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# **Flexor Digitorum Brevis - An Anatomical Variation**

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### Abstract

The first layer of sole of foot consists of 3 muscles and Flexor Digitorum Brevis (FDB) is one of them. This muscle usually divides into four tendons, which pass to the lateral four toes. This paper reports a case in which the muscle variates with three tendons of the same muscle in the right foot. FDB flexes the lesser toes at proximal interphalangeal joint. The muscles of second layer, flexor hallucis longus and flexor digitorum longus (FDL) of the foot although presented with normal anatomy and FDL had 4 tendons. This variation is important from an evolutionary aspect that explains the atrophy of the muscles that are not used over time and may be a result of bipedal evolution, which emphasises the gradual reduction in use of little toe. These kind of variations are also important for the anatomists, sports people and surgeons for tendon transfer and designing foot prosthesis etc.

Keywords: Flexor digitorum brevis, Variation, Evolution, Anatomy, Foot.

## Introduction

Many variations of the muscles of leg and foot have been reported over the time by various authors<sup>1</sup>. This variation was observed during routine cadaveric dissection at department of Anatomy MGM Medical College, Indore. It is customary to group the planter muscles of the foot in four layers, because this is the order in which they are encountered during dissection<sup>2</sup>. This superficial layer includes abductor hallucis, abductor digiti minimi and flexor digitorum brevis (FDB) (Figure-1).

All three extend from the calcaneal tuberosity to the toes, and all assist in maintaining the concavity of the foot. FDB arises by a narrow tendon from the medial process of the calcaneal tuberosity, central part of the plantar aponeurosis and the intermuscular septa between it and adjacent muscles. It then divides into four tendons which pass to the lateral four toes and enter digital tendon sheaths.

Here they are accompanied by the tendons of flexor digitorum longus (FDL), which lie deep to them. At the bases of the proximal phalanges, each tendon divides around the corresponding tendon of FDL; the two slips then reunite and partially decussate, forming a tunnel through which the tendon of FDL passes to the distal phalanx<sup>2</sup>.

FDB is supplied by the lateral and medial plantar arteries, the plantar metatarsal arteries and the plantar digital arteries to the lateral four toes and innervated by the medial plantar nerve, S1 and S2. It flexes the lesser toes at the proximal interphalangeal joint, and its effect is same in any position of the ankle joint. It reinforces the longitudinal arch of foot, along with other muscles of the foot. Distortion of arches of foot is a consequence of paralysis of this muscle.



Muscles of 1<sup>st</sup> layer of sole of foot<sup>2</sup>

#### **Case Report**

During routine cadaveric dissection for postgraduate medical students at department of Anatomy, MGM Medical College, Indore, an anatomic variation was found in Flexor Digitorum muscle of the right foot. The FDB was exposed after removal of planter skin, adipose tissue and central part of planter aponeurosis. In the sole of right foot, FDB had 3 muscle bellies inserting into second, third and fourth toes and the 4th tendon of FDB muscle was absent (Figure-2). The left foot although showed 4 bellies of FDB. FPL of both feet were normal and showed 4 bellies.



Figure-2 Anatomic Variation with Flexor Digitorum Brevis of right foot having only 3 tendons

## Discussion

The slip to a given toe may be absent, or it may be replaced by a small muscular slip from the long flexor tendon or from flexor accessorius. Conversely, the slip may be joined by a second, supernumerary slip<sup>2</sup>. In a case reported from South India a 50 year old male presented with only 3 tendons of the FDB for the middle 3 toes while that for the little toe was missing, in place of which there was an isolated flexor muscle arising from the medial margin of tendinous plate of FDB<sup>3</sup>. Nathan and Gloobe reported that in 23% of their cases, a part of muscle and tendon inserting the fifth toe was absent and in 3% cases that inserting in fourth and fifth toe were absent. The muscle belly for fourth and fifth toe originated solely from tendon of FDL in 5% cases. They also reported in 1 % of their cases the muscle belly for fifth toe arising from the inter-muscular septum and its tendon fusing with that of FDL without dividing into two  $slips^4$ . 21% cases in a study by Bergman et al showed absent FDB tendon for the fifth toe where it was replaced by a small fusiform belly ring from the long flexor tendon<sup>5</sup>. FDB showed reduced 4th tendon in right foot and absent 4th tendon of both FDB and FDL, replaced by an isolated flexor to the fifth toe arising from the medial part of medial tubercle of calcaneum in the left foot in a case reported by the Claassen and Wree<sup>6</sup>. In another study by Yalcin and Ozan conducted on 33 feet, 6 feet showed absent muscle belly for the fifth toe where as in 12 feet it was observed that the muscle belly for the fifth toe was much smaller than the others<sup>7</sup>.

The usage of fifth toe in humans is minimal when compared to the little finger. It has no opposition action in humans. The variation presented in this paper may be a result of bipedal evolution, which emphasizes the gradual reduction in the use of little toe<sup>8</sup>.

From a clinical point of view, FDB musculocutaneous flap is used in the construction of the heel pad and FDB tendon transfer is employed in the correction of flexible claw and hammer toe deformities<sup>9</sup>. Thus, an in depth knowledge of the anatomical variations of this muscle will facilitate preoperative diagnosis as well as the surgical procedures of foot.

# Conclusion

Understanding muscle architecture of foot may assist the surgeons in designing foot prosthesis, in procedures such as tendon transfer and anatomists in understanding the evolutionary changes affecting foot. Reporting of such anatomical variations could also facilitate diagnostic imaging of foot.

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