Mechanics of Human Movement
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Lecture – 03 Part b
Movements about Joints

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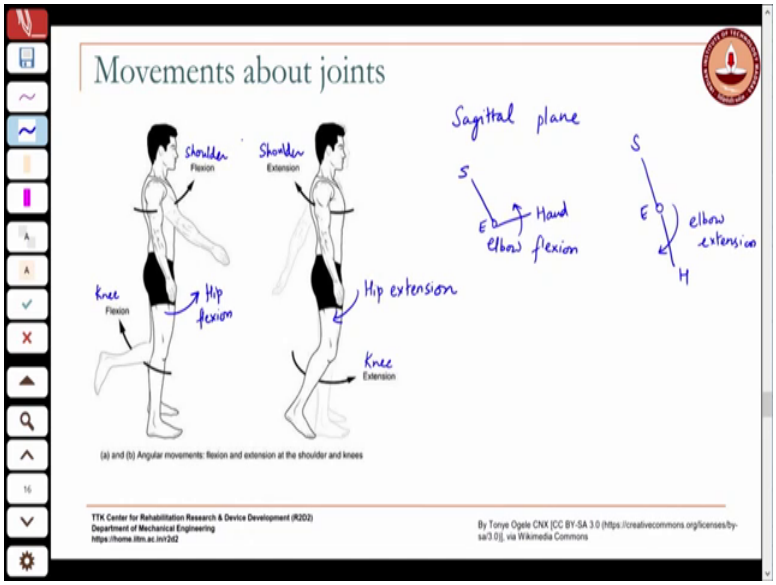

So, now let us talk about this terminology associated with, now we know what are the different kinds of joints that are present in the body. Let us talk about some of the terminology that is associated with these movements and how they are used. So, if you look at movements in the sagittal plane, so let us look at movements in the sagittal plane, flexion is the movement that brings the arm closer. So, if you take at the shoulder moving the arm in this direction is shoulder flexion and bringing it back to the anatomical position and maybe taking it beyond that movement is called extension.

So, you can see here this is flexion; extension is moving it back to the anatomical position and then taking it beyond. In some literature you will see this term as called as hyperextension, when you move it beyond the anatomical position ok. But otherwise in the sagittal plane you talk about flexion and extension ok, this is flexion about the shoulder. Similarly, for the elbow in the sagittal plane this is flexion, this is extension, when I bend the elbow that is flexion, this is extension. If I look at the knee, then knee flexion is bending in the sagittal plane, bending the knee is knee flexion, bringing it back

to the straight position is extension. If I try to move it beyond that most of us cannot but that is called high, would be called hyperextension, moving it beyond the anatomical position.

So, in the anatomical position we say the knee is in 0 degrees of flexion, 0 degrees of flexion is full extension for the knee otherwise you bend, when you bend the knee we say the knee is in flexion. Let me show you, in the case of the foot, I cannot move this foot at all so I will. I n the case of the hip it works a little differently.

So, when you; you have the hip like this moving your hip like this is hip flexion. So, for the hip this would be hip flexion, this is knee flexion, but hip flexion is opposite. So, you are actually when you flex the flexion movement is when you are bringing that segment closer to the rest of the body or closer to the adjacent segment that is considered flexion.

So, the hip flexion would be when you are bringing it closer to the trunk, when you move back to the this, to the anatomical position and beyond then you call it hip extension. So, this is important, knee flexion and knee extension, hip flexion and hip extension happen in what seem to be opposite directions, so that is something you need to be aware of.

Whereas, in the case of the shoulder and the elbow so, if I have this, this is a elbow flexion, moving it in this direction is elbow flexion. So, if this is my shoulder, this is my elbow and this is my hand and straightening that, moving it like this is elbow extension, bringing it back to the anatomical position ok.

So, this is elbow and shoulder, this is shoulder extension. So, the joint about which it happens usually we talk about flexion and extension about that joint or we may talk about the arm, you know if you just say forearm flexion, then you know you are talking about flexion at the elbow joint ok, the motion happens at the joint and you may be talking about a specific. So, you could also say thigh flexion or femur flexion, the flexion of the femur which is the same as flexion about the thigh joint ok. So, those terms are somewhat interchangeably used, but the segment will tell you which joint that motion is happening about.

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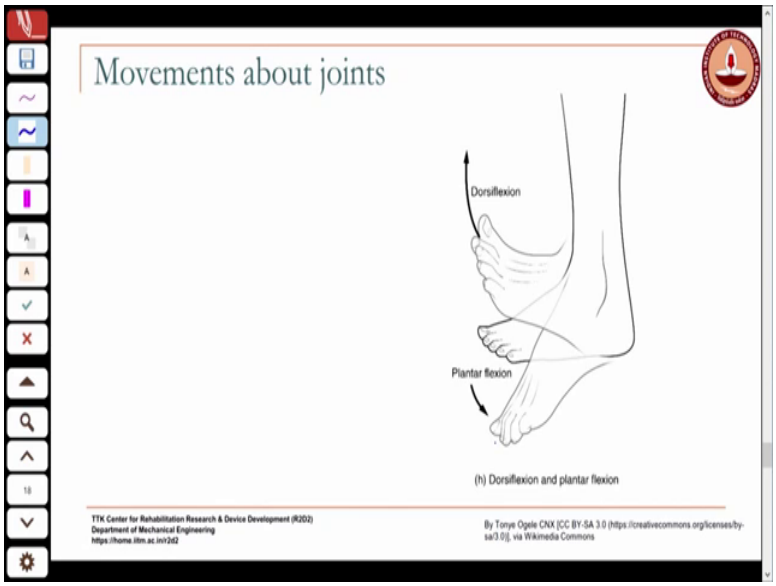

For the ankle alone ok, for the foot or the ankle you talk about the terms used are slightly different.

So, when you bring your foot. So, imagine this is my foot ok, when I bring my foot closer to my leg that movement is called dorsiflexion ok. Dorsi is, dorsum is the top part of so dorsiflexion is moving the foot upwards and plantar flexion is planting the foot on the ground, you can think of it as planting the foot on the ground. So, that is the neutral position is when you have your foot like this plantar flexion is moving away from that.

So, what would be just flexion and extension right ? Extension is, so if I have I have this segment and I have the foot right, normally I would call this flexion because I am moving the foot closer to the shank, that is called dorsiflexion inter in, when you are talking about the foot. And the movement away which we would normally term as extension we call it plantar flexion in this case.

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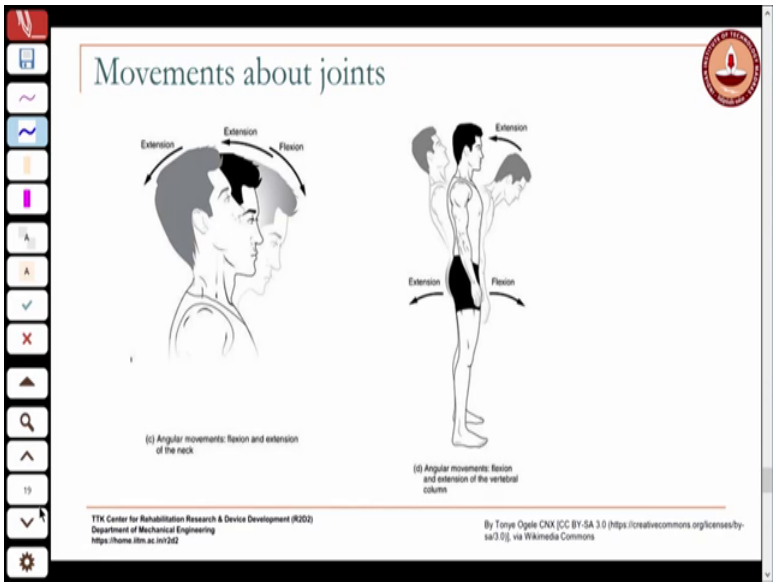

Similarly, I get still in the sagittal plane you can see your head or the neck you know the because you talk about the neck because that is where your cervical vertebra, that is the where the joints are about which this mo motion is happening. So, your neck flexion, extension happens about which joint? The neck flexion extension we talked about happens about the atlanto occipital joint right.

But actually the entire, if you look at the whole neck flexion it is, you know just you are nodding happens about the atlanto occipital joint ok, but if you move further then again the vertebrae start adding up, The motion about each of these cartilaginous joints kind of sums up and that is why you are able to go this far ok. So, it is gone the so the that is why it is called neck flexion because it is about the entire cervical spine is involved in the motion ok, but just the nodding when you do it that happens about your atlanto occipital joint.

Similarly, when you look at the trunk, when you look at the whole trunk again about the vertebra you have trunk flexion where you move your body closer, move your body forwards, trunk extension is when you straighten up extending the trunk imply straightening up. If I try to move further backwards that would be extension or hyperextension ok.

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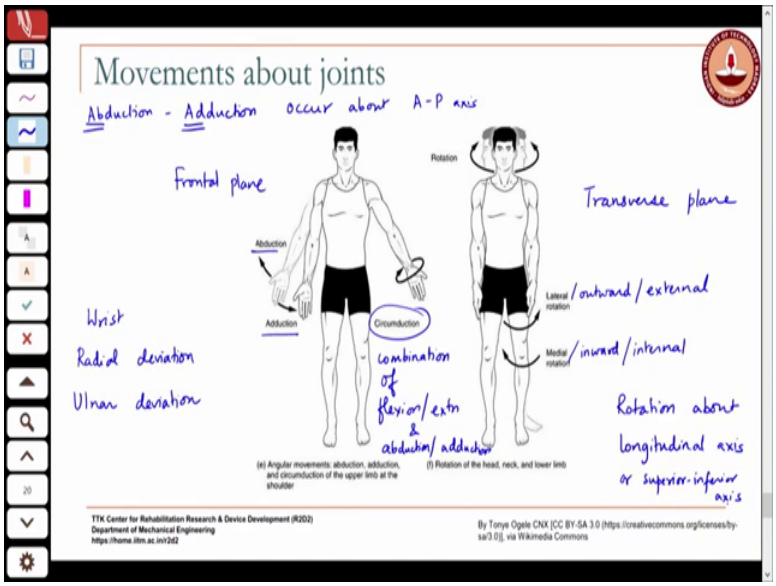

So, if you look at movement in other planes, so in the frontal plane one of the important movements is abduction and adduction. So, abduction is when I move say my arms, so if I say shoulder I am abducting my shoulder, it means I am moving my arm like this, I am moving it away from the body. If I adduct it means I am moving it closer to the body so that is abduction and adduction.

Then longitudinal rotation is typically left for the limbs, it is referred to as medial or inward rotation, lateral or outward rotation. So, if I look at my arm inward rotation, outward rotation I, medial rotation where I am moving the arm towards the medial side, moving the arm towards the lateral side medial rotation, lateral rotation. For the neck or if I am talking about the trunk moving rotating in the transverse plane; then I can call it left or right rotation ok.

Left or right is always with respect to myself ok, it is not what somebody what it appears to somebody. So, like with the anatomical planes when we say left or right it is always with respect to the person that you are because, it is with respect to the anatomical plane of the person ok. So, this is left hand so, this is movements in the transverse plane. So, this longitudinal rotation occurs in the transverse plane.

So, this was in the frontal plane and so and there is a special movement called circumduction, which is actually a combination of flexion extension and abduction, adduction. So, this is so say for example, I have my wrist ok, I can do this movement is

flexion extension. So, wrist flexion, so remember wrist flexion, so you are talking from the anatomical position. So, flexion happens with the palm open, I mean when I say wrist flexion I mean this motion, when the palm is coming closer to the forum that is the wrist flexion, this is wrist extension and this is you know this is also hyperextension of the wrist. But you do not call this wrist flexion because it is again with reference to the anatomical position. So, if I look at the wrist I can also do, in the case of the wrist instead of abduction, adduction I call it radial deviation or ulnar deviation, this is my radius this is my ulna.

So, if I, in the frontal plane I call it radial deviation or ulnar deviation ok, so radial deviation ulnar deviation. Now, I cannot really rotate my wrist about a longitudinal axis, but I can do this, I can do this ok. This is a combination of the movements in the sagittal plane and the frontal plane and this movement is called circumduction. So, it is a combination of and it is possible in other at other joints as well.

Like for instance if you see somebody walking with a locked knee, if they do not bend their knee you will see they will do this, they will rotate their leg about the hip joint that is not rotation in the transverse plane. So, here you are extending, you are abducting say it is a combination of flexion extension and abduction, adduction that particular motion is called circumduction. So, you trace a conical path with the end of the lymph ok, so that is the motion that you see with the, that is circumduction. So, flexion extension occurs about which axis? Flexion this flexion extension occurs in the sagittal plane which means it occurs about which axis.

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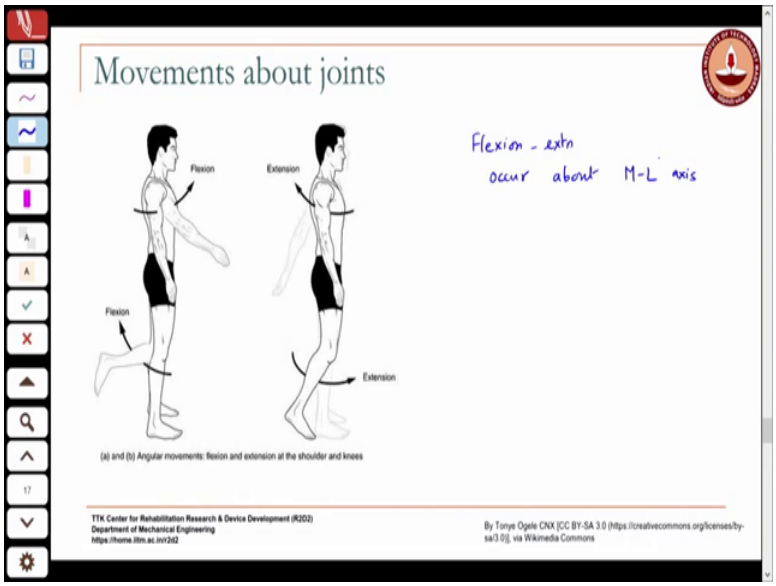

Occur about the medial lateral axis ok, it is the axis perpendicular to the sagittal plane. So, flexion extension occur about the medial lateral axis, similarly abduction, adduction, note the spelling, occur about the A-P axis because they occur in the frontal plane. And rotation occurs about the longitudinal axis ok, circumduction is of course, a complex motion, it is a conical type of motion ok.

So, internal rotation so this is inward or internal rotation, external rotation where you are bring moving the limp closer towards the medial aspect and the other is when you are taking it about the. So, the tibial rotation I am, I mean the longitudinal occurs about the longitudinal or and superior, inferior axis ok.

So, rotation we have talked about rotation of at the wrists, they have talked about wrote the major motions in the various planes, only for the forum we said the outward rotation so, the outward rotation of the yeah.

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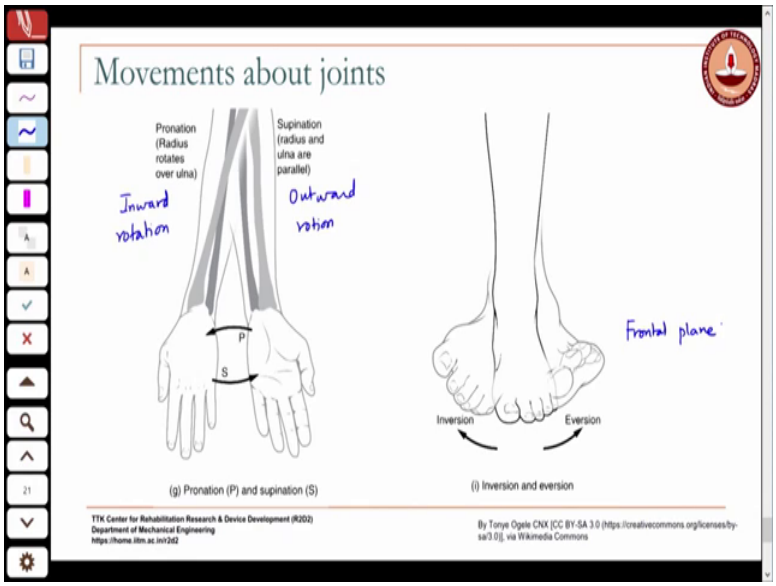

So, the outward rotation of the forearm is your supination, the inward rotation is the pronation. This is the inward rotation and this is the outward rotation, then in the frontal plane for the foot you also have these motions of similar to abduction adduction you have inverse inversion, where the sole of the foot goes inward and then the sole of the foot goes outward that is eversion, inversion and eversion is also, it happens in the frontal plane.

Although it is a little bit, so many of these motions even though they are predominantly in one plane; they may actually be some slight movements happening in the other planes also. But you look at where the predominant motion is happening and that tells you what this motionless ok.

So, in the anatomical position the forearm is in the supinated position, you talk about the forearm in the supinated position ok. I think that concludes the terminology that we will use when we talk about movement of the body segments. You now have a good idea of the different joints in the body and what kind of movements they would allow. So, the knee is a hinge joint that allows flexion extension of the knee, the hip joint allows flexion, extension, abduction, adduction it is a 3 degree of freedom ball and socket joint. Flexion extension in the sagittal plane, abduction adduction in the frontal plane and medial and lateral rotation in the transverse plane, similarly with the shoulder ok.

So, we will see how lot of these movements we will look at when we are discussing movements of the body as a whole. Because, the lower limbs contribute to especially when we talk about walking, the movements with respect to add the joints of the lower limb are very important in they are predominantly what move the center of mass of the body. The center of mass of the body moves because of the movements in their various lower limbs ok. So, the next thing we will look at in the musculoskeletal system is some of the characteristics of muscle, before we head on to the application of mechanics to movements.