Mechanics of Human Movement
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Lecture – 38
Human Gait

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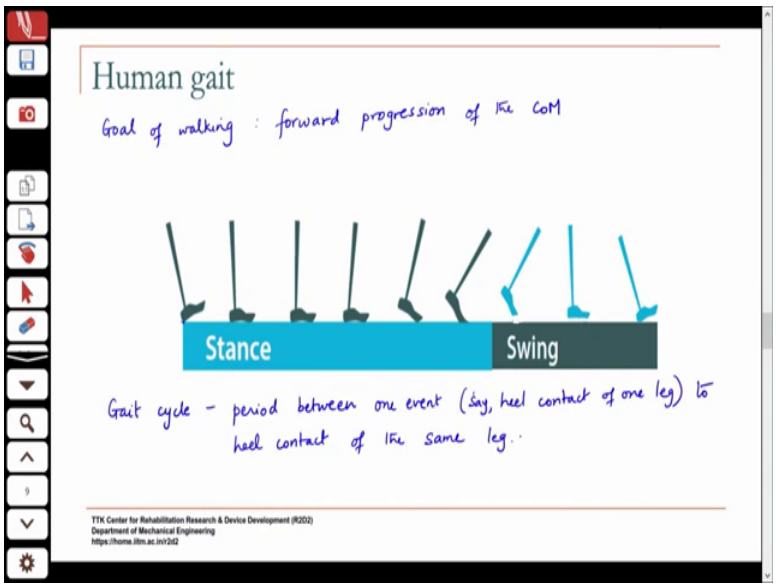

So, we will start off with looking at human walking the manner in which you walk is called gait. So, what is human walking? Human walking essentially we do a set of alternative alternate motions right. Our legs there are alternating support and swing of the legs, which basically helps to then move your center of mass to point from point a to point b. The purpose of human walking is basically movement of the center of mass. We walk in order to move.

There are of course, other means of locomotion and in fact human walking is also a learned technique. If you see babies when they first start walking you know it is very so first we start off with you know the swimming kind of action. Then you start crawling because bipedal walking; walking on two feet is a very tricky task. You know it is essentially your body falling forward, you catch it with the advancing leg then again you know it starts falling forward you catch it with the next leg. Say it is a very it requires a lot of muscular and neural control.

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How are we?

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Landing. So, what do you do? When you walk, one leg swings through and then lands right; and then this leg gets off the ground. So, essentially you are falling forward and then you catch yourself with the other leg before you do that. So, it is the mechanism is inherently an unstable one it is something that requires a lot of control from the muscular and neural system.

And of course, we do not think about it so much; we do not think about how we walk, but you will hopefully at the you know after this introduction to walking you will be able to appreciate how much goes into at least the musculoskeletal system in terms of stabilizing, because essentially you are supporting the body weight, then again swinging through for the next support.

So, if you look at a particular leg ok, initially it goes through what is known as the stance face. The stance face is when that leg is on the ground ok. Stance face is when the leg is on the ground; swing is when the leg is off the ground. So, it is no longer touching the ground till it comes to and it is a repetitive process. So, it is a very cyclic process Walking is a cyclic process, the same set of events repeat over and over in order to enable this forward progression of your center of mass. So, the goal of walking is basically the forward progression of the center of mass.

And predominantly when we look at walking, we look at the lower limbs they are the ones that are most involved. Because if you look at the upper body it is more or less you know it is like a block that moves on this segmented carriage ok. So, the upper body yes you do have the motion of the arms, but typically in walking as we saw earlier the motion of the arms is more for balancing out the angular momentum in that about the longitudinal axis.

And usually the study of walking if you look at more studies they will focus on the sagittal plane; because that is where most of the joint movements, the major joint movements take place in the sagittal plane as well as progression happens progression of the center of mass happens in the sagittal plane. There are some frontal plane movements that are very crucial for balance. Because see even with walking you have to make sure

that you have ground reaction forces you know you are alternately changing your steps right, you have these ground reaction forces acting.

Now, you have your center of mass which is move. So, if this you have to make sure that this ground reaction force is not creating moments about the center of mass or very significant. Now, in most cases because for balance it otherwise you are going to be like are the, if it creates there is going to be a lot of sway. If your if there is a moment created about your center of mass every time that you walk. So, it is a very fine balance between how the forces act together to accomplish this task.

And the other challenge is that your body is a again multi segmented right you have so many joints. You have to ensure stability and motion at many of these joints in order to be able to walk successfully. Because you stay upright you have to be able to see what is in front of you know there are so many other tasks that are associated with walking nobody focuses only on the walking, we walk in order to accomplish other things right so that is something that we will look at.

So, if you look at each leg, each leg will have some time when it is in contact with the ground and then a period when it is not in contact with the ground. So, we have what is known as a gait cycle. So, a gait cycle is essentially the period between one event, so let us say heel contact of one leg ok, heel contact of one leg. So, you see here, this leg is contacting the ground ok, heel contact of one leg to heel contact of the same leg.

So, if I contact if I start counting my gait from the time that I contact the ground with my right leg, then you know in between I am going to contact my contact the ground with my left leg and then come back and contact the ground again with my right leg. So, the period between heel contact of the right leg to heel contact of the same right leg of the same leg is termed as one gait cycle. I could start off with some other event also or I could start off with left heel contact to left heel contact. It is the same thing ok, so that is termed as one gait cycle.

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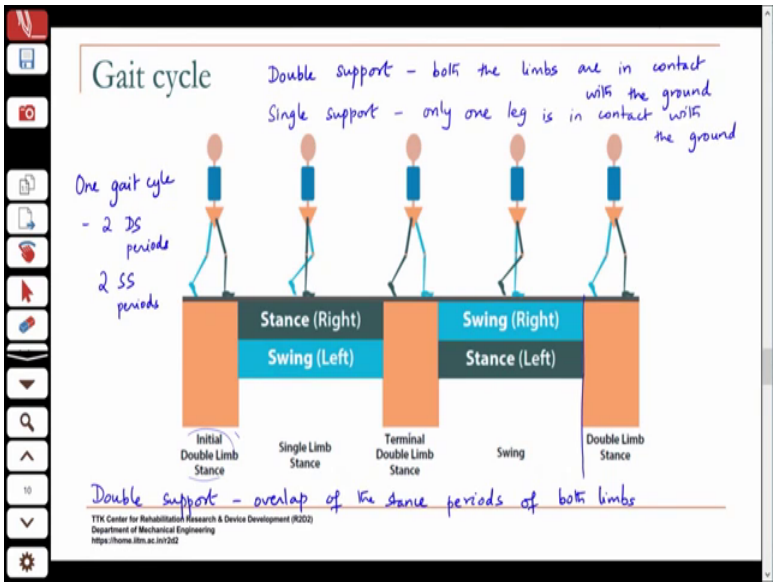

So, you can see here. You have the right leg which is contacting the ground and then you have the left leg swinging through. And then you have once the left leg contacts the ground after some time the right leg lifts of the ground and swings through ok. So, it alternates the stance and the swing alternate. And there is a period called double support in walking. So, in the period of double support, that face is then both the limbs are in contact with the ground.

So, in a gait cycle, there are periods where both the limbs are in contact with the ground. And this face is called the double support face ok. So, when you look at the leg you talk about stance and swing, whether the leg is in stance or whether the leg in. When you look at it in with respect to how the interaction is with the ground of both limbs, then you talk about the double support and you talk about single support where only one leg is in contact with the ground.

So, when the right leg is in single stance that is when your left leg is in swing single stance implies only the right leg is in contact with the ground which means during that time the left leg is swinging through. And initially you have so you can start off with double support. So, when one leg contacts the ground. If you notice how you walk, when your leg contacts the ground, your other leg will still be on the ground. So, it will be a small period of double support after which this other leg leaves the ground, and this limb becomes the sole supporting limb the single supporting limb the stance.

So, it its instance right from the time it contact. So, during double support both the legs are in stance because both of them are in contact. So, there is an overlap in the stance period of both limbs which is known as the double support phase. So, double support is stance periods of both limbs. So, you can see here you will have an initial period of say double limbs.

So, suppose this is one gait cycle that we are talking about. You have a period of initial double limbs stance, then when you have single limb stance the other leg is swinging through then you have another period of double limbs stance and then this one. So, in this case actually this any gait cycle will have two periods of double limb stance and two periods of single limb stance.

So, one gait cycle also called double support. So, you have two double support periods and two single support periods. So, the two single support periods are one when the right leg is in single support, one when the left leg is in single support. There is quite a bit of terminology associated with gait, but you will become more comfortable as we go along when you keep hearing these terms again.