

## **VARIATIONS OF FLEXOR DIGITORUM SUPERFICIALIS MUSCLE**

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### **ABSTRACT**

The first sign of beginning limbs in the primitive sharks is a lateral fold on each side continues from gill to anus into which muscle grow in later development. The hand developed before the arm and intrinsic muscles of hand were primordial, some of them joining later with the forearm muscles to become long extensors and long flexors. This is apparently the development of long extensors and long flexor sublimis and profundus in man which now control our digits from the forearm. The aim of the present study was to study the variations of flexor digitorum superficialis muscle. The present study was done on 60 upper limbs (56 Males and 4 Females) of embalmed adult human cadavers obtained from Department of Anatomy, Govt. Medical College Patiala. In this study, in 6(10%) cases tendon of flexor digitorum superficialis going to little finger was not splitting proximally and the tendons of both flexor digitorum superficialis and flexor digitorum profundus were found running parallel to each other. The tendon of flexor digitorum profundus was not piercing the tendon of flexor digitorum superficialis. Near insertion each tendon of flexor digitorum superficialis was splitting into two slips and the insertion of two slips was on the sides of the middle phalynx. In 2 cases (3.3%), the muscle contributed to three tendons, when these tendons were traced to the palm, it was found that tendon for little finger was absent. An awareness of anatomical variations in this region would be useful to many health care professionals.

**Keywords:** *Flexor Digitorum Superficialis, Flexor Digitorum Profundus, Sublimis, Humero-Ulnar Head, Radial Head, Medial Epicondyle, Intermuscular Septum, Coronoid Process, Radial Tuberosity, Flexor Retinaculum*

### **INTRODUCTION**

Anatomical variations of the muscles and nerves around the wrist are common. Knowledge of such variations is derived from 2 sources; anatomical dissections and clinically reported cases (Al-Qattan and Duerksen, 1992). Most modern anatomical texts usually do not illustrate or describe common variations in muscles and tendons in hand. Because these variations are not listed in most anatomy textbooks, students often believe, during laboratory dissection, that they have discovered a new muscle or tendon. Therefore, the muscle and tendon in the hand are studied to determine which variations occur most frequently and to use these findings to supplement textbook description (Perkin and Hast, 1993). Flexor digitorum superficialis, formerly called sublimis stretches across the forearm between the medial epicondyle and the radius and separates the superficial group of muscles from the deep group throughout much of the forearm (Hollinshead, 1969).

#### **Origin of FDS**

*Humero-ulnar head:*

- Medial epicondyle of the humerus via the common flexor tendon
- Anterior band of the ulnar collateral ligament
- Adjacent intermuscular septa
- Medial side of the coronoid process proximal to the ulnar origin of pronator teres

*Radial Head:*

Thin sheet of muscle, arises from the anterior radial border extending from the radial tuberosity to the insertion of pronator teres. The muscle usually separates into two strata, directed to digits 2-5 as follows:

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- The superficial stratum, joined laterally by the radial head, divides into two tendons for the middle and ring finger; the deep stratum gives off a muscular slip to join the superficial fibres directed to the ring finger, and then ends in two tendons for the index and little finger.
- As the tendons pass behind the flexor retinaculum they are arranged in pairs: the superficial pair going to the middle and ring fingers, the deep to the index and little finger.
- Distal to the carpal tunnel the four tendons diverge, each passing towards a finger superficial to the corresponding flexor digitorum profundus tendon.
- The superficialis splits into two bundles which pass around the profundus to lie posteriorly.
- In this position they reunite and some fibres interchange from one bundle to another to form the Chiasma of Camper.

### **Insertion**

The two slips insert into the anterior surface of the middle phalanx.

### **Nerve Supply**

By several branches containing fibres from C8 and T1 and perhaps C7 From the median nerve. The uppermost usually arises before the median nerve passes through the pronator teres and goes to the humero-ulnar head of the muscle as the median nerve passes behind it. While the median nerve lies behind the muscle, it gives one or more branches to the radial head and usually an additional branch or so into the humero-ulnar head (Hollinshead, 1969).

## **MATERIALS AND METHODS**

The present study was done on 60 upper limbs (56 Males and 4 Females) of embalmed adult human cadavers obtained from Department of Anatomy, Govt. Medical College Patiala. The upper limb specimens were dissected in the following manner- The skin was reflected from the front of arm and hand. The superficial fascia was removed, and then the deep fascia was reflected. This exposed the muscles and tendons of the anterior group of forearm and hand. The flexor groups of forearm muscles were arranged in three groups: superficial, intermediate and deep. The muscles of each group were cleaned and identified from their origin and their tendons were followed as they passed beneath and above the flexor retinaculum and in the palm of the hand as far as their insertion. After cutting through middle of the muscles of superficial layer i.e flexor Carpi radialis Palmaris longus and pronator teres, intermediate layer was exposed which had one muscle i.e., flexor digitorum superficialis. After cutting through the middle of flexor digitorum superficialis, deep layer of flexor muscles was exposed in which flexor digitorum profundus and flexor pollicis longus were lying in one plane and pronator quadratus was identified deep to them.

### **Observation**

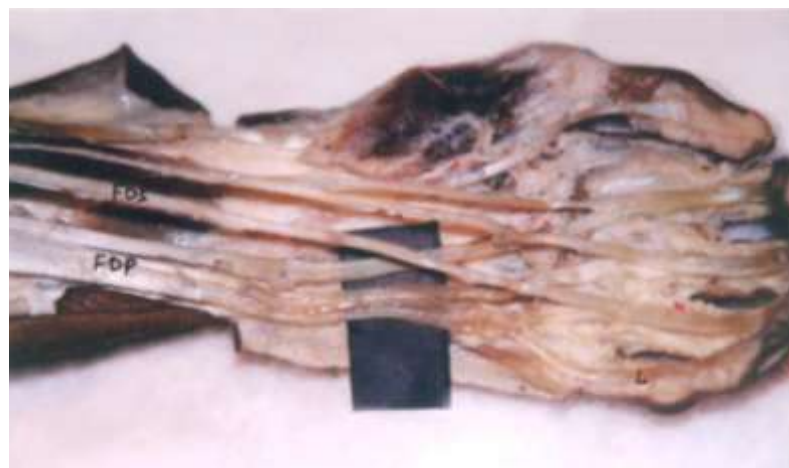
In all the 60 cases, Flexor digitorum superficialis (FDS) muscle was getting origin from medial epicondyle of humerus, medial border of the base of the coronoid process and about upper two third of the anterior border of the radius. The median nerve was passing behind the muscle. The site of insertion of flexor digitorum superficialis was on the side of middle phalanx by two slips, the nerve supply was from median nerve in all cases. These findings were in accordance with the standard textbook description.

In this study, in 6(10%) cases tendon of flexor digitorum superficialis going to little finger was not splitting proximally and the tendons of both flexor digitorum superficialis and flexor digitorum profundus were found running parallel to each other (Figure 1). The tendon of flexor digitorum profundus was not piercing the tendon of flexor digitorum superficialis. Near insertion each tendon of flexor digitorum superficialis was splitting into two slips and the insertion of two slips was on the sides of the middle phalanx. In 2 cases (3.3%), the muscle contributed to three tendons, when these tendons were traced to the palm, it was found that tendon for little finger was absent (Figure 2).

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**Figure 1: Tendon of FDS and FDP going parallel to each other in little (L) Finger and FDP is not piercing FDS tendon FDS- Flexor digitorum superficialis, FDP- Flexor digitorum profundus L- Left side**



**Figure 2: Tendon of FDS to little finger (L) is absent FDS– Flexor digitorum superficialis, FDP- Flexor digitorum profundus L- Left side**

**DISCUSSION**

In the present study in two cases (3.3%), the muscle contributed to three tendons, when these tendons were traced to the palm, it was found that tendon for little finger was absent.

Furnas (1965) found that in six instances (5%) out of 117 there was no muscle belly or tendon in the wrist representing the flexor digitorum sublimis to the little finger. In four of these cases dissection of the little finger revealed a small but otherwise normal distal tendon with the usual aperture for transmission of the profundus tendon. The tendon faded out proximally into a few diaphanous strands which merged into the walls of the ulnar bursa adjacent to the profundus tendon to the little finger. Schmidt (1990) also described this finding in both the hands of an eighty five year old female. The muscle bellies of the superficial finger flexor muscle for the little finger were absent. Instead of this, a thin tendinous cord arose from the tendon of the flexor digitorum superficialis of the ring finger proximal to the carpal tunnel to pass into the radial side of the flexor tendon sheath of the little finger at the level of the annular ligament. Together with an abortive tendon on the ulnar side the tendon was inserted into the middle phalanx.

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The curious anomaly is probably to the fact that the tendon of flexor digitorum sublimis are derived from the primitive intrinsic musculature of the hand whereas the muscle belly originates in the primitive extrinsic musculature (McMurrich, 1965). The most common cause of the absence of the tendon of little finger was found to be because of injury. The study of typical amphibian anatomical arrangement in the hand of *Megalobatrachus*, the giant salamander of Japan had shown that the superficial flexors of all the digits arose from the palmar fascia and are entirely intrinsic to the palm. All muscles of the forearm are inserted no farther distal than the metacarpus. It has been hypothesized that in the evolutionary development of the primate hand, the tendinous attachments of the forearm flexor muscles migrated beyond their metacarpal limit, establishing motile connection with the tendons of the intrinsic flexors in the palm. At this stage of evolution it is assumed that the palmar muscle tissue was resorbed producing the present anatomical arrangement of the primate hand (Wesser *et al.*, 1969). The flexor digitorum sublimis appeared first in mammals.

The arrangement of the tendons of the superficial brevis muscles, being perforated for passage of the profundus tendons, was already present as the results of the division of the digital slips of the aponeurosis. The belly of the sublimis muscle, split from the profundus muscle as the condylar portion, was first inserted into the palmar aponeurosis from which the superficial brevis took origin, so all that was needed in order for the muscle to move the digits was a separation of the aponeurosis from the carpus and conversion of brevis muscle into tendon (Bunnell, 1948). Dylevsky (2000) and Chaplin and Greenlee (1975) also have discussed these variations in relation to development. An anomalous muscle belly of flexor digitorum superficialis causing carpal tunnel syndrome is also reported by Vichare (1970) and Smith (1971). Still and Kleinert (1973) reported the anomalous muscles in nine patients which were clinically misdiagnosed as lipomas, ganglionic cyst, neurolipoma. They were causing nerve entrapment in wrist and hand. Out of these nine cases, three were related with flexor digitorum superficialis muscle. Considering the Importance of thumb and wrist mobility in hand function and the complexity of surgical procedures currently being used to remedy dysfunction in these areas, an awareness of anatomical variations in this region would be useful to many health care professional. So the variations are probably of more importance to the surgeons than to the comparative anatomist who attempt to solve the problem of the phylogenetic derivation of different muscles.

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