**The movements of the ankle-joint / by W. Arbuthnot Lane.**

With the Author's compliments

19.

# Movements of the Ankle-joint.

by

W. Arbuthnot Lane.

FROM THE

JOURNAL OF ANATOMY & PHYSIOLOGY

1888 Vol. XXII.

# THE MOVEMENTS OF THE ANKLE-JOINT.

By W. Arbuthnot Lane, M.S., F.R.C.S., *Senior Demonstrator of Anatomy, Guy's Hospital; Assistant Surgeon to the Hospital for Sick Children, Great Omond Street.*

In a recent contribution to the *Guy's Hospital Reports*, 1887, entitled "The Causation, Pathology, and Physiology of the Deformities which Develop during Young Life," I discussed very fully the anatomy and physiology of the movements of the foot, and I believe that I succeeded in placing them on a completely new and correct scientific basis.

In it I argued, that *as the labour changes in the skeleton represent first the fixation, and subsequently the exaggeration of a single normal voluntary movement, so do many of the acquired deformities, such as lateral curvature, flat foot, dorsal excurvation, knock-knee, &c., represent first the fixation, and subsequently the exaggeration of a normal physiological position of rest.*

In this paper I intend to consider in detail the anatomy and physiology of the ankle-joint. I can, perhaps, best do this by quoting from the last edition of Quain's *Anatomy* the movements which are said to take place between the astragalus and the tibia and fibula, since that text-book may be regarded as best representing the teaching of the present day, and I will then attempt to show that the description is incorrect.

The acceptance as fact of the principles laid down in it has led to erroneous methods of diagnosis and of treatment of fractures of the tibia and fibula occurring in the vicinity of the ankle-joint, as well as to many other surgical inaccuracies.

In order to do so I must first state briefly some of the conclusions at which I arrived from the study of the foot, since they bear upon the subject.

They are, *firstly*, that besides the ligaments of the foot already described in works on anatomy, there is another very important one which has escaped the observation of anatomists. It is attached to the inner aspect of the sustentaculum tali

behind, and in front to the inner surface of the tuberosity of the scaphoid, and to the whole of the posterior margin of the upper surface of that bone. One portion of this ligament lies internal to the head of the astragalus, and another portion above the head. Its posterior margin receives the insertion of the deltoid and superior astragalo-scaphoid ligaments, these being attached but indirectly to the scaphoid.

This ligament I have named the *superior internal calcaneo-scaphoid ligament*, on account of the position it occupies with regard to the head and neck of the astragalus. Since it lies in two planes, the direction of its fibres differs. Those in the vertical portion are directed upwards and forwards, while those which lie above the head of the astragalus run outwards and forwards.

That part of the superior internal calcaneo-scaphoid ligament which is in relation with the inner surface of the head of the astragalus is always very thick, and in some cases is enormously so. It is frequently a quarter of an inch in thickness, and cartilaginous and gritty on section. *The tendon of the tibialis posticus muscle lies on the inner surface of this ligament.*

*Secondly*, that the inferior calcaneo-scaphoid ligament is a much less important structure than the preceding. As compared with it it is comparatively thin. Behind it is attached to the fore part of the sustentaculum tali, and in front to the posterior margin of the lower surface of the scaphoid. Its fibres are directed obliquely inwards and forwards, its inner margin being parallel to and in contact with the lower margin of the superior internal calcaneo-scaphoid ligament, with which it is often continuous, and its outer margin with the short calcaneo-cuboid and external calcaneo-astragaloid ligaments. The *body of the tendon of the tibialis posticus bears no relationship to this ligament*, though the process which passes backwards and slightly outwards from its posterior margin to the sustentaculum tali lies immediately beneath it. The head of the astragalus lies upon its upper surface.

*Thirdly*, that the external calcaneo-scaphoid ligament is triangular in form. Its apex is attached to the upper surface of the greater process of the os calcis, and its base to the junctions of the posterior margin of the lower and outer surfaces of

the scaphoid. The fibres forming its inner margin run parallel to those of the inferior calcaneo-scaphoid ligament, while those forming its upper or outer margin run forwards and upwards. This ligament opposes any displacement outwards or inwards of the scaphoid, when that bone is rotated upon an antero-posterior axis.

It is obvious, therefore, that the os calcis is connected to the scaphoid by a capsule, which is complete everywhere except above and externally, the superior astragalo-scaphoid ligament filling in the interval between the superior internal and the external calcaneo-scaphoid ligaments. The fibres forming this capsule are arranged very obliquely in relation to an antero-posterior axis passing through the head of the astragalus, and their direction of obliquity is such that, if the scaphoid be rotated by raising its tuberosity, the longitudinal extent of the ligaments connecting it with the os calcis is diminished, while, if the scaphoid be rotated in a reverse direction, their antero-posterior measurement is increased.

On the contraction of the tibialis posticus muscle the astragalus is displaced a little upwards and backwards by the shortening of the calcaneo-scaphoid ligaments. At the same time, the traction exerted by these three ligaments, and the process of the tibialis posticus which is inserted into the sustentaculum tali, draws the os calcis inwards and upwards with the scaphoid.

The traction exerted by the tibialis posticus upon the scaphoid is transmitted anteriorly and laterally to the adjoining bones. The oblique fibres of the short calcaneo-cuboid ligament prevent the inward displacement of the cuboid from off the anterior surface of the os calcis, while it is assisted to some extent by the long plantar ligament in retaining the opposing surfaces of these bones in contact. The same principle of limiting movement is made use of in the calcaneo-cuboid articulation as is utilised in the sacro-iliac joint, namely, the apposition of irregularly concavo-convex surfaces, any movement between them being followed by their necessary separation, this being limited and opposed by strong, dense ligaments. The slight separation of the cuboid and os calcis, produced by the contraction of the tibialis posticus, causes, by means of the long plantar ligament, an increase in the convexity of the outer arch.

The contraction of the tibialis posticus muscle produces an increased convexity of both longitudinal arches, and more especially of the inner, also a movement of those arches inwards around an axis which passes from behind, forwards, inwards, and downwards through the astragalus.

I have called this movement *adduction of the longitudinal arches, or of the foot, upon the astragalus.* A movement termed *inversion of the foot* is described in the text-books. I think it is obviously the movement I have explained above, though it is described somewhat briefly and very incorrectly by the authors of those works. For instance, I find in Quain, vol. i. p. 185, the following:—

"The navicular and cuboid bones can be moved downwards and inwards, or upwards and outwards, over the fore part of the astragalus and calcaneum respectively. It is in these articulations mainly that the movements known as *inversion* and *eversion* have their seat. In inversion the fore part of the foot is depressed and carried inwards, the longitudinal arches are increased, and the outer margin of the foot descends more than the inner, so that the sole is turned to some extent inwards. In eversion these actions are reversed, and the foot resumes its normal position. . . . . Inversion of the foot is always associated with extension, and eversion with flexion of the ankle-joint."

I will only state here that I see no reason for the last assertion, and would refer the reader for full details to my paper in the *Guy's Hospital Reports.* Before proceeding further, I will again quote from Quain's *Anatomy,* vol. i. p. 170, from the movements of the ankle-joint:—

"The movements of the ankle-joint are mainly those of flexion and extension of the foot, the direction of those movements being determined by the shape of the articular surfaces. The external border of the superior cartilaginous surface of the astragalus is curved and longer than the internal border, and hence extension of the ankle-joint is accompanied with a slight inward movement of the fore part of the foot. The horizontal surfaces of both the tibia and astragalus are broader in front than behind; hence in complete extension of the ankle the narrow part of the astragalus is brought into the widest part of the space between the malleoli, and a certain amount of lateral motion is allowed under influence of external force; whereas in complete flexion, as when the weight of the body, with fully bent knees, is supported on the toes, the broad part of the surface of the astragalus is pushed back in the narrowest part of the space, and the inferior extremity of the fibula is pressed upon, so as to stretch the ligaments between it and the tibia, and thus to prevent lateral move-

ment of the joint, and give it at the same time a certain amount of spring. There appears to be no other movement between the tibia and fibula; these bones being bound together at their lower ends with remarkable firmness."

The above includes the whole of the description of the movements of the ankle-joint, and there is *no portion* of it to which I cannot take exception, and *which, I think, I can show to be absolutely incorrect.* With regard to the first statement, I hope to show that very little lateral movement can take place between the astragalus and the tibia and fibula in the vigorous adult subject in any position of the ankle-joint. I will first call attention to the second sentence, namely, to the description of the upper and outer articular surfaces of the astragalus, since I believe that it is absolutely incorrect, and that the deductions derived from it are also equally unfounded.

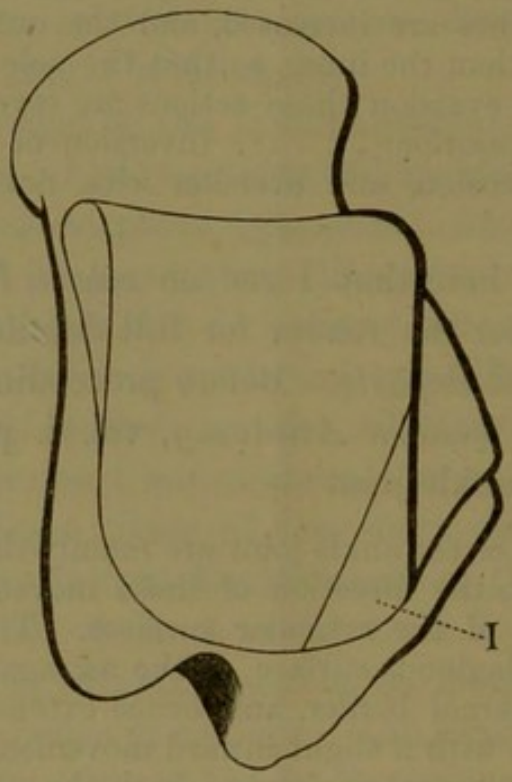


FIG. 1.—Ankle-Joint.

As the point which I wish to demonstrate is but feebly marked on the dry bone, I have represented the upper surface of a recent astragalus diagrammatically in fig. 1, since the articular surfaces are much more clearly defined when covered by cartilage.

The outer border of the superior cartilaginous surface of this

bone is said to be curved, and a superficial examination of the dry bone might lead one to suppose this statement to be correct, but in the recent state it is at once obvious that what appears to be the direct prolongation, backwards and inwards, of the outer margin of the superior articular facet, is merely the inner boundary of a special undescribed triangular facet, which I have indicated by the numeral I in the diagram. This triangular facet is limited externally by what is the true outer border of the upper surface of the astragalus, so that it is consequently but a subdivision of it, and not a portion of the fibular facet, as the descriptions in works on anatomy would lead one to suppose. According to the account of this bone in Quain's *Anatomy*, this triangular facet must be included in the outer surface of the astragalus, since the latter surface is said to be separated from the upper by the so-called oblique backward prolongation of its outer margin.

To describe the articular surface of the astragalus more accurately, one should describe a triangular area as being cut off from the posterior and outer part of its upper surface. This portion looks obliquely backwards, outwards, and slightly upwards. The apex of the triangle is directed forwards, and corresponds to a point considerably in front of the centre of the outer margin of the upper surface of the bone, its inner margin passes obliquely backwards and inwards to the posterior limit of the articular surface, while its outer boundary is formed by the prolongation directly backwards of the outer margin of the tibial facet.

The anterior extremity of the outer border of the tibial facet on the astragalus is on the same transverse vertical plane as that of the inner margin. The borders of the upper surface, including, of course, the triangular area to which I have called attention, run parallel, or nearly so, to one another as far back as the posterior extremity of the inner one, the outer being prolonged for nearly a quarter of an inch beyond the inner. In some bones, as in that from which I traced fig. 1, these borders run quite parallel to one another, but in a larger proportion the interval between the posterior extremity of the inner and that point in the outer border in the same vertical transverse level is less than that between the anterior terminations of these borders by about $\frac{1}{16}$th to $\frac{1}{19}$th of an inch.

The next question which arises is—What function does this triangular area perform? or, putting the question in another way—What are the factors which determine its formation? In order to answer this question, I must digress for one moment in order to consider certain anatomical details.

Quain describes the anterior and posterior ligaments of the ankle-joint as "merely scattered fibres in front of or behind the joint; those of the posterior are weak, and principally transverse."

As regards the posterior ligament, the portion of the above description which refers to it is most incomplete and incorrect.

Quain describes a *transverse* or *inferior tibio-fibular ligament* as "a short band of yellowish fibres, under cover of the posterior ligament; it runs horizontally from the hinder border of the lower articular surface of the tibia to the contiguous part of the external malleolus, and closes the angular interval between the bones."

I would point out that a long and narrow bundle of ligament does exist in the position described by Quain; but when cleaned out and exposed as a separate ligament it is loose and flaccid, and in such a condition cannot perform any useful function.

I would describe this band of fibres as only a portion of the posterior ligament of the ankle-joint. This latter structure is, in my opinion, a very distinct and important one. It is attached externally to the fibula in the interval between the attachments of the posterior inferior tibio-fibular ligament and the posterior fasciculus of the external lateral ligament. Long bands of dense fibrous tissue extend from the malleolus obliquely outwards and upwards, to be attached to the posterior inferior margin of the tibia; others pass outwards and downwards, to be attached to the posterior surface of the astragalus; and others, which are less strong, run inwards, and blend with the posterior border of the deltoid or internal lateral ligament.

These radiating fibrous bands are connected together to form a single complete ligament, which covers in the ankle-joint posteriorly.

The upper margin of this ligament is practically continuous with the posterior inferior tibio-fibular ligament, and its lower limit with the posterior fasciculus of the external lateral ligament.

On flexing the ankle-joint, the posterior ligament, which appears to be somewhat elastic, is made tense, and opposes and tends to limit flexion. While the joint is being flexed, the posterior ligament, together with the posterior inferior tibio-fibular and the posterior portion of the external lateral ligament, rest and play upon the triangular area which I have described as being present in the upper articular surface of the astragalus. These ligaments are separated from the remainder of the superior articular surface of the astragalus by a distinct interval.

Careful examination will show that this triangular facet is produced by the habitual pressure exerted by the ligaments upon the bone in flexion of the ankle-joint; also, that however extreme be the position of flexion, yet *the ligamentous facet*, if I may so term it, never articulates with the articular surface of the tibia or fibula.

The plane of the facet on the inner surface of the astragalus lies in a double incline, since it runs forwards, downwards, and inwards, the direction of its surface being inwards, upwards, and backwards. The inward slope is exaggerated in the lower and anterior portion of the facet.

Though the plane of the triangular facet on the outer surface of the astragalus does not deviate continuously from the vertical, it presents a slight convexity from before backwards. From a study of the form of the articular surfaces of the astragalus, and especially of that of its inner surface (and not from any supposed curvation of the outer border of the inferior articular surface of the bone), it would appear that, if the inner facet remained in intimate apposition with the corresponding articular surface on the internal malleolus in all positions of the ankle-joint, as the ankle-joint passes from a position of complete flexion to one of complete extension, the astragalus should move in an oblique and not in a vertical plane, its head passing outwards in the former movement and inwards in the latter. I have, however, carefully observed the variations of the position of the astragalus in the various movements of flexion and extension, and have been unable to detect any deviation from the vertical. The reason of this is, that in extension of the ankle-joint the astragalus is separated by an interval from the inner malleolus. This I will describe more fully at a later stage of this paper.

I will now pass on to the third statement in the description of the movements of the ankle-joint in Quain's *Anatomy*. Since the borders of the upper surface of the astragalus lie almost if not quite parallel to one another, the upper surface is practically of equal breadth as far back as the posterior extremity of the inner border. Below and behind this point there is a prolongation of the tibial and *ligamentous* facets, which is inclosed between the posterior margin of the superior articular surface and its outer margin.

If we examine the movements of the ankle-joints which are possible between the astragalus and the tibia and fibula in the dried skeleton, we would apparently be able to verify the remainder of Quain's description, commencing, "Hence, in complete extension of the ankle-joint, . . . . . a certain amount of lateral movement of the astragalus is allowed under the influence of external force," &c.

As, however, it is quite possible that the presence of the somewhat complex and very incorrectly described ligaments of the ankle and tibio-fibular articulations may influence the apparent mobility of the astragalus in the recent subject, let us appeal to it. If we take the leg of a vigorous adult body, from which the muscles have been removed, and attempt to rotate the astragalus in a horizontal plane upon the tibia and fibula, *while the ankle-joint occupies a position intermediate between complete flexion and extension*, we find that it is possible to displace the head a little inwards and outwards; that when the head is displaced inwards the posterior inferior tibio-fibular ligament is rendered tight, the anterior inferior tibio-fibular ligament is relaxed, the fibula is rotated slightly upon its vertical axis, and the posterior deep portion of the deltoid ligament is made tense. If the head of the astragalus be displaced outwards, the anterior inferior tibio-fibular ligament, the anterior portion of the deltoid ligament, and the posterior fasciculus of the external lateral ligament are put on the stretch, while the fibula is rotated slightly on its own axis in a direction the reverse of that in the preceding experiment.

If we now *flex the ankle-joint completely*, the outer malleolus is slightly raised and displaced a little outwards. The fibula undergoes a slight rotation on its own axis, the anterior margin

of the malleolus being separated from the tibia by a greater interval than the posterior. In fact, the anterior ligament is rendered very tense, while the posterior ligament is very slightly so. The external malleolus is raised from the horizontal level which it occupies when the erect posture is assumed.

Without going further, it is obvious that *the astragalus is not fixed immovably as regards the possibility of rotating it in a horizontal plane solely by the strain exerted by the ligaments connecting the tibia and fibula*, and that the movements which are permitted in the tibio-fibular joints are not simply those of separation and approximation.

The former fact may be demonstrated more completely by dividing the ligaments which connect the astragalus to the tibia and fibula, and, after placing the astragalus in the position which it occupies in complete flexion of the ankle-joint, attempting to adduct or abduct the head of the astragalus from a vertical antero-posterior plane. It will be found that the strain sustained by the tibio-fibular ligaments is insufficient to prevent a considerable amount of lateral motion of the astragalus. The fixation of the astragalus in a horizontal plane in extreme flexion of the ankle-joint depends upon the enormous strain sustained by the back part of the deltoid ligament and by the posterior fasciculus of the external lateral ligament. If, in the dead body, the posterior ligament be removed and the ankle-joint be flexed completely, it is seen that the anterior inferior tibio-fibular ligament prevents the separation of the anterior margin of the malleolus from the tibia, that the posterior portion of the deltoid ligament exerts an immense traction in a forward and inward direction upon the back part of the astragalus, fixing it immovably to the inner malleolus, while the equally great strain exerted in a direction inwards and backwards by the posterior fasciculus of the external lateral ligament upon the fibula behind its axis of vertical rotation fixes its posterior margin immovably upon the tibia and astragalus.

Therefore, while the anterior portion of the astragalus is fixed between the anterior portions of the malleoli by the strain exerted by the anterior inferior tibio-fibular ligament, its posterior portion is fixed immovably by the strain exerted upon it on either side by the posterior fasciculus of the external lateral

ligament and by the back part of the internal lateral ligament, the former exerting traction upon it in a direction from behind, outwards and forwards, the latter from behind, inwards and forwards.

We see that the ligaments which are chiefly engaged in preventing the separation of the malleoli by the wedge-shaped internal articular surface of the astragalus are the anterior inferior tibio-fibular ligament, the posterior fasciculus of the external lateral ligament, and the back part of the deltoid ligament. The interosseous membrane, the posterior inferior tibio-fibular, and inferior interosseous ligaments take but a very secondary share in this work.

The amount of strain which the ligaments so fixing the astragalus can stand is very considerable indeed, as is demonstrated by the great degree of pressure which is required in order to force the malleoli beyond the anterior limits of the facets on the astragalus. The mechanism which is adopted here is similar to, though not identical in character with, that I have described as being made use of in the sacro-iliac and calcaneo-cuboid joints.

I would also point out that the position of the ankle-joint which is assumed habitually as its *position of rest*, namely, that which is sustained with a minimum expenditure of muscular energy, *is one of partial flexion.*

In labourers who are in the habit of transmitting much weight through the flexed ankle-joints, I have found very distinct changes in the malleolar articulations, and more especially in the inner one, the anterior margin of the facet on the astragalus being abruptly prominent and lipped, while the opposing margin of the inner malleolus presents corresponding changes.

In the merchant service seamen, the joints of whose foot and ankle allow of a remarkable freedom of movement, there is developed upon the anterior surface of the lower extremity of the tibia an articular surface with a convex upper margin. This surface is continuous with the inferior articular facet upon this bone, and is included within the cavity of the ankle-joint. It articulates in extreme flexion with a corresponding articular surface upon the outer part of the upper aspect of the neck of the astragalus. The mode of causation of this modification in the

form of the ankle-joint is quite obvious from a knowledge of the habits of the individual.

We will now pass on to examine the supposed lateral movement which is said to be possible between the astragalus and tibia and fibula when the ankle-joint is extended completely. If in a leg from which the muscles have been removed *the ankle-joint be extended to its full extent*, and an attempt be made to adduct or abduct the head of the astragalus, it is found impossible to produce any lateral movement of that bone.

This result is obviously quite contradictory to that usually received, which would appear to have been obtained by an analysis of the movements which are possible between the astragalus and the tibia and fibula when cleaned and articulated.

Before proceeding further, I must call attention to another anatomical point which appears to have escaped the notice of previous observers. The astragalus (fig. 1) presents behind its upper articulating surface, on what is described as its posterior aspect, a prominence bounded externally by the oblique groove which lodges the tendon of the flexus longus hallucis. The upper surface of this projection is concave, and is usually continuous by a gradual incline with the upper articular surface of the astragalus, and in some cases it is covered by a prolongation of its covering of articular cartilage. In most cases, however, it is coated with a layer of fibrous tissue and synovial membrane.

In the outer portion of the posterior margin and on the adjacent surface of the astragaloid facet on the tibia, there is a transversely oval facet, to the hinder margin of which the fibres of the posterior inferior tibio-fibular ligament are attached.

In complete extension of the ankle-joint the concavity on the projection on the back of the astragalus comes into contact and articulates with the corresponding little articular surface on the tibia, and with the adjacent portion of the posterior inferior tibio-fibular ligament, and it is this impact of these two opposing surfaces which limits the movement of extension of the ankle-joint. In fact, if the ankle-joint be carefully examined while it is in a position of very complete extension, neither the tibial facet on the upper surface of the astragalus nor the facet on its inner surface are in contact with their corresponding

tibial facets, but the astragalus articulates with the tibia solely by the concave facet on the upper surface of the prominence on its posterior surface. Its outer articular surface is fixed immovably to the corresponding facet on the outer malleolus.

The interval that exists between the opposing surfaces of the tibia and astragalus while in this position is occupied by an interarticular synovial fold, which contains fat and projects from the posterior surface of the anterior ligament of the ankle-joint. In those who habitually perform this movement of complete extension of the ankle-joint this interarticular synovial structure is remarkably well developed.

In a slightly less degree of extension portions of the upper and inner facets on the astragalus come into contact with their corresponding surfaces on the tibia.

In complete extension the outer malleolus is drawn slightly downwards and inwards by the strain exerted upon it by the strong anterior fasciculus of the external lateral ligament, and also inwards by the posterior fasciculus of the same ligament. I would point out here that the latter portion of the external lateral ligament limits and opposes movements both of complete flexion and complete extension of the ankle-joint, for the reason that its fibres occupy a horizontal plane, and the interval between its points of attachment is least where the joint occupies a position midway between complete flexion and extension. Any deviation from this posture, either in the direction of flexion or extension, renders the fibres of this ligament oblique, separating its bony attachments and making it tense. In extreme flexion of the ankle-joint the posterior fasciculus is rendered tense, and exerts a traction upon the lower end of the fibula in a direction inwards, backwards, and downwards, while in extreme extension the same band of fibres tends to draw the malleolus inwards, backwards, and upwards. In the latter position the strain exerted by the tense anterior fasciculus of the external lateral ligament in a direction from above downwards, forwards, and inwards displaces the fibula slightly downwards. This movement of the fibula is limited by all the tibio-fibular ligaments and by the posterior fasciculus of the external lateral ligament. In extreme extension the anterior portion of the deltoid ligament is rendered very tense.

Now, it is obvious that in extreme extension the astragalus is retained, as regards rotation in its horizontal plane, immovably upon the external malleolus by the ligaments which connect these bones together, namely, by the anterior and posterior fasciculi of the external lateral ligament, the fibula being fixed immovably by the strain exerted upon it by the several tibio-fibular ligaments, by the impact of the prominence on the back of the astragalus upon the lower end of the tibia, and by the strain exerted upon the astragalus in a direction backwards and inwards by the anterior portion of the deltoid ligament.

To put this in another way. The head of the astragalus cannot be displaced inwards owing to the strain exerted upon it in an outward and backward direction by the anterior fasciculus of the external lateral ligament. It cannot be displaced outwards on account of the strain exerted upon it by the anterior portion of the deltoid ligament in a backward and inward direction. The fibula is fixed immovably upon the astragalus by the strain exerted in an inward, downward, and forward direction by the anterior fasciculus of the external lateral ligament, and in an inward, backward, and upward direction by the posterior fasciculus of the same ligament. The fibula is fixed upon the tibia directly by the ligaments which connect them, all of which are rendered tense by the tractions exerted upon the outer malleolus by the two fasciculi of the outer lateral ligament, and indirectly by means of the fixation of the astragalus upon the tibia.

It is also worthy of notice, that the several flexor muscles and the peroneus longus and brevis are attached to the fibula, and exert traction upon it in such a manner as to assist the ligaments very materially in fixing the fibula upon the tibia when the body is retained erect upon the fully extended foot, by opposing the displacements of the fibula which the traction tends to produce. The shape of the fibula and the direction of its several surfaces lend themselves very readily to this purpose. Practically I suppose we may assume that the peculiar form of the human fibula has arisen in consequence of the function of rotating the fibula, &c., which the flexor and peronei muscles attached to it perform, and by means of which the ankle-joint is strengthened and rendered secure.

Much of the error into which anatomical and surgical text-books have fallen with regard to the movements permitted in the ankle-joint of the vigorous adult subject is due also to the great freedom with which the foot may be adducted or abducted upon the astragalus when the ankle-joint is extended, and to the inability to perform this movement when the ankle-joint is forcibly flexed. The reason is that in the latter case the astragalus is fixed, and the astragalo-scaphoid capsule and the plantar ligaments are rendered extremely tense by the force exerted in forcibly flexing the ankle-joint, and it is therefore impossible to adduct or abduct the foot in the manner I have described in the *Guy's Hospital Reports*, 1887, and to which I would refer for full particulars. I would also call attention here to another contribution contained in the same volume of the *Reports* ("An Undescribed Fracture of the Lower End of the Tibia or Fibula, or of Both Bones, which cannot be recognised during lifetime"). In it I showed that excessive rotation of the astragalus in a horizontal plane might produce fracture of one or both bones of the leg, the bones yielding rather than the ligaments which are attached to them. In the large majority of cases the fragments presented no displacement whatever. The reason of this is obvious, if the seat of the fracture or fractures be carefully observed.