International Journal of Scientific Engineering and Science
Volume 2, Issue 12, pp. 7-8, 2018. ISSN (Online): 2456-7361

Long Flexors of the Forearm and Hand: An Incidence of a Variation in the Pattern of Separation of Their Tendons

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Abstract*—Long flexors of the forearm are divided to deep and superficial groups. Superficial muscles are flexor carpi radialis, flexor carpi ulnaris, flexor digitorum superficialis and palmaris longus. Deep flexors are flexor policis longus and flexor digitorum profundus. The flexor digitorum profundus is a muscle belonging to the deep flexors of the forearm forming most of the muscular bulk on the flexor aspect of the forearm.*

The normal pattern of separation of the four tendons of the profundus muscle is for the tendon for the index finger to separate out distinctly in the distal forearm prior to entering the carpal tunnel while the tendons for the middle, ring and little fingers separate out in the palm.

In the variants presented in this study it was evident that the profundus tendon to the middle finger separated out within the carpal tunnel. This is thus a variation from the normal pattern of separation of the deep flexor tendons of the hand suggesting a possible evolutionary trend in affording greater independence of movements of fingers which is probably an adaptation to better prehensile movements of the human hand.

***Keywords*—** *Flexor digitorum proundus*.

I. INTRODUCTION

The flexor compartment of the forearm and hand incorporates a superficial and deep set of muscles together with intrinsic muscles of the hand. The superficial muscles are made up of the flexor carpi radialis, flexor carpi ulnaris, palmaris longus and flexor digitorum superficiallis. The deep set of muscles are the flexor pollicis longus and flexor digitorum profundus. While the flexor digitorum superficialis enters the palm through the carpal tunnel, their four tendons to the index, middle, ring and little fingers divide over the proximal phalanx into a double decussation before being attached to the base of the middle phalanx, the flexor digitorum profundus tendons pass deep to the flexor digitorum superficialis tendons within the carpal tunnel before its tendons to the above fingers pass through the double decussation mentioned above, to get attached to the bases of the distal phalanx of the four fingers mentioned above.

The double decussation of the flexor digitorum superficialis tendons is a special adaptation to prevent the compression of the flexor digitorum profundus tendons when both profundus and superficialis tendons work synergistically to bring about flexion of the proximal and distal inter phalangeal joint of the medial four fingers namely the index, middle, ring and little fingers being a prerequisite for gripping and fine skilled movements.

II. METHODOLOGY

This study was carried out on dissections of both hands in 44 cadavers obtained from the dissection theatres in the department of Anatomy, Faculty of Medicine, University of Ruhuna and the Faculty of Medicine, University of Kelaniya over a period of 2 years. The hands were dissected by removing the skin and superficial and deep fascia. The palmaris longus was identified and divided proximal to the wrist joint and the palmar aponeurosis was removed. The flexor retinaculum was identified and removed from their attachment to the four carpal bones namely medially the pisiform and the hook of hamate and laterally tubercle of the scaphoid and the crest of the trapezium. The flexor carpi ulnaris and flexor carpi radialis muscles were identified and left intact. The four tendons of the flexor digitorum superficialis which runs in two planes were identified and divided just proximal to the wrist joint and reflected. The four tendons of the flexor digitorum profundus which run in a single plane were identified. The course of the four tendons of the flexor digitorum profundus were defined and cleaned out in the distal forearm and hand.

III. RESULTS

On analyzing the findings, we found that in five of the left hands dissected the separation of the tendon to middle finger took place within the carpal tunnel while the profundus tendon to the index finger separated in the distal forearm while those to the ring and little fingers separated in the mid palm distal to the carpal tunnel. The results are illustrated in figure 1 and 2. The pattern of separation of the tendons in all the right hands and the rest of the left hands in the cadavers in this study demonstrated the normal pattern of separation.

IV. DISCUSSION

From the results discussed above, it is evident that the normal pattern for the separation of the tendons of the flexor digitorum profundus to the medial three fingers namely little, ring and middle fingers occurs within the palm distal to the carpal tunnel. In the variants in this study it was evident that the separation of the profundus tendon to the middle finger has taken place more proximally within the carpal tunnel. This could be an adaptation to providing more independence of movement of the middle finger as in the case of the index

finger. Further studies incorporating a larger number of cadavers need to be carried out in order to establish this variant in the normal pattern of separation of long flexors of the forearm and arm.

Fig. 1. Normal pattern of separation of flexor digitorum profundus tendon.
Profundus tendon to index (A) middle (B) ring (C) and little (D) fingers can be identified. Cut section of flexor retinaculum (F) can be seen. Profundus tendon to index finger separated in distal forearm while others separated in mid palmar area. Flexor carpi radialis and flexor carpi ulnaris left intact and tendons of palmaris longus and flexor digitorum superficiallis are removed with skin, superficial fascia and palmer aponeurosis.

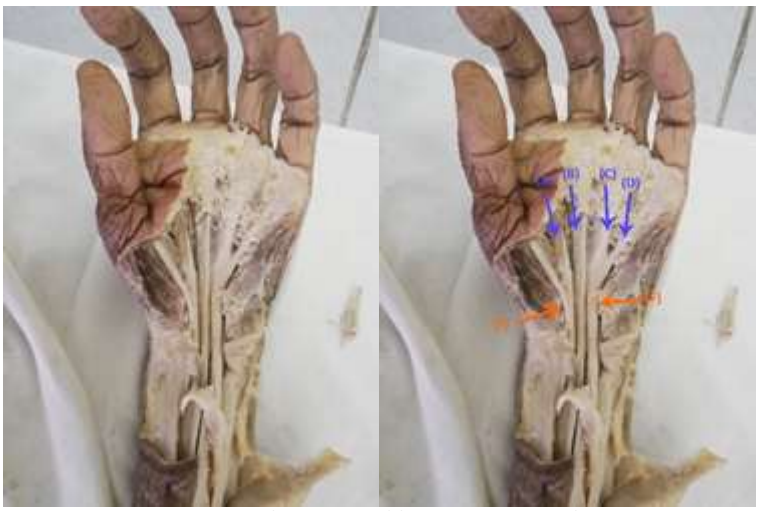

Fig. 2. Variant pattern of separation of flexor digitorum profundus tendon.
Profundus tendon to index (A) middle (B) ring (C) and little (D) fingers can be identified. Cut section of flexor retinaculum (F) can be seen. Profundus tendon to index finger is separated in distal forearm. Profundus tendon to little and ring fingers separated in mid palmar area while profundus tendon of middle finger is separated in carpal tunnel which was the variant.

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