Variation in the Origin of Flexor Digitorum Brevis – A Case Report

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Authors’ contributions

This work was carried out in collaboration between both the authors. Author TRR designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author SRR managed the analyses of the study and managed the literature searches. Both the authors read and approved the final manuscript.

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ABSTRACT

Arches of foot is the blend of skeletal and muscular components, which is exclusive characteristic feature of evolution as an alteration to routine erect posture in humans. The human foot is convened mechanical intricacy and essential constancy due to “arches of foot”. Appreciative muscle construction of the foot may assist in the intention of surgical trials such as tendon transfer, biomechanical sculpting of the foot, prosthesis strategy, and scrutiny of foot function. During routine dissection of the foot it was noted that the tendon of flexor digitorum brevis to the little toe was missing and was replaced by a musculo-tendinous slip arising from the tendon of flexor digitorum longus in the sole of the foot. Hence, the awareness of the incidence of absence and deviations of fourth slip of flexor digitorum brevis in relation to the demographic features of patients would be of clinical importance.

Keywords: Flexor digitorum brevis; anatomical variation; anomaly; muscles of the foot; phylogenetic variation.
1. INTRODUCTION

The flexor digitorum brevis (FDB) is one of the muscles which is undergoing a phylogenetic degeneration mainly owing to the various anatomical presentations, such as the absence or the hypotrophy of its fourth slip destined to the little toe. FDB presents in the middle of the sole of the foot, directly above the central part of the plantar aponeurosis, with which it is resolutely combined. It ascends by a slender tendon from the tuberosity of the calcaneus, the middle part of the planter aponeurosis, and the intermuscular septa, which flanked by it and neighboring muscles. It courses onward and splits into four tendons, to the lateral four toes. At the bases of the proximal phalanges, each tendon in turn divides into two slips, to let the channel of the resultant tendon of flexor digitorum longus; The two slips of the tendon then fuse together and form a grooved canal for the reception of the convoying long flexor tendon. Again, it splits for another time, and gets attached to the sides of the middle phalanx above its middle [1]. In 23.0% of cases, slip to the little toe recurrently lacking or it may be substituted by a small fusiform muscle taking origin from the long flexor tendon or from the Quadratus plantæ [2].

2. CASE REPORT

During routine dissection of cadavers for undergraduate medical students, in one of the middle aged Trinidadian African male embalmed cadaver we noticed the absence of the tendon of FDB going to the fifth toe. It was replaced by a musculo-tendinous slip arising from the tendon of flexor digitorum longus tendon in the sole of the left foot. However the insertion was found to be normal. Following the fine dissection, this anomalous muscular slip of origin was photographed. However, similar variation was not observed on the contra-lateral side (Fig. 1). Patients with such variations may be asymptomatic. Our aim is to contribute to existing knowledge of the variations and explaining their morphological and clinical significance. The details of this variation and its clinical significance are discussed herein.

3. DISCUSSION

Flexor digitorum brevis beside the other intrinsic muscles of the foot assist to preserve the longitudinal arches of the foot. Review of literature shows that FDB provides four tendons to the lateral four toes. Disparities in flexor digitorum brevis have been documented to happen in 63.0% of all limbs [3]. Nevertheless the nonappearance of FDB tendon to the fifth toe was described by many, however, the usage of the fifth toe in humans is minimal. In the distant future, some more variations in flexor digitorum brevis can be anticipated and total disappearance of FDB may be a possibility [4].

Fig. 1. Anomalous origin of flexor digitorum brevis slip to the little toe
1. Flexor digitorum brevis (FDB)
2, 3, 4. Tendons of FDB going to 2nd, 3rd & 4th toe
5. FDB to the little toe arising from the tendon of flexor digitorum longus
6. Tendon of FDB going to the little toe
7. Flexor digitorum longus tendon
8. Plantar aponeurosis

Variations of flexor digitorum brevis are clinically significant because FDB musculocutaneous flap is used in the reconstruction of the heel pad and flexor digitorum brevis tendons are used in tendon transfer surgeries for claw or hammer toe deformities. The absence of FDB tendon to the 5th toe shows cluster around Asian region, which
signifies possibility of occurrence of evolutionary changes in specific topographic region [5].

The slip of the flexor digitorum brevis to the little toe is recurrently faulty or incomplete. It may be existing but fail to extent the toe, it may blend on the fascia, or may extent to the toe but will not display the normal perforation. It may ascend distinctly from the fibular band of the plantar aponeurosis. In 21% of cases it is completely absent but may be substituted by a small fusiform muscle taking origin from the long flexor tendon, with sporadic added attachments to the medial tubercle of the calcaneus, the lateral intermuscular septum, or the accessorius. This slip represents part of the deep head which occurs in monotremes, marsupials, and all primates below man. The deep head may also be represented in another and more vestigial form by slips which pass from the deep tendon to reinforce or replace the tendons of the short flexor [6].

The muscle shows a tendency toward reduction, one or more of its fasciculi being frequently absent, and occasionally the whole muscle. The fasciculus for the fifth toe is absent in about 20% of bodies. When a fasciculus is absent, its tendon is usually replaced by an accessory tendon from the long flexor. The muscles or its tendons may be more or less fused to the tendons of the flexor digitorum longus [7]. The slip from the FDB to the little toe either be imperfect or completely absent. It could be present but fail to reach the toe, by blending with the fascia. It may arise separately from the fibular band of the plantar aponeurosis. It is absent in about 21% of cases, but may be replaced by a small fusiform muscle arising from the long flexor tendon, with occasional additional attachments to the medial tubercle of the calcaneus or lateral intermuscular septum. Either the muscle or its tendon may be comparatively joined to the joined to the tendon of flexor digitorum longus. Variations in this muscle occur in 63.0% of all limbs [8].

In the study conducted in Sri Lankan population, the fourth tendon is absent in 71.8%. The muscle was displayed to take origin from the medial process of calcaneus, plantar aponeurosis and intermuscular septa of neighboring muscles. It separated into three (71.8%) or four parts (28.1%) which terminated in small tendons to the 2nd, 3rd, 4th or 5th toes. It is indistinct that a complete awareness about the anatomical variants of flexor digitorum brevis will ease the consequence of surgical as well as diagnostic imaging techniques of the foot [9].

The 4th slip of flexor digitorum brevis, has a substantial clinical and surgical significance in medical practice. Conversely, as for the majority of tendons ordained to the little toe, the fourth slip is undergoing a phylogenetic deterioration. The intention of this study is to conduct an evidence creation on the occurrence of flexor digitorum brevis-5 and its deviations in humans. The awareness of the incidence of flexor digitorum brevis agenesis of the 4th slip and variants in relation to the demographic features of patients would be of significance for tendon repair, transfer or soft tissue reconstruction in foot surgery [10]. A rotational transfer of a musculocutaneous fold comprising of the flexor digitorum brevis muscle is considered as one of the best techniques presently accessible for casing and restructuring the weight-bearing area of the heel [11-14].

4. CONCLUSION
A sound knowledge of anatomical variations of FDB will simplify the consequence of surgical and diagnostic imaging of the foot. Surgeons and radiologists should be aware of the high rates of agenesis and smaller size of this slip when considering it for tendon transfer surgeries of claw and hammer toes, musculocutaneous flap for heel pad reconstruction or diagnostic imaging of soft tissue of foot to decrease chances of error while considering options of treatment.

CONSENT
It is not applicable.

ETHICAL APPROVAL
As per international standard or university standard written ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS
Authors have declared that no competing interests exist.

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