Biomechanics
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Lecture – 40
Ankle Anatomy and Movements

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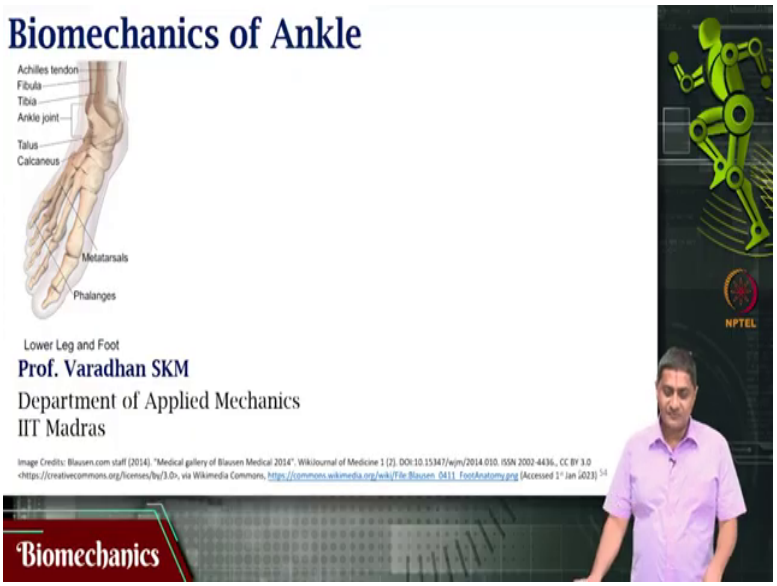

(FL) Welcome to this video on biomechanics. So far, we have looked at biomechanics of the upper limb we started out with shoulder. Then we did elbow rest fingers. Then we did biomechanics of spine. Then we did biomechanics of hip. Then we discussed a knee. In this video, we will be continuing our discussion of the musculoskeletal system the joints of the musculoskeletal system and focus on the biomechanics of the ankle joint.

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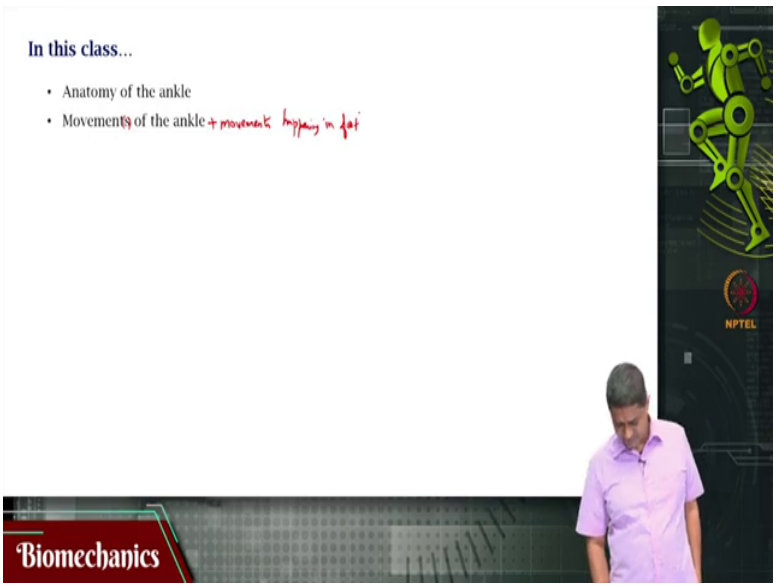

So, in this video we will be discussing the anatomy of the ankle joint and the movements that are happening at the ankle joint. Technically, there is only a movement that happens at the ankle joint. Some other moments that also happen within the foot happen not in the ankle joint but happen within the foot. So, this is essentially only movement of the ankle joint and other movements that happen in the foot movements happening in the foot.

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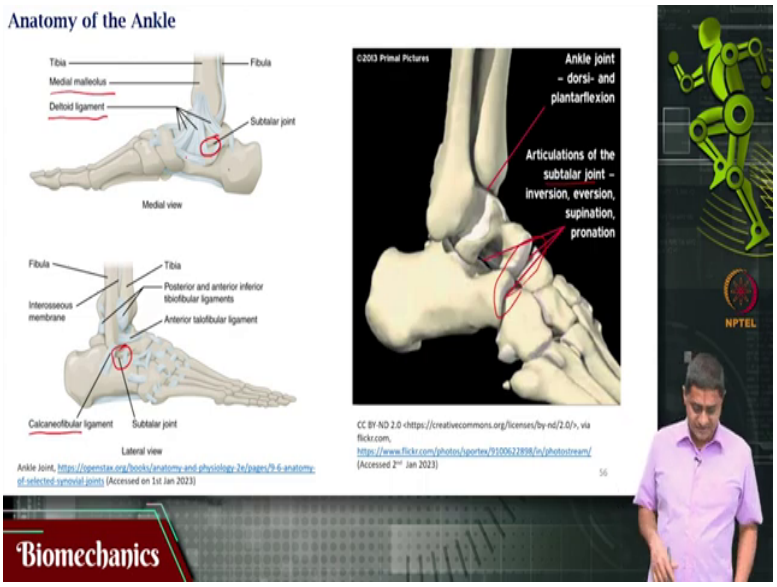

So, this is the talus head, there are many parts to this bone, the big bone that is the talus. That also appears as the ankle visible joint, visible mark in the body. Visible architectural or something that you can note within the body the ankle joint that is the talus. So, when you say ankle joint, we are essentially referring to the talocrural joint which is a hinge joint. It is a hinge joint means only one degree of freedom possible.

That one degree of freedom that is allowed by the talocrural joint or the ankle joint is the flexion and extension. What would normally be called as flexion and extension of the ankle? But in this case called as dorsiflexion and plantar flexion of the foot, dorsiflexion of the ankle joint and plantar flexion at the ankle joint. It is not called as flexion and extension. Remember that in biology exception is the rule we spoke about this.

For example, when we spoke about that movement of the wrist that we called as radial deviation and that movement as a ulnar deviation. It is not called abduction and adduction. It is called radial and ulnar deviation we said this earlier. Likewise, you have dorsiflexion and plantar flexion. And this is the only movement or these two are the only movements that are possible in the ankle joint.

But below the talus that is the so called subtalar joint. And there are other joints that are present at the calcaneus bone. That is at the subtalar joint between the talus and the calcaneus bones and movements that are happening at the tarsal bones. All these bones allow for very small amounts of movements. An art well articulated joints, like the other joint that we have seen so far.

They are not like elbow joint, they are not like shoulder joint, they not like knee joint or plane joints. These are plane joints, unlike the talocrural joint which is the ankle joint which is a hinge joint. These joints that we are speaking about the joint between the talus and the calcaneus under tarsal joints are all plane joints. All these joints together produce a substantial amount of movement.

But each of them produce a very small amount of movement in the plane that we are discussing. That plane joint movement is really small but all of them add up to produce a relatively large or what is a visible amount of movement? This is called as aversion and inversion will come back to that inner bit. So, those are the movements that are possible. So this is the subtalar joint.

That is a subtalar joint in the side view, the lateral view. See articulations of the subtalar joint that are happening here. Those movements that you can perform movements of the foot such that the foot, the toe moves towards the midline and the little toe moves away from the

midline. All this are possible. An important part to discuss, while discussing the ankle joint is a crucial role of the many ligaments that are present in the foot.

Because these ligaments, for example, the calcaneofibular ligament, the medial malleolus and the lateral malleolus. And all these ligaments together, are responsible for the stability of the ankle joint and the foot. Some of them prevent excess aversion and some of them prevent excess inversion. Some of them are responsible for stability of the ankle joint itself. So, this some of the also the delta ligament, is shown here.

So this is one of the more ligamentous joints. Obviously, because it has the responsibility of passing on the entire load of the body onto the ground and not destabilize, while doing so. So, it is having quite a few ligaments that are responsible for stabilizing all these joints. So, you want to have movements when you want to have movements and you want to prevent unwanted movements.

It is a very complicated exercise a very complicated or very challenging exercise. Preventing unwanted movements are stabilizing is one of the crucial roles that is achieved by all these ligaments. But at the same time, I want to move, when I want to move? If there is no movement then there is no purpose. So, you want to have movements it turns out that this is the crucial aspect of movements that many people who are not from movement science fail to recognize.

In movement science there are two aspects to studying moments and to rehabilitating moments. One is having the moments that are desired. Two is preventing movements that are not decided. After this occasion, let us continue with our discussion, so, we were discussing that the talocrural joint has only a single degree of freedom as a hinge joint. And the other moments that are happening at the calcaneo or between the calcaneus and the talus the subtalar joint.

And the other joints are the tarsals. All these joints together produce this small movement that then combine that then add up to produce the so called aversion and inversion of the photo. This is what we have discussed.

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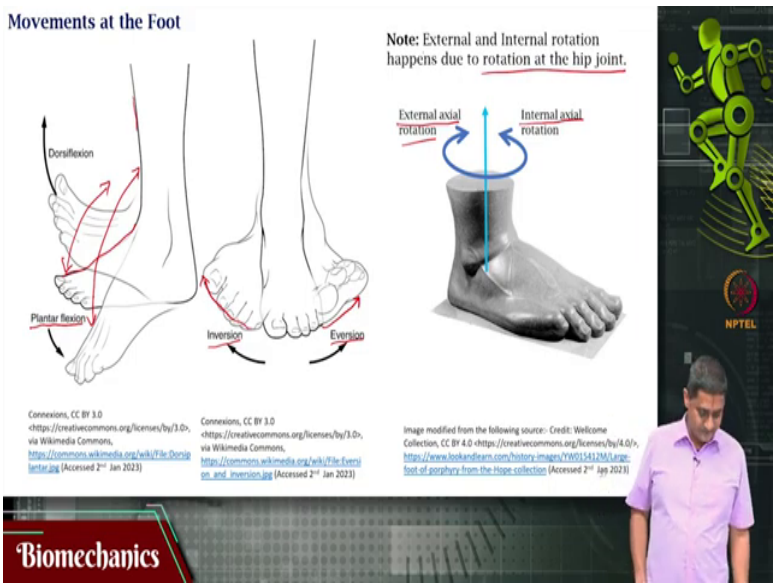

Now, let us look at the movements that happen at the foot. When the ankle moves or when the foot moves such that the big toe or the toes of the foot are moving towards the front side of the shin. Front side of the lower leg or in other towards the anterior side of the leg. So, such that so this is where the foot is originally and this is the leg that distance at that angle is reduced. This is called as dorsiflexion.

This is where the dorsal side of the foot fluxes which is why it is called as dorsiflexion. Now, if you move the foot such that your toe is moving down and your heel is raising up like I am now doing. I am standing and I am doing that. Such that it is almost like you are standing on the toes of your foot. You can try doing that. Like the ballet dancers, it is almost like you are standing on the toes of your foot.

The movement that happens at the ankle joint to do this action is called as plantar flexion. In this case the angle between the leg or the anterior side of the leg and the toes will increase this is called as plantar flexion. These are the only two movements that happen in the ankle joint or the talocrural joint. This is the only movements possible in the talocrural joint or the ankle joint.

Now, other movements that happen through the addition or through the summation of the small movements that happen at the subtalar joint. At the other bones of the foot cause inversion such that the big toe moves, medially or aversion such that the toes move more laterally. This is not moving the foot itself. This is not moving the whole foot. You can bend

slight bending of the foot towards the middle side, towards the medial side or towards the lateral side.

If that happens, it is called as inversion and aversion. Of course, I can rotate the entire leg that is called as internal rotation and external rotation. But that is not happening at the foot. Suppose this hand is the foot it is not like I can rotate the foot like this. I rotate the entire leg, along with that the foot also rotates. That is why that internal and external rotation is happening due to rotation at the hip joint.

Remember the hip joint is a ball and socket joint with three degrees of freedom, is it not? Something that we have seen while discussing the hip dance. So, it can also rotate that rotation is what is visible at the foot? That does not mean that the foot is having one extra degree of freedom such that it can rotate a whole I mean in the plane of the ground that is not possible.

I mean the foot does rotate in the plane of the ground but the rotation is not happening at the ankle joint. It is happening at the hip joint.

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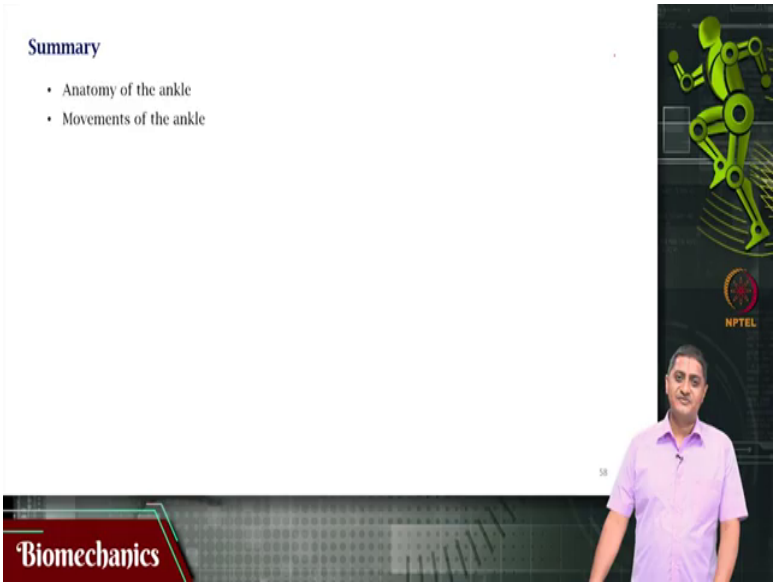

So, in this video we saw the anatomy of the ankle. We saw the movements that are possible in the ankle. We saw that the ankle is actually, a hinge joint that is allowing only for one degree of freedom or only one movement that is the plantar flexion and the dorsiflexion. And other moments such as inversion, aversion are happening due to movements of the other joints.

For example, calcaneus and the subtalar joint and the internal external rotations are movements that are happening at the hip joint but that is that may be visible. That may be manifested at the foot. So, with this we come to the end of this video. Thank you very much for your attention.