority of hands have an intertendinous connection, connecting the common extensor tendon of the fourth finger to the extensor aponeurosis of the little finger. On the other hand, if there is a relatively large EDCS, the intertendinous connection is likely to be absent [8].

CONCLUSION

By this study we conclude that JT of the hand can show great variability in their arrangement.

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