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An Applied Anatomical Study on the Inferior Extensor Retinaculum of Ankle

Un Estudio de Anatomía Aplicada del Retináculo Extensor Inferior del Tobillo

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SUMMARY: Through anatomical observations, the anatomical characteristics of the inferior extensor retinaculum of ankle (IER) of the ankle joint were elucidated, and its potential applications in treating lateral ankle instability or other conditions were discussed. A total of 12 adult foot specimens were dissected to expose the inferior extensor retinaculum of ankle, and a standard model was established. The pre-experimental scheme guided the recording of general findings, adjacent structures, lateral attachment in the tarsal sinus region, and influence on movement of inferior tendons. 1, attachment mean width: lateral band of IER 6.6±1.38 mm, oblique superomedial band of IER (32.3±3.97 mm), oblique inferomedial band of IER (30.0±5.30 mm) ; 2, mean length:lateral band of IER (78.1±4.20 mm) , oblique superomedial band of IER (14.2±0.80 mm), oblique inferomedial band of IER (71.8±2.61 mm); 3, maximum mean thickness: lateral band of IER (1.52±0.03 mm), oblique superomedial band of IER (0.89±0.05 mm), oblique inferomedial band of IER (0.73±0.16 mm); 4, the closest distance between IER and the tip of lateral malleolus: 23.9±0.83 mm; 5, mean width of the fiber tunnel:lateral fiber tunnel (11.9±1.16 mm), intermedium fiber tunnel (6.8±1.24 mm), medial fiber tunnel (8.6±0.79 mm); 6, mean distance from tunnel midpoint to lateral malleolar tip: lateral fiber tunnel (38.0±3.74 mm), intermedium fiber tunnel (69.8±4.15 mm), medial fiber tunnel (181.1±6.00 mm); 7, the distance between medial dorsal cutaneous nerve and the tip of lateral malleolus on the level of the IER (79.2±8.3 mm) the distance between intermediate cutaneous nerve of dorsum and the tip of lateral malleolus on the level of the IER (57.9±1.02 mm). The inferior extensor retinaculum of ankle is a crucial restraint unit of the anterior ankle tendon, and a comprehensive understanding of its anatomical characteristics holds significant implications for treating chronic ankle instability and exploring potential clinical applications.

KEY WORDS: Inferior extensor retinaculum of ankle; Anatomical characteristics; Ankle joint.

INTRODUCTION

Located at the junction of the anterior ankle and dorsum of the foot, IER inferior extensor retinaculum of ankl is typically shaped like a transverse "Y" due to local deep fascia thickening (Stecco *et al*., 2010), which effectively stabilizes the subtalar joint while preventing arch-string-like eminence in both inferior tendon and deep fibular nerve (Lui, 2014).The clinical application of IER's Broström-Gould modified operation (Gould *et al*., 1980) for the treatment of chronic ankle instability (CAI) has gained widespread consensus and demonstrated certain outcomes (Cox, 1985; Karlsson *et al*., 1988; Hamilton *et al*., 1993; Scranton Jr. *et al*., 2000; Lee *et al*., 2011; Martin *et al*., 2021). However, it has been established that there are still some unresolved issues. Furthermore, as a prominent topic in foot and ankle surgery, IER has also been found to be closely associated with the occurrence and progression of Sinus tarsal syndrome (STS) (Choudhary & McNally, 2011; Li *et al*., 2018). Currently, there is a lack of comprehensive exposition on IER within this subject field. Therefore, the objective of this paper is to provide a detailed anatomical analysis of IER through an in-depth study of foot specimens, aiming to establish an anatomical foundation for its clinical application.

MATERIAL AND METHOD

Specimens and Ethics. There were 6 adult foot specimens and 6 fresh foot specimens fixed by 10 % formalin solution, including 10 for anatomical observation and 2 fresh foot specimens for exercise observation (formalin specimens were perfused through popliteal artery or posterior tibial artery. There are 6 left and right specimens, 6 males and 6 females). The specimens were included in the criteria: no

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trauma, no joint degeneration, no graft, no severe osteoporosis.

Medical anatomical tools, 4-0 silk thread knitting non-absorbent suture, vernier caliper (accuracy 0.02 mm), soft ruler (accuracy 1.0 mm), Nikon D7100 SLR camera, Photoshop 6. 0 software. The collection and experimental process of specimens meet the ethical requierments of the use of cadaver specimens in Shenzhen University.

Gross observation. In 10 specimens, the skin lines and body surface marks around the IER were observed in the neutral position. A longitudinal midline incision is made over the anterior ankle, extending 10 cm proximally to the third metatarsal bone. Then, a transverse incision was made at the level of 10 cm above the supramalleolar region, followed by another transverse incision from the medial cuneiform bone along the dorsum of foot to reach of tuberosity of fifth metatarsal bone. The free skin margin turned to respective sides and removed the skin, identified and protected the cutaneous nerves and blood vessels in the superficial fascia, identified the superior extensor retinaculum of ankle, inferior extensor retinaculum of ankle, superior fibular retinaculum and inferior fibular retinaculum. The general shape, fiber distribution and attachment position of the inferior extensor retinaculum of ankle were observed, and the mean length, width and maximum thickness of the lateral band, oblique superomedial band and oblique inferomedial band were measured.

Adjacent structure. The distribution and course of the superficial fibular nerve were observed in the superficial fascia layer. Also we investigated whether the medial and lateral branches of the superficial fibular nerve have branches at the level of the inferior extensor retinaculum of ankle. The distance from the superficial fibular nerve to the tip of the lateral malleolus was recorded. The deep fascia around the inferior extensor retinaculum of ankle was carefully dissected to expose the inferior extensor retinaculum of ankle and its fiber tunnels. The position, number and contents of the fiber tunnels were observed, and the mean width of each tunnel and the distance from the midpoint of the channel to the tip of the lateral malleolus were measured.

Lateral attachment. Carefully clean the external opening of the tarsal sinus, remove the extensor digitorum brevis and extensor hallucis brevis, which are covering the external opening of the tarsal sinus to ensure that the lateral attachment of the inferior extensor retinaculum of ankle are clearly visible. Then record the number and position of the lateral attachment. Further dissection, completely exposing subtalar joint, observing and recording the attachments and course of the two ligaments in the tarsal sinus, and their positional relationship with the lateral attachment of the inferior extensor retinaculum.

Motion observation. Another 2 fresh specimens were treated with the same method, the superficial fascia was dissected, the inferior extensor retinaculum of ankle in the transverse region of the ankle (about 1.5 cm) was removed, three fiber tunnels were exposed, and the integrity of the surrounding deep fascia was ensured. At the junction of the muscle and tendon of the ankle extensor apply the tension to the proximal end to simulate the dorsal extension movement of the ankle joint, and observe whether the anterior ankle tendon will appear bowstring-like eminence, in the case of the defect of the extensor retinaculum in the transverse region of the ankle.

Statistical analysis. The anatomical measurements of all specimens were performed by the same operator for three times and took the mean. The results were statistically processed by Excel software, and the measurement data were expressed by mean ±standard deviation (x±s).

RESULTS

Gross observation. Through the anatomy of 10 specimens, it was found that the body surface of IER was projected distal to the line between the medial and lateral malleolus and below the transverse striations of the dorsum foot. When the skin and superficial fascia were removed, the thickness of IER was thicker than that of the surrounding deep fascia, and the fiber bundle was tough, showing a banded, flat and non-independent "Y" structure (Fig. 1).

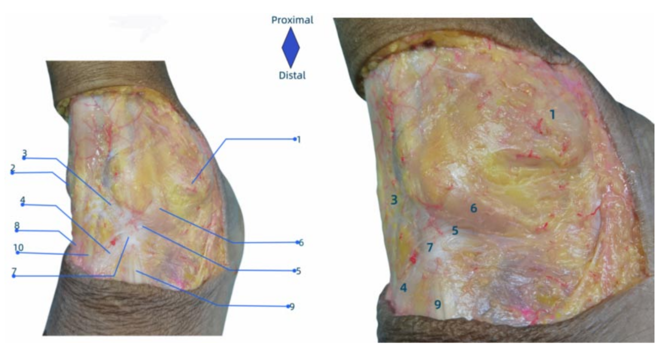

Fig. 1. The inferior extensor retinaculum of ankle preserves the superficial fascia layer. 1. Lateral malleolus; 2. Medial malleolous; 3. Oblique superomedial band of inferior extensor retinaculum of ankle; 4. Oblique inferomedial band of inferior extensor retinaculum of ankle; 5. Lateral band of inferior extensor retinaculum of ankle; 6. Tarsal sinus; 7. The three parts of inferior extensor retinaculum of ankle meet at the "Y" point; 8. Tendinous sheath of tibialis anterior muscle; 9. Extensor digitorum longus tendon and fibular tertius tendon; 10. Extensor hallucis longus tendon.

The lateral band of IER gradually narrowed and thickened at the lateral orifice of the tarsal sinus, ended at the lateral wall of calcaneus, and gradually moved outward to act as the inferior fibular retinaculum. The lateral band of IER was divided into two bundles to the medial side of foot at the medial edge of the digitorum longus tendon ("Y" bifurcation) (Fig. 2): the oblique superomedial band ran medially and upward to the anterior edge of the medial malleolus, and the oblique inferomedial band ran medially and downward to the medial margin of the plantar aponeurosis of abductor hallucis, scaphoid and medial cuneiform bone. The nearest distance D1 between IER and the tip of lateral malleolus was 23.9±0.83 mm. The observation results of each part of IER are shown in Table I.

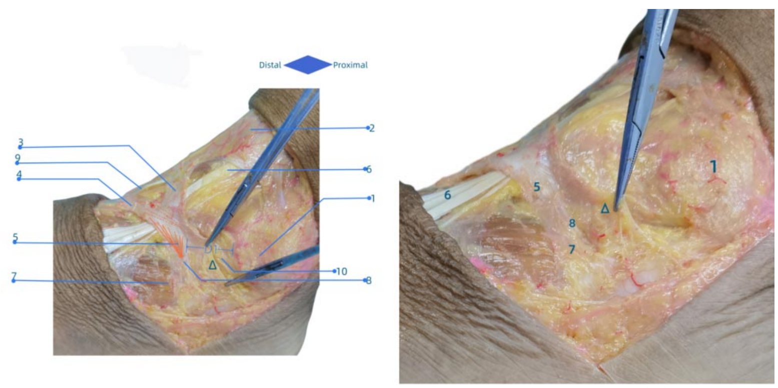

Fig. 2. Part of the superficial fascia was removed and inferior extensor retinaculum of ankle was exposed. 1. Lateral malleolus; 2. Superior extensor retinaculum of ankle; 3.Oblique superomedial band of inferior extensor retinaculum of ankle; 4. Oblique inferomedial band of inferior extensor retinaculum of ankle; 5. Lateral band of inferior extensor retinaculum of ankle; 6. Extensor digitorum longus tendon; 7. Origin of extensor digitorum brevis; 8. tarsal sinus; 9. Extensor hallucis longus tendon; 10. Anterior talofibular ligament with superficial fascia preserved (obscured). D1=23.9±0.83 mm. (The portion of the forceps lifted): the portion of the superficial fascia in the sinus tarsi area retained. Solid arrow: Course of fibers in the lateral band of inferior extensor retinaculum of ankle. Dashed line: Course of fibers in the superficial fascia in the sinus tarsi region above and outside the subextensor retinaculum.

Adjacent structure. It was found that the terminal branch of superficial fibular nerve passed through the surface of IER in all 10 specimens.After the superficial fibular nerve emerges from the deep fascia in the middle and lower leg,the distal part is divided into medial dorsalis pedis nerve and intermediate cutaneous nerve, both of which pass through the surface of the lateral band of IER. The distances between the medial dorsal cutaneous nerve (D2) and the Intermedium dorsal cutaneous(D3) nerve at IER level and the tip of the lateral malleolus were (79.2±8.3) mm and (57.9±1.02) mm, respectively.

IER sends out muscular septum to the deep part and surrounds the talus neck horizontally, forming three fibrous tunnels.The top of the fibrous tunnel is IER, the bottom is composed of articular capsule and deep fascia, and the bilateral walls are muscle septum.

The contents of the lateral fibrous tunnel are the third fibula tendon and the extensor digitorum longus tendon, which are attached to the navicular-cuboid joint. The intermediate tunnel is attached near the talonavicular joint, through the tendon of the extensor hallucis longus tendon, dorsalis pedis artery and vein, and deep fibular nerve. The medial tunnel is the anterior tibial tendon, which is attached to the navicular wedge joint, and the surface of each fiber tunnel is covered with synovium. The width of the three fiber tunnels and the distance from the midpoint to the tip of the lateral malleolus are shown in Table II and Figure 3.

Table I. The measurement of the IER based on morphology (Mean±SD).

	Lateral band of IER	Oblique superomedial band of IER	Oblique inferomedial band of IER
Attachment mean width (mm)	6.6±1.38	32.3±3.97	30.0±5.30
Mean length (mm)	78.1±4.20	14.2±0.80	71.8±2.61
Maximum mean thickness (mm)	1.52±0.03	0.89±0.05	0.73±0.16

Table II. The measurement of fiber tunnels of dorsal foot observations (Mean±SD).

	Lateral fiber tunnel	Intermedium fiber tunnel	Medial fiber tunnel
Mean width of the fiber tunnel (mm)	11.9±1.16	6.8±1.24	8.6±0.79
Mean distance from tunnel midpoint to lateral malleolar tip (mm)	38.0±3.74	69.8±4.15	181.1±6.00

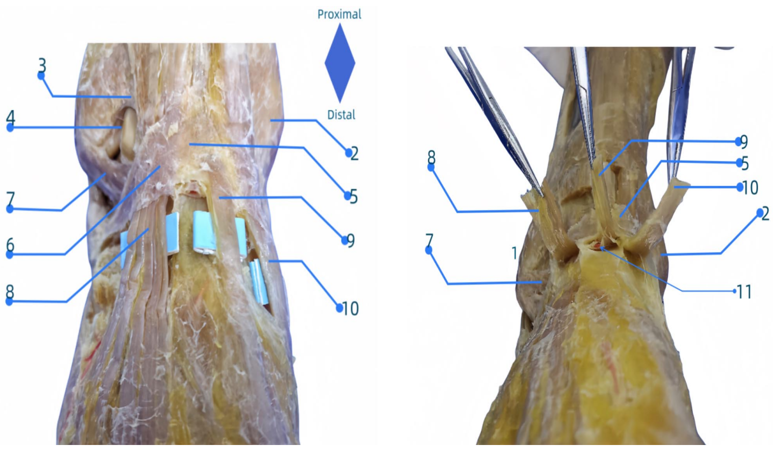

Fig. 3. Anatomy of dorsalis pedis fiber channels (Plantar flexion). 1. Lateral malleolus; 2. Medial malleolous; 3. Anterior lower tibiofibular ligament; 4. The articular surface of the talus and lateral malleolus; 5. Inferior extensor retinaculum of ankle ; 6. Lateral band of inferior extensor retinaculum of ankle; 7. Anterior talofibular ligament; 8. Extensor digitorum longus tendon (located in lateral fiber tunnel); 9. Extensor hallucis longus tendon; 10. tendinous sheath of tibialis anterior; 11. Dorsal pedis artery, deep fibular nerve of the intermedium fiber tunnel.

Lateral attachment. The lateral attachment of IER was located at the external orifice of tarsal sinus, where the lateral band of IER gradually narrowed, thickened and extended laterally, ending at the lateral wall of calcaneus. The lateral attachment of IER consists of three cable-like fiber bundles, with clear boundaries. The attachment is arranged in the coronal plane in turn in the tarsal sinus, which is divided into lateral root, intermediate root and medial root. Among them, the lateral root runs outward and downward, and the attachment is located on the lateral wall of the calcaneus far from the fibular trochlea, and extends laterally to the inferior fibular retinaculum. The intermediate root is located in the posterior medial part of the anterior tubercle of the calcaneus, adjacent to the calcaneal attachment of the cervical ligament, located at the proximal calcaneal attachment of the cervical ligament and the intermediate root exits the tarsal sinus in a vertical direction.

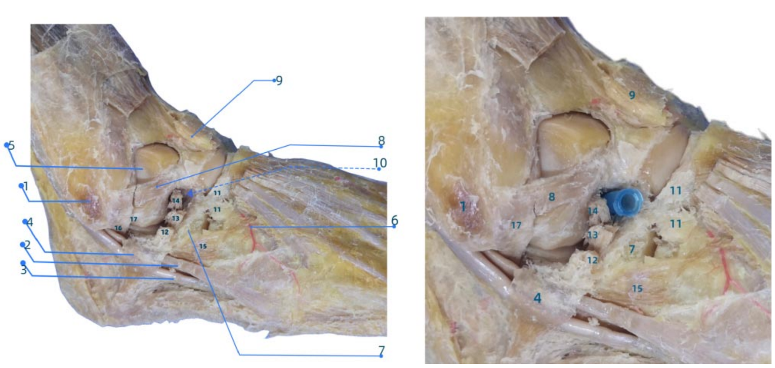

Fig. 4. Lateral attachment of inferior extensor retinaculum of he ankle (IER). 1. Lateral malleolus; 2. Fibular brevis tendon; 3. Fibular longus tendon; 4. Inferior fibular retinaculum; 5. The articular surface of the talus and lateral malleolus; 6. Lateral tarsal artery; 7. Anterior tubercle of calcaneus; 8. Anterior talofibular ligament; 9. The severed IER; 10. Cervical Ligament, CL; 11. Bifurcate ligament; 12. Lateral root of IER; 13. Intermediate root of IER; 14. Medial root of IER; 15. Dorsal side of the calcaneocuboid ligament; 16. Calcaneofibular ligament (occluded by the fbular brevis tendon); 17. Lateral talocalcaneal ligament.

The medial root attachment of IER is located in the final interior part of the tarsal canal and is widely fused with the calcaneal attachment of the interosseous talocalcaneal ligament (ITCL), the synovium in the calcaneal sulcus and the fat pad. The ligament between medial root and ITCL shows a V-shaped distribution on the coronal plane. The medial root runs obliquely from the tarsal canal through the tarsal sinus, converges with the intermediate root and lateral root to form the lateral band of IER (Fig. 4).

Motion observation. By dissecting and simulating the dorsal extension of ankle joint in 2 specimens, it was found that with the contraction of the ankle extensor group, the three tendon bundles slided in the inner wall of their respective fiber tunnel. No protuberance was found in the defect region.

DISCUSSION

Anatomical characteristics of IER. The inferior extensor retinaculum of ankle (IER) is located at the distal end of superior extensor retinaculum of ankle and the junction of the anterior ankle and dorsalis pedis. It is a transverse "Y" shaped uneven, asymmetric, and tenacy-like structure in the superficial layer of the deep fascia of the ankle joint, which is thickened by the local deep fascia rather than an independent anatomical structure. Its unevenness is reflected in the inconsistency of fiber thickness throughout the IER. The thickening of IER was most obvious at the junction of lateral band, oblique superomedial band and oblique inferomedial band (the "Y" bifurcation of extensor digitorum longus tendon).In addition, the attachment region where the lateral band of IER converges into the tarsal sinus is thickened under direct vision. On the contrary, the IER gradually becomes thinner as it moves medially to the medial malleolus and medial cuneiform bone, and its boundaries are difficult to distinguish. The asymmetry of IER is reflected in the difference between the two medial bands and the lateral band of IER. The length of the two medial bundles is long, the width is large, the fiber is thin, and the attachment is widely distributed, while the lateral band is short, the width is small, the fiber thickens and converges, and the attachment is concentrated in the tarsal sinus. The strong toughness of IER is reflected in that it is not easy to pull and the degree of activity is small under direct vision, especially in the thickest junction of the three bands (the "Y" bifurcation of the extensor digitorum longus tendon) to the lateral attachment region. Dalmau-Pastor *et al*. (2016) believes that the lateral band is the essential part of IER and compares the lateral band to the rhizome of the trunk of trophoblast, which is called stem/frondiform ligament. The upper surface of IER passes through the terminal branches of the superficial fibular nerve, that means, the medial dorsalis pedis cutaneous nerve and intermedium dorsal pedis cutaneous nerve. They all branch far from the inferior edge of the IER. The position relationship between the medial dorsalis pedis cutaneous nerve and the IER is relatively unstable, which may be related to the height exit of the superficial fibular nerve from the deep fascia in the lower leg. The projection of the intermedium cutaneous nerve of the dorsalis pedis on IER is located between the third fibula muscle and the extensor digitorum longus tendon, and the position relationship with the lateral malleolus is relatively constant. The shortest distance between the intermedium cutaneous nerve of dorsalis pedis and the tip of lateral malleolus was (57.9 ±1.02 mm) at the level of IER. The superficial fibular nerve passes through the surface of IER and the lateral terminal branch is close to the lateral malleolus, therefore, it can help us to locate and avoid nerve injury during operation.

Anatomy of IER in tarsal sinus region. As the attachment area of the lateral attachment of IER, the tarsal sinus plays an important role in the stability of IER in the dorsum of foot and the limitation of tendons in anterior malleolus. The thickening, narrowing and rotation of IER through the orifice of the tarsal sinus are transformed into three fascicular stops distributed on the coronal plane: the medial root, the intermediate root and the lateral root.

The lateral attachment of IER and the nuchal ligament jointly closes the external orifice of the tarsal sinus, in which the lateral root of IER walks outward and downward and continues to extend to the fibular retinaculum. The intermediate root ends at the posterior medial side of the anterior tubercle of the calcaneus, near the calcaneal attachment of the cervical ligament. At the same time, it extends longitudinally and perpendicular to the horizontal plane in the tarsal sinus, which is consistent with the ultrasonic observation of previous findings (Jotoku *et al*., 2006; Dalmau-Pastor *et al*., 2018). The medial root of IER ends in the innermost tarsal canal and is at the same level as the ITCL. It is of clinical significance to grasp the anatomical structure of IER in the tarsal sinus region for the protection of the sinus structure.

Numkarunarunrote *et al*. (2007) and Dalmau-Pastor *et al*. (2016) also studied the lateral part of IER and found that IER has an extra flat, short, weak, active external oblique superolateral band (OSLB)which is defined as the "X" type retinaculum. We consider that this statement is inappropriate. Anatomically, IER has been always described as a "Y"-shaped structure, defined as the thickened part of the deep fascia, while the oblique superolateral band has no visible thickening, so conceptually, the characteristics of the external oblique superolateral band contradict the definition of IER. The lateral attachment of IER is that the lateral band enters the tarsal sinus through narrowing, thickening and rotation, and is closely attached to the calcaneus. Compared with the three fiber roots of the tarsal sinus, oblique superolateral band is not as dense and tenacious as the three fibers in the IER sinus, besides, the attachment is unstable. The external oblique superolateral band described Dalmau-Pastor *et al*. (2016, 2018) is different from the traditional concept of IER and our anatomical findings. We think that oblique superolateral band is most likely to be the deep fascia of the ostium of the tarsal sinus, which may mislead clinicians, so oblique superolateral band does not have a full representation of IER, and the traditional definition of "Y" shape is more consistent with the characteristics of IER.

Clinical application of IER. At present, IER is mainly used to treat chronic ankle instability. As a frontline method for anatomical repairing the anterior talofibular ligament, Broström-Gould has done a lot of research, but there are only a few articles on IER itself, and our cognition of IER is also not systematic. The initial literatures only mentioned the use of IER in the lateral part of the Broström-Gould procedure (Gould *et al*., 1980), but did not describe in detail which part of the IER was used to strengthen the lateral malleolus. At present, most of the recording methods are to pull the lateral part of the IER directly to the periosteum of the lateral malleolus for suture and anchor fixation. However, according to our experimental results, IER, especially its lateral part, has extremely strong toughness, is not easy to extend, and is deeply integrated with the surrounding fascia and has a certain distance from the lateral malleolus, so it is extremely difficult to pull the lateral bundle to the lateral malleolus.

At present, most of the recording methods are to pull the lateral part of the IER directly to the periosteum of the lateral malleolus for suture and anchor fixation. However, according to our experimental results, IER, especially its lateral part, has extremely strong toughness. It is not easy to extend, and is deeply integrated with the surrounding fascia and has a certain distance from the lateral malleolus. Obviously it is extremely difficult to pull the lateral bundle to the lateral malleolus. If IER is to be used, it must be dissociated during the operation and its tight connection with the lower ligament and joint capsule must be completely severed so that it can reach the lateral malleolus. Therefore, it is likely that the previous surgery did not use IER but instead utilized the deep fascia in the tarsal sinus.

Currently, the Gould method has been subject to scrutiny by scholars who have conducted biomechanical tests and postoperative follow-up to compare it with the traditional Broström repair as well as the modified Broström-Gould method. The findings indicate that there is no significant difference between these two approaches (Behrens *et al*., 2013; Jeong *et al*., 2014; Samejima *et al*., 2021; Murray *et al*., 2023). Dalmau-Pastor *et al*. (2016, 2018) also suggests that while surgery using the Gould method may be feasible in cases where the "X" retinaculum exists, its weak structure compromises ankle stability and reconstruction outcomes. Therefore, further investigation and discussion are necessary to assess the feasibility and practicality of implementing the modified Broström-Gould procedure. In the foot anatomy that simulates active contraction of the anterior calf muscles, absence of attachment of IER directly above the anterior ankle tendon results in absence of bowstring-like eminence, which is consistent with Lee *et al*. (2021) conclusion. Cho *et al*. (2012) believes that the IER is an important structure for stabilizing the transverse tarsal joint and metatarsal appendage joint. It also restricts the lateral movement of the Extensor digitorum longus tendon at the anterolateral fornix of the talus.

According to our anatomical observations, the IER serves as a protective and restrictive mechanism for the anterior ankle and dorsalis pedis tendons, forming a pulley-like structure that prevents subluxation or chord-like eminence of the extensor tendon. This is achieved through extensive fusion of fascia and bone surfaces at both medial and lateral ends, close attachment to lower fibrous channels, as well as superior retinaculum of the extensor and deep fascia of the dorsalis pedis. In essence, if the fascia system of the dorsalis pedis is closely attached, any minor defect in IER has negligible impact on the anterior ankle tendon. Our experiments have revealed that IER surrounds the talus neck and is in close proximity to the talus stop of the anterior talofibular ligament. These characteristics suggest potential clinical applications for IER and warrant further investigation. Tourné & Peruzzi (2019) have utilized IER as an autogenous tendon to reconstruct the anterior talofibular ligament , while others propose using it to reconstruct the inferior tibiofibular ligament (Beumer *et al*., 2000; Harris *et al*., 2022).This provides a practical basis for considering IER reconstruction of the anterior talofibular ligament.

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RESUMEN: A través de observaciones anatómicas, se dilucidaron las características anatómicas del retináculo extensor inferior (IER) de la articulación del tobillo y se discutieron sus posibles aplicaciones en el tratamiento de la inestabilidad lateral de esta articulación u otras afecciones. Se disecaron 12 muestras de pies de individuos adultos para exponer el retináculo extensor inferior del tobillo y se estableció un modelo estándar. El esquema preexperimental guió el registro de los hallazgos generales, las estructuras adyacentes, la inserción lateral en la región del seno tarsal y la influencia en el movimiento de los tendones inferiores. Se determino: 1. Ancho medio de inserción: banda lateral de IER (6,6 ± 1,38 mm), banda superomedial oblicua de IER (32,3 ± 3,97 mm), banda inferomedial oblicua de IER (30,0 ± 5,30 mm); 2. Longitud media: banda lateral de IER (78,1 ± 4,20 mm), banda superomedial oblicua de IER (14,2 ± 0,80 mm), banda inferomedial oblicua de IER (71,8 ± 2,61 mm); 3. Espesor medio máximo: banda lateral de IER (1,52 ± 0,03 mm), banda superomedial oblicua de IER (0,89 ± 0,05 mm), banda inferomedial oblicua de IER (0,73 ± 0,16 mm); 4. Distancia más próxima entre IER y el ápice del maléolo lateral: (23,9 ± 0,83 mm); 5.Ancho medio del túnel de fibra: túnel de fibra lateral (11,9 ± 1,16 mm), túnel de fibra intermedio (6,8 ± 1,24 mm), túnel de fibra medial (8,6 ± 0,79 mm); 6. Distancia media desde el punto medio del túnel hasta la punta del maléolor lateral: túnel de fibra lateral (38,0 ± 3,74 mm), túnel de fibra intermedio (69,8 ± 4,15 mm), túnel de fibra medial (181,1 ± 6,00 mm); 7. Distancia entre el nervio cutáneo dorsal medial y el a´pice del maléolo lateral en el nivel del IER (79,2 ± 8,3 mm); la distancia entre el nervio cutáneo intermedio dorsal y el ápice del maléolo lateral en el nivel del IER (57,9 ±1,02 mm). El retináculo extensor inferior del tobillo es una unidad de restricción crucial del tendón anterior del tobillo, y una comprensión integral de sus características anatómicas tiene implicaciones significativas para el tratamiento de la inestabilidad crónica del tobillo y la exploración de posibles aplicaciones clínicas.

PALABRAS CLAVE: Retináculo extensor inferior del tobillo; Características anatómicas; Articulación talocrural; Articulación del tobillo.

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