International Journal of Anatomy and Research,
Int J Anat Res 2017, Vol 5(3.2):4247-50. ISSN 2321-4287
DOI: https://dx.doi.org/10.16965/ijar.2017.298

Original Research Article

STUDY OF ABSENCE OF 4TH TENDON OF FLEXOR DIGITORUM BREVIS MUSCLE

Rakesh Kumar Agarwal [1], Seema Rani Khajuria *[2], Hemant Saini [3].

[1] Assistant Professor, Department of Anatomy, Maharishi Markandeshwar Medical College and Hospital, Kumarhatti Solan (H.P.) India.

*[2] Assistant Professor, Department of Anatomy, Maharishi Markandeshwar Medical College and Hospital, Kumarhatti Solan (H.P.) India.

[3] Demonstrator , Department of Anatomy, Maharishi Markandeshwar Medical College and Hospital, Kumarhatti Solan (H.P.) India.

ABSTRACT

Background: Flexor digitorum brevis is an intrinsic muscle of the sole of foot that lies immediately deep to central part of plantar aponeurosis.The flexor digitorum brevis divided into four tendons for lateral four toes. Each tendon is divided into two slips at base of proximal phalanx, to allow the flexor digitorum longus tendons and get inserted on both sides of the shaft of middle phalanx. It helps to reinforce arch of foot by flexing the proximal interphalangeal and metatarsophalangeal joints of the lateral four toes. Flexor digitorum brevis muscular flap is used in the reconstruction of the heel pad and it is frequently used to correct crossover toe deformity so architecture of the foot is important because it may help in the surgical procedures during correction of above deformities.

Materials and Methods: This study was conducted on 50 feet in 25 healthy cadavers to see the variation of flexor digitorum brevis tendon.

Result: We observed that fourth tendon of flexor digitorum brevis for the fifth toe was absent in 37 cadaver feet. Out of these 14 cadavers (28 feet) showed bilateral absence of the 4th tendon while unilateral tendon absence was seen in 9 feet.

Conclusion: we concluded that such variation may occur as phylogenetic change due to minimal use of 5th toe in evolved bipedal posture. The action of flexor digitorum brevis being flexion of toes can be compensated by another long flexor of the foot.

KEY WORDS: 4thTendon, 5th toe, Flexor digitorum brevis, Metatarsophalangeal joints.

Address for Correspondence: Dr. Seema Rani Khajuria, Assistant Professor, Department of Anatomy, Maharishi Markandeshwar Medical College and Hospital, Kumarhatti Solan-173229 (H.P.) India. **E-Mail:** drrakeshagarwal@rediffmail.com

Access this Article online

Quick Response code

DOI: 10.16965/ijar.2017.298

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 12 June 2017
Peer Review: 15 June 2017
Revised: None

Accepted: 03 Aug 2017
Published (O): 31 Aug 2017
Published (P): 31 Aug 2017

INTRODUCTION

Flexor digitorum brevis is an intrinsic muscle of the sole of foot that lies immediately deep to central part of plantar apnoneurosis and inferior to the tendons of flexor digitorum longus.It take origin from center part of plantar apnoneurosis, medial tubercle of calcaneal tuberosity and medial and lateral intramuscular septa.The flexor digitorum brevis is divided into four tendons for lateral four toes. Each tendon

is divided into two slips at base of proximal phalanx, to allow the flexor digitorum longus tendons and get inserted on both sides of the shaft of middle phalanx. Flexor digitorum brevis is supplied by medial plantar nerve. It helps to reinforce arch of foot by flexing the proximal interphalangeal and metatarsophalangeal joints of the lateral four toes [1]. Paralysis of flexor digitorum brevis results in distortion of arch of foot [2]. Due to bipedal posture the function of little toe is minimal and has no opposition action in humans. Hence, the tendon of little toe coming from flexor digitorum brevis muscle maybe absent sometime such variations of flexor digitorum is of clinical importance because it is often used in reconstruction of the heel pad and it is frequently used to correct cross over deformity and to treat painful toe disorders such as lateral ankle deformity [3,4].

Recent and ongoing advances in plastic and orthopedic surgeries of lower limb have created a need for detailed understanding of anatomical variations and morphometry of flexor digitorum brevis muscle. Bergman and Henle also describe the Anatomical variations and morphometry of flexor digitorum brevis in their studies [5,6].

MATERIALS AND METHODS

This study was conducted on total number of 50 feet on 25 healthy human cadavers in the department of anatomy, Maharishi Markandeshwar medical college and hospital, Kumarhatti, Solan (H.P).

Dissection of the sole of feet were performed according to the guidelines by Cunningham manual [1].

We took longitudinally incision through the skin and superficial fascia of the sole of foot from heel to the root of middle toe and reflected it. Then we cut the planter apnoneurosis 2- 3 cm from front of heal and split the distal part longitudinally away from the first layer of sole thus exposing the flexor digitorum brevis muscle and tendon [1].

RESULTS

This study was conducted on 50 feet of 25 healthy cadavers during this study we noticed that the 4th tendon which inserted on 5th toe was absent in 37 feet (74%) also see table no 1.

Bilateral absence of the 4th tendon shows in 14 cadavers in 28 feet (56%) (fig.1) and 9 (18%) show unilateral absence. Out of these 9 cadavers 5 (10%) were on right feet (fig.2) and 4(8%) were on left feet (fig.3).

Table 1: Frequency of variation in absence of 4th tendon of flexor digitorum brevis muscle Anatomical Variations.

Total No. Of Feet	Normal Feet	Percentages (%)
50	13	26%
	Total variations	
	37	74%
	Bilateral absence	
	28	56%
	Unilateral absence	
	9	18%
	Right sided (Unilateral)	
	5	10%
	Left sided (Unilateral)	
	4	8%

Fig. 1: Bilaterally absent of 4th tendon of (FDB) flexor digitorum brevis muscle showing only 1st, 2nd, 3rd tendons.

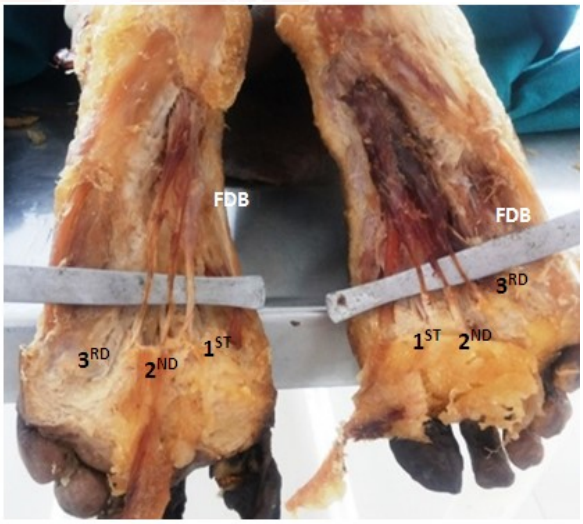

Fig. 2: Unilateral (right side) absent of 4th tendon of (FDB) flexor digitorum brevis muscle showing only 1st, 2nd, 3rd tendons.

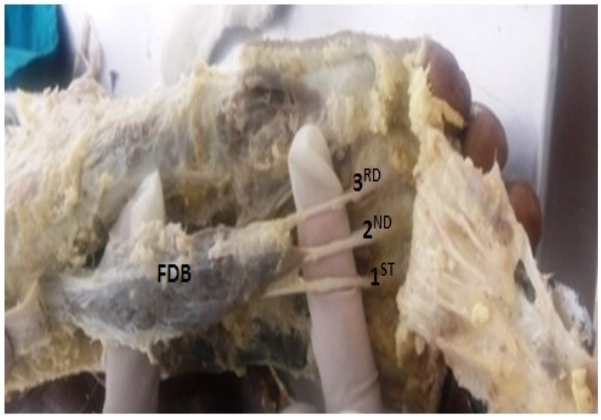

Fig.3: Unilateral (left side) absent of 4th tendon of (FDB) flexor digitorum brevis muscle showing only 1st, 2nd, 3rd tendons.

DISCUSSION

The knowledge of flexor digitorum brevis is essential in treating congenital abnormalities, pathological conditions and traumatic injuries of feet and ankle [7]. Flexor digitorum brevis is very important because it helps to control the changes in posture of foot and maintains the longitudinal arch of foot [8]. It carries out flexion of 2nd to 5th toe, a function maintained by flexor digitorum longus when former is expanded [9].

The incidence of absence of flexor digitorum brevis tendon of 5th toe is the commonest anatomical variation of this muscle. In our study we found incidence of 74% which is close to the incidence of 72% reported by llayperuma et al. [10] However lower incidences were seen in various other studies, 63%, 21%, 18% [11,5,12]. Lobo et al reported absence of 4th tendon in100% of the study population [13].

The incidence of bilateral absence of flexor digitorum brevis tendon of 5th toe in our study was 56% which is close to the incidence of 46% reported by Srivastava et al [14] and 38.2% reported by Yammine [15].

The incidence of unilateral absence of right flexor digitorum brevis tendon of 5th toe in our study was 18% out of which right sided absence was seen in 10% and left side in 8%. Srivastava el at reported similar findings 9% on right and 18% on the left [14].

During evaluation as brachiation is not used for locomotion, degenerative changes have occurred in muscle therefore, in man muscle is often absent unilaterally or bilaterally and incidences of agenesis is gradually increasing in different races and population [7]. The usage of 5th toe in human is minimal further more no opposition action in humans [16]. Thinking along these lines, it has been speculated that muscle acting on little toe are undergoing evolutionary changes [13]. This is further supported by the results obtained from an electronomiographic investigation of foot muscles that reports three toe flexor muscles act together to reassist extension of toes during the stancephase of locomotion.Despite the large flexor accesorius muscle in human, neither it nor the flexor digitorum brevis were preferentially recruited over the flexor digitorum longus for any normal posture or locomotion [17].

Sirasanagandla SR et alevaluated the morphometry of 44 fixed limbs. He measured length and breadth of the muscle and the length of each tendon from its origin to distal attachment. He revealed that the tendon of the great toe had the highest mean length (9.5 cm) and the tendon of the fourth toe had the lowest mean length (6.3 cm). Four of the limbs studied (9.09%) had only three tendons. Three of the limbs studied (6.81%) had five tendons [18].

Clinically, the knowledge of anatomical variation of flexor digitorum brevis is necessary for surgical and diagnostic purpose because understanding about muscle attachment of the foot may assist in designing of surgical procedures such as tendon transfer, biomechanical modeling of foot, reconstruction of heel pad, correction of flexible claw and hammer toe deformity.

CONCLUSION

In our study we observe that flexor digitorum brevis variation is common because out of the 50 feet, 37 feet shows the fifth toe did not receive any tendon. Bilateral absence observed in 28 feet while unilateral absence was observed in 9 feet. Out of these 9, right side tendon absence in 5 feet and left side in 4 feet. On the basis of our study and review of other literatures we concluded that such variation may occurs as phylogenetic change due to minimal use of 5th toe in evolved bipedal posture [13]. The action of flexor digitorum brevis being flexion of toes can be compensated by another long flexor of the foot. An awareness of this

variation is important for the surgeons for the reconstruction of the heel pad by transferring the musculocutaneous flap of flexor digitorum brevis muscle.[19, 20]

Conflicts of Interests: None

REFERENCES

[1]. Romnes GJ. Cunningham's Manual of practical Anatomy. 15th Edition, Vol 1. Oxford Medical Publication, Newyork, 2012.

[2]. Rosse C, Gaddum- Rosse P. Hollinshed's Text book from anatomy,6th edition. Lippincott – Raven. Philadelphia.P.867

[3]. Westlin NE, Vogler HW, Albertsson MP, Arvidsson T, Montgomery F. Treatment of lateral ankle instability with transfer of the extensor digitorum brevis muscle. J Foot Ankle Surg. 2003;42():183-92.

[4]. Lui TH, Chan KB. Technique tip: modified extensor digitorum brevis tendon transfer for crossover second toe correction. Foot Ankle Int. 2007;28 :521-3.

[5]. Bergman RA, Afifi AK, Miyauchi R. Extensor Digitorum Brevis (Pedis). Illustrated encyclopaedia of human anatomic variation: Opus I: Muscular system: alphabetical listing of muscles: E. Anatomy Atlases. 1988.

[6]. Henle J. Handbuch der Muskellehre des Menschen, in Handbuch der systematischen Anatomie des Menschen. Braunschweig: Verlag von Friedrich Vieweg und Sohn; 1871.

[7]. Chaney DM, Lee MS, Khan MA, Krueger W, Mandracchia VJ, Yoho RM. Study of ten anatomical variants of the foot and ankle. J Am Podiatric MedAssoc. 1996; 86 (11):532-7.

[8]. Grogono BJS, Jowsey J. Flexor accessoreus Longus-An unusual Muscle Anomaly.J Bone Joint Surg.1965; 47:118-9.

[9]. Hartrampf CR, Scheflan M and Bowstwick J. The flexor digitorum brevis muscle Island pedicle flap: A new in dimension heel reconstruction. Plast Reconstr surgy.1980; 66:264-70.

[10]. Ilayperuma I. On variation of muscle flexor digitorumbreves: anatomical insight. Int J Morphol. 2012; 30(1):337-40.

[11]. Nathan, H. & Globe, H. Flexor digitorum brevis- anatomical variations. Anat Anz.1974; 135:295-301.

[12]. Yalcin B, Ozan H.Some variations of muscular flexor digitorum brevis. Anat Sci Int. 2005; 80:189-92.

[13]. Lobo SW, Menezes RG, Mamata S, Baral P, Hunnarji S. Kanchan T et al. Phylogenetic variation in flexor digitorum: a Nepalese cavaderic study. Nepal Med Coll J.2008;10:230-2.

[14]. Srivastava AK, Solanki S, Gupta AK, Supriti, Singh B, Tandon A. Phylogenetic variation of muscle flexor digitorum brevis- Rare variation on the right foot. Ann Int Med Den Res.2016;2(1):117-20.

[15]. Yammine K. The fourth slip of the flexor digitorum brevis muscle of the human foot. A systemic review and meta-analysis.IJAE. 2015;120(1):59-70.

[16]. Stevenson TR, Kling TF Jr, Friedman RJ. Heel reconstruction with flexor digitorum brevis musculocutaneous flap.J Peditar Orthop. 1985;5:713-6.

[17]. Susman RL. Evolution of human foot: evidence from plio-pleistocene hominids. Foot ankle.1983;3:365-76.

[18]. Sirasanagandla SR, Swamy RS, Nayak SB, Somayaji NS, Rao MKG, Bhat KMR. Analysis of the morphometry and variations in the extensor digitorum brevis muscle flap and tendon transfer surgical dissection. Anat Cell Biol. 2013;46(3):198-202.

[19]. Ikuta Y, Murakami T, Yoshioka K, Tsuge K. Reconstruction of heel pad by flexor digitorum brevis musculocutaneous flap transfer. Plast Reconstr Surg.1984;74:86-96.

[20]. Garcia-GonzalezA, Bayod J, Prados-Fructos JC, Losa-Iglesias M, Jules KT, Vallejo RBB et al. Finite-element stimulation of flexor digitorum longus or flexor digitorum brevis tendon transfer for treatment of claw toe deformity. J Biomech. 2009;42:1697-704.

How to cite this article:

Rakesh Kumar Agarwal, Seema Rani Khajuria, Hemant Saini. STUDY OF ABSENCE OF 4Th TENDON OF FLEXOR DIGITORUM BREVIS MUSCLE. Int J Anat Res 2017;5(3.2):4247-4250. **DOI:** 10.16965/ijar.2017.298