



ABNORMAL CONNECTIONS BETWEEN THE PLANTAR APONEUROSIS AND CALCANEUS

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ABSTRACT

There is a band of very tough tissue found under the foot called the plantar aponeurosis or plantar fascia. The areas found within it are called central, lateral and medial and the most important of these is the central area. In this segment, the front is wider and dips to the back, while two long, upward-directed septa are found between the muscles of the foot. The soft tissue on your sides and center is the thinner portion and the center is the thinnest part of all. In front, the left and right sides of the midbrain are thin, while they thicken as you move toward the back. The plantar fascia mainly supports the shape of the longitudinal arch in our feet. As part of a standard dissection at the Medical University, I found an abnormal appearance of the plantar aponeurosis. Using tissue taken from a human body, researchers photographed the unusual finding. Several strands were detected at the beginning or proximal point, of the plantar aponeurosis in the left foot. All of them appeared like various octopus tentacles organized in different ways. Two threads went from side to side, joining the body's fat cells and a third went straight back away from the centre. Particularly, the beginning of the cell revealed that the first lateral strand split into several different fascicles. Not many research findings exist about changes in the plantar aponeurosis. Foot surgeons must be familiar with the special features of the foot's anatomy.

Keywords :- Fibers, Brain, Human, Aponeurosis, Calcaneus.

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INTRODUCTION

From this point of view, it is mainly the plantar aponeurosis that helps maintain the shape of the foot's arch. This tissue helps hold the foot's structure while rotating, reduces movement in the metatarsals and affects the flexibility of the foot [1,4,7]. Over time, the plantar aponeurosis (also called plantar fascia) is constructed of white and shiny fibers. This blood vessel is formed by a central, lateral and medial segment [11]. The plantar region and sometimes the plantar fascia can experience several clinical health problems. Dupuytren's contracture

occurs when too many fibroblasts near connective tissue result in the body making too much matrix material in the palmar and plantar fasciae [13]. Inflammation of the plantar fascia or plantar fasciitis, is one of the most common foot conditions in the United States and causes pain along the sole from the heel. The thickest section of the plantar aponeurosis is over its midline. In this place, the fibers are very close to the medial process of the calcaneal tuberosity at the back wall of the flexor digitorum brevis origin. In front, the human fibula first gets wider, then narrows again before breaking down into

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five digital processes near the metatarsal bone heads.

Most people use one of two approaches which are called the superficial approach and the deep approach. It goes beneath the skin down to the transverse groove, where it divides the bottom of the foot from the toes. The deep layer breaks up into two parts, covering the tendons of the toes and becoming part of their sheaths. The arches that short and long tendons go beneath are held in place by the transverse metatarsal ligament and these slips. Out of the muscle fibers, these form two vertical septa that rise up into the foot and separate the intermediate group from the muscles on the other sides of the foot. The flexor digitorum brevis starts on the back surface of the central lower leg. The abductor hallucis muscle's most narrow part, the medial part, runs beneath it. In addition, the extensor digitorum brevis connects on the medial side with the fascia across the top and ties into the lacinate ligament in the back. In addition, the muscles attach to the middle part of the aponeurosis along their side. The lateral portion has a thicker back than front. Also, it reaches the abductor digiti minimi muscle and becomes a strong band linking the lateral portion of the calcaneus to the base of the fifth metatarsal. This type of muscle reaches from its middle to its two sides, where it attaches to the dorsal fascia. Much of the weight on this part of the arch is handled by the plantar fascia. Because it often weakens the top of the calcaneus, plantar fasciitis results in pain where the heel connects to the foot. After surgical or torn fascia, a person's lost arch flexibility and stiffness is commonly seen. Function in the plantar fascia varies every time you put pressure on your feet. During contact, the arch extends which greatly improves foot performance [11]. Many studies point out many tasks of the plantar fascia, though it mainly helps by keeping the arch stable and operating in the windlass mechanism. It is hoped that this study will show a different architectural structure of the human foot that may influence certain medical issues.

MATERIALS AND METHODS

As part of a thorough morphological study, the Department of Anatomy and Histology at the Medical University carried out dissection on specimens donated by the public. These experiments were completed according to the university's ethical rules and were approved by its review board. All steps of the donor program upheld the donor's dignity, privacy and consent. When dissecting the plantar region of the foot in our specimens, we came across a noticeable variation in one. Here, the scientist studied the plantar aponeurosis, a strong and tough structure found on the sole of the foot. Most often, this structure stabilizes the longitudinal arch and helps the body carry weight and maintain movement. But the researchers observed only on the left

foot a pattern of fibers that wasn't detected in the right foot of the specimen. At the bottom of the shin, above the calcaneal tuberosity, small extensions of fibers were spread in different directions. The surface of these strands reminded me of octopuses tentacles as they branched in different directions underneath the skin. The vein had two extensions into the side adipose tissue and one center extension toward the inside. Most interesting was a group of finer nerve fibers that subdivided into many narrower ones, taking on the form of a cluster with a fan-like shape that was not mentioned in the existing literature. Experts don't usually classify plantar fascia into smaller branches because that's atypical for this type of tissue. The focus on the central component has stood out the most as it features the thickest tissue and helps hold up the foot's arch. Still, this finding suggests there may be more to peripheral fascia than was thought before. Traditional anatomical books lack information about these peripheral short paths seen so typically in this case. Given that plantar aponeurosis features in many surgical situations, including plantar fasciotomy, repair of the foot arch and addressing plantar fasciitis, having knowledge about these variations is very important. Doing surgery on them incorrectly could cause the surgeon to miss or misinterpret the real diagnosis and face surgical problems. In addition, this finding demonstrates the need to review basic anatomy covering the plantar aponeurosis and motivates further studies on this tissue. Analyzing the spread and role of variations in feet could lead to better information on foot movement, planning for surgery and learning about foot disorders. The results of this study suggest that we should keep studying how people's bodies vary. Additional studies ought to explore how important these fascial strands are for the stability, movement and health of the foot.

RESULT

When we opened up the plantar aponeurosis of the left foot, we found a unique and previously unseen variation. The anatomy of the variation featured the presence of fibrous strands growing out of the origin (origo) of the plantar aponeurosis. They looked like tentacles, marked 2, 3, 4 and 5 and were missing from the right foot. Two of the strands ran out into the nearby adipose tissue, while a third pointed backward and toward the center of the body. Importantly, the first lateral strand subdivided into a number of smaller fibers, pointing towards a more detailed structure here. By contrast, standard plantar aponeurosis structure was found, marked by a main part that is triangularly thickened and splits into five bands from the middle of the metatarsal bones. The bands of these two layers are separated at the metatarsal heads into superficial and deep layers. Additional findings include ten transverse

septa formed by deep fibers, the medial plantar nerve passing through the space between the aponeuroses and the septum dividing into middle and lateral bands. Some of the fibers seen in the fibular region were different and occasionally they joined muscles such as the adductor

hallucis and flexor digiti minimi brevis. The way the fibers are arranged in the plantar fascia has not been described before and highlights the fact that plantar fascia anatomy is both complex and varied from person to person.

Table 1: Anatomical Variation and Structural Overview of the Plantar Aponeurosis: A Case Observation

Category	Details
Anatomical Structure Observed	Unusual fibrous strands on the left foot only ; not present on the right foot.
Description of Variation	<ul style="list-style-type: none"> - Fibrous strands at the proximal end (origo) of plantar aponeurosis. - Resemble octopus tentacles (arrows 2, 3, 4, 5). - Two strands extend sideways into adipose tissue; one goes backward and inward. - One lateral strand subdivides into many tiny fascicles.
Normal Anatomy – Central Part	<ul style="list-style-type: none"> - Central part is triangular, thickened, and strongest. - Separates into five bands near mid-metatarsal joint.
Band Division	- Near metatarsal heads: each band splits into superficial and deep parts.
Deep Tract Function	<ul style="list-style-type: none"> - Formed by fibers from medial and lateral aponeuroses. - Continues to plantar ligament of 4th MTP joint. - Stabilizes joint during movement.
Transverse Bands	<ul style="list-style-type: none"> - Retinacula cutis form transverse bands. - Deep fibers create 10 septa leading to deep transverse metatarsal ligament and proximal phalanges.
Fibular Side Variation	<ul style="list-style-type: none"> - Known for high individual variation. - Medial fiber bundle may start transverse head of adductor hallucis and flexor digiti minimi brevis.
Medial Septum	<ul style="list-style-type: none"> - Often ends or does not exist where great toe flexors/adductors cross foot. - Area where tendinitis could originate (medial cuneiform, navicular, tibialis posterior tendon).
Medial Plantar Nerve Path	- Passes through large opening towards associated muscles.
Septum Band Division	<ul style="list-style-type: none"> - Starts centrally, divides into three bands. - Each has middle and side slips that attach deeply.
Flexor Hallucis Longus Passage	<ul style="list-style-type: none"> - Passes through distal septal bands. - Held in position by lateral head of flexor hallucis brevis.
Flexor Hallucis Brevis Origin	- Originates from middle band of the septum.
Tibialis Posterior	- Passes muscle called ' metatarsal extension ' through the septum.
Literature Review	- Prior studies describe general structure and function , but do not mention unusual strand-like texture observed in this case.

DISCUSSION

Results from this dissection show an unusual feature in the plantar aponeurosis that has not been discussed in previous scientific literature. The discovery of tentacle-like fibrous strands at the front end of the plantar aponeurosis on the left foot indicates that fascial structure may be different for every individual. Instead of one simple arrangement, they show several, with two going to the sides of the fat pad and the other toward the back inside the muscle. Most sources describe the plantar aponeurosis as having three areas, medial, lateral and central and it is recognized that the central section is both the thickest and most important in how it functions.

It supports the arch from front to back and helps movement of the foot through the windlass. The case study also adds a new aspect by finding lateral branching of the fascicle and thin, occasional divisions within the fibers. Such an approach may distribute loads better or give more mechanical support for some, though researchers have not yet investigated its biomechanical impact thoroughly. Histology often points out that the plantar aponeurosis is built from uniform connective tissue. Registry of such interesting fascicular groupings makes it clear that our knowledge of brain structure is incomplete. Such fibrous bands, with the first lateral band branching into many small bundles, might suggest

either an adaptive change or a developmental mistake. They are believed to impact foot symptoms such as unexplained pain on the heel or difficulties while performing surgical procedures such as plantar fasciotomy. These observations on the fibular side agree with previously reported anatomical variations in the region. It also makes it clear that clinicians should know how the body's structures function in each patient. Since there can be different structures around the plantar surface, surgeons need to be careful not to make mistakes during the procedure. If these traits are well understood, surgeons could make better decisions and give patients with plantar fasciitis or tarsal tunnel syndrome more successful outcomes from surgery. Studying further types of fascial arrangements can add to our knowledge of both healthy foot mechanics and conditions.

CONCLUSION

The case study shows an undescribed variation in the plantar aponeurosis, with multiple fibers shooting out from the upper side of the left foot. These strands—with the lateral one even branching into smaller groups—give the plantar fascia a more detailed structure than was previously understood. Being only on one side and how complex they everge, optive aponeurosis i a

fundamental component of foot function, helping to hold the arch and participate in the windlass mechanism while walking. Accordingly, small differences in the structure, described in the study, can play a role in biomechanics and raise the risk for plantar fasciitis, tendinitis or plantar pain. Although there are clear divisions of the plantar aponeurosis into medial, lateral and central parts, its anatomy is best understood with details of fine fascicles and lateral extensions. Such abnormalities should be well understood by foot and ankle surgeons in the medical field. Problems can occur during procedures on the plantar fascia, tendons or reconstruction if surgeons do not notice unusual fascial structures. It's important to take into account that the textbook descriptions may not exactly match what you find anatomically. This study suggests that more work is needed to study the plantar fascia at the anatomical, histological and biomechanical levels, to learn more about these variants and their implications in medicine. A lot of the time, anatomy shows considerable variation between individuals which may impact their health and functions. The practice of studying anatomy by watching medical cases allows doctors to be better at diagnosing, performing surgery and supporting patients in podiatric and orthopedic fields.

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