



## Coexistence of anomalous m. peroneus tertius and longitudinal tear in the m. peroneus brevis tendon

M. peroneus brevis tendonunda longitudinal yırtığa eşlik eden anormal m. peroneus tertius

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The longitudinal tear in the m. peroneus brevis tendon is frequently observed as a less common cause of chronic ankle pain and disability. In this case the rare association of a longitudinal tear in the m. peroneus brevis tendon and an anomalous m. peroneus tertius origin of muscle bulk and insertion were detected during a routine dissection of the lower left extremity. The m. peroneus tertius was originating separately from the fibula rather than as a slip from extensor digitorum longus. The muscle bulk was also bulkier than normal. The fanned-out m. peroneus tertius tendon adhered almost on the entire dorsal surface of the fifth metatarsal bone. According to our case report one of the possible causes of the longitudinal tear in the m. peroneus brevis tendon can be an anomalous m. peroneus tertius with its different origin and insertion points and muscle bulk, via changing the ankle motion mechanism. This anomaly should be considered in the patients presenting with ankle pain in the clinic.

**Key words:** Anomaly; m. peroneus brevis; m. peroneus tertius; tendon tear.

M. peroneus brevis tendonunda görülen longitudinal yırtık, sık görülen kronik ayak bileği ağrısı ve rahatsızlığının yaygın olmayan bir nedeni olarak dikkat çeker. Bu olguda m. peroneus brevis tendonundaki longitudinal yırtık ve m. peroneus tertius tendonunun anormal orijini, kas kitlesi ve insertio'sunun nadir birlikteliği sol alt ekstremitenin rutin diseksiyonu sırasında bulundu. M. peroneus tertius'un origosu m. ekstansör digitorum'un bir kısmı olmaktan ziyade kendi başına fibula'dan başlıyordu. Kas kitlesi de normalde bulunan daha gelişmiş bir formdaydı. Yelpaze şeklinde olan m. peroneus tertius tendonu beşinci metatarsal kemiğin tüm dorsal yüzüne tutunuyordu. Olgumuza göre farklı başlangıç ve sonlanma noktaları ve gelişmiş kas yapısıyla varyasyonlu m. peroneus tertius'un ayak bileği hareket mekanizmasını değiştirerek muhtemelen m. peroneus brevis tendonundaki longitudinal yırtığa neden olduğu düşünüldü.

**Anahtar sözcükler:** Anomali; m. peroneus brevis; m. peroneus tertius; tendon yırtığı.

Longitudinal erosions and/or tears of the m. peroneus brevis tendon may lead to symptoms from mild pain to lateral ankle instability.<sup>[1-4]</sup> The exact pathoanatomy of this disorder is not clear. The m. peroneus brevis tendon's longitudinal erosions and/or tears are attributed to various mechanisms and anatomical variations such as a tear in the superior peroneal retinaculum, a distally located muscle belly of the m. peroneus brevis, avascular

zones in the m. peroneus brevis tendon, degenerative processes, presence of the m. peroneus quartus, abrasion over the calcaneofibular ligaments, cartilaginous ridge on the peroneal surface of the lateral malleolus, chronic ankle instability and an anomalous m. peroneus tertius tendon. Therefore it has been concluded that m. peroneus brevis tendon tears are of mechanical origin and not a result of degeneration.<sup>[5-7]</sup>

We found an anomalous m. peroneus tertius during the routine dissection of a lower left human extremity along with the longitudinal tear of the m. peroneus brevis tendon. We consider that this may be related to the pathoanatomy of longitudinal tears in the m. peroneus brevis tendon. We hereby aim to clarify the contribution of the m. peroneus tertius and brevis within the muscular system around the ankle and to review the role of their variations in ankle pain and instability cases within the scope of this case study report.

### CASE REPORT

During the dissection of the lower extremity of a 74-years-old male cadaver, an anomalous origin, a muscle bulk and tendon insertion of the m. peroneus tertius in the left ankle region was observed.

In this case, the m. peroneus tertius originated from the middle and lower third of the fibula and crural fascia but not from the extensor digitorum longus muscle. The m. peroneus tertius had an unusually large muscle bulk and its tendon was also thicker and wider than of the other cadavers (Figure 1). The tendon descended anteriorly and laterally and fanned out near its attachment point towards the almost entire dorso-lateral surface of the fifth metatarsal (Figures 2, 3).

In the same ankle, the m. peroneus brevis originated from the lateral aspect of the distal



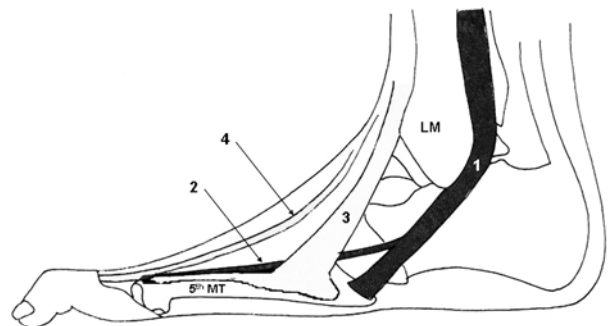
**Figure 1.** Dorsal aspect of left leg and foot showing muscles and tendons of peroneus tertius and extensor digitorum longus. 1: Common tendon of extensor digitorum longus; 2: Muscle belly of peroneus tertius; 3: Fanned-out insertion of peroneus tertius; 4: Tendons of extensor digitorum longus to the four toes; LM: Lateral malleolus.

two-third of the fibula, anteriorly to the m. peroneus longus origin and from the anterior and posterior of the crural intermuscular septa. It descended anteriorly to the m. peroneus longus and ended in a tendon that passed behind the lateral malleolus together with the m. peroneus longus tendon. Just below the tip of the lateral malleolus, the tendon turned anteriorly as it followed the contour of the bone. It was enclosed within the fibrous sheath of the peronei. The tendon then directed anteriorly and slightly laterally downward. After crossing the calcaneofibular ligament superficially, it passed above the calcaneal trochlear process through the tunnel formed by the inferior peroneal retinaculum. It fanned out and inserted on the styloid process of the fifth metatarsal bone (Figures 2, 3).

The m. peroneus brevis had a 4.3 cm long longitudinal tear where the peroneal muscles passed through the superior peroneal retinaculum behind the lateral malleolus (Figure 4). A thin tendinous



**Figure 2.** Lateral aspect of the left foot. 1: Fanned-out insertion of peroneus tertius; 2: Insertion of peroneus brevis tendon; 3: Thin tendinous extension of peroneus brevis tendon; 4: Sural nerve.



**Figure 3.** Illustration of the lateral aspect of left ankle joint showing anatomical variation of lateral peronei. 1: Peroneus brevis tendon; 2: Thin tendinous extension of peroneus brevis tendon; 3: Peroneus tertius tendon; 4: Extensor digitorum longus tendon; LM: Lateral malleolus; 5<sup>th</sup> MT: Fifth metatarsal bone.



**Figure 4.** Lateral aspect of the left ankle joint. 1: Proximal end of the peroneus brevis tendon tear; 2: Distal end of the peroneus brevis tendon tear; 3: Peroneus longus tendon; 4: Superior peroneal retinaculum; LM: Lateral malleolus.

slip extended from the *m. peroneus brevis* tendon, pierced through the fanned-out fibers of the *m. peroneus tertius* tendon and inserted on the base of the fifth proximal phalanx. This thin tendon of the *m. peroneus brevis* was lying very close to the sural nerve (Figure 2).

The extensor digitorum longus muscle has long thin tendons. The tendons of extensor digitorum longus muscle reached over to the second, third, fourth and fifth distal and middle phalanges. The tendon of the second phalanx was too thin compared to the other tendons of the extensor digitorum longus (Figure 1).

## DISCUSSION

In the majority of cases, the *m. peroneus tertius* is part of the extensor digitorum longus muscle and it arises from the distal third or more frequently, from the medial surface of the fibula; the adjacent anterior surface of the interosseous membrane and the anterior crural intermuscular septum.<sup>[8,9]</sup> In our case, the *m. peroneus tertius* originated from the middle and lower third of the fibula and crural fascia but not from the extensor digitorum longus muscle and it had an unusually large muscle bulk together with unusual tendon structures. Also a tear in the *m. peroneus brevis* tendon has been evaluated. There are an insufficient number of studies<sup>[10]</sup> regarding variations in the anatomy of the *m. peroneus tertius* in human subjects. Clinical studies proposed a correlation between a longitudinal splitting of the peroneal tendons and chronic

lateral ankle ligament instability, so that this condition causes chronic pain and causes the need for surgical treatment.<sup>[1,4,11]</sup>

Meyers<sup>[12]</sup> recognized the longitudinal tear in the *m. peroneus brevis* tendon in 1924. So far, longitudinal tears of the *m. peroneus brevis* tendon have been reported with an incidence of 11% to 37%,<sup>[2-4]</sup> and in all specimens only the *m. peroneus brevis* was involved. Sammarco and DiRaimondo<sup>[11]</sup> found 17 cases (average age 33 years) of *m. peroneus brevis* tendon tear in 47 patients who presented lateral ankle pain and instability. *M. peroneus brevis* tendon tears at young age may point to possible additional factors rather than the degenerative processes involved. The anatomical variations in adjacent structures may put additional strain on the *m. peroneus brevis* and enhance degeneration and tearing.<sup>[13]</sup>

Several mechanisms<sup>[3,5-7,12-16]</sup> have been described in the literature to explain the pathoanatomy of *m. peroneus brevis* tears. The main predisposing factor is probably the tear in the superior peroneal retinaculum, but the exact pathophysiologic mechanism is still unknown.<sup>[1,13]</sup> Other possible mechanisms include various anatomical patterns and blood supply defects of the peroneal tendons, structural differences of the fibular groove besides the traumatic and degenerative processes.<sup>[3,5-7,12-16]</sup>

Meyers<sup>[12]</sup> hypothesized that a *m. peroneus brevis* tear is the result of movement causing friction over the calcaneofibular ligaments, which are taut and prominent on both sides when the feet are markedly adducted or extended. A low, narrow, inconstant cartilaginous ridge was described on the peroneal surface of the lateral malleolus. This may also be a factor in producing the split in the fibrous portion of the tendon of the *m. peroneus brevis* or in roughing and later on damaging the edges when the tendon of this muscle is bifurcated.<sup>[12]</sup> During the last decade, several investigations of the micro-vascular anatomy and descriptions of the pathophysiology of a *m. peroneus brevis* tear have been published.<sup>[13-15]</sup> In the region where the *m. peroneus brevis* tendon passes through the fibular groove, the longitudinally-oriented intratendinous vascular network is interrupted and the tendon is almost avascular. In this region, the tendon is squeezed between the *m. peroneus longus* tendon and the bony slide bearing

of the lateral malleolus. The avascular zone of the m. peroneus brevis tendon has a variable longitudinal extension between 29 mm and 55 mm (average length: 40 mm).<sup>[14]</sup> Almost always, the central portion of the tendon is damaged and the most frequent type of rupture in both peroneal tendons is longitudinal splitting in the region behind the lateral malleolus.<sup>[3,13]</sup> This location corresponds well to the avascular region of the gliding zone behind the lateral malleolus.<sup>[15]</sup> In the literature the length of longitudinal ruptures in the m. peroneus brevis tendon was reported between 2 to 5 cm.<sup>[11,12]</sup> In our study the m. peroneus brevis tendon tear was 4.3 cm long. The angle of the fibular incisura with crural surface and its shape may effect the direction of the peroneal tendons, and can be lead longitudinal ruptures of these tendons during traumatic processes.<sup>[16]</sup>

Sobel et al.<sup>[13]</sup> found a m. peroneus brevis tendon tear in 34% of cases associated with the presence of an extra anomalous tendon, the m. peroneus quartus. The relative risk of a tear was duplicated in the presence of the m. peroneus quartus.<sup>[13]</sup> The relationship between the tears of the m. peroneus brevis tendon and the distal extent of its muscle belly was also evaluated.<sup>[5,6]</sup>

The presence of an anomalous m. peroneus tertius tendon has also been described to be associated with a m. peroneus brevis tear.<sup>[2,4]</sup> Its importance in ankle injuries was investigated previously but its relationship between the degenerative processes of the m. peroneus brevis tendon is still unknown.<sup>[17]</sup>

In conclusion, the longitudinal tear in the m. peroneus brevis tendon is being frequently observed and is now considered a less uncommon cause of chronic ankle pain and disability. The search for its etiology and association with various anatomical variations warrant further investigation. According to our study one of the possible causes of a longitudinal tear in m. peroneus brevis tendon can be an anomalous m. peroneus tertius with its different origin and insertion points and muscle bulk, via changing the ankle motion mechanism.

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