Biomechanics
Prof. Varadhan SKM
Department of Applied Mechanics
Indian Institute of Technology, Madras

Lecture - 10
Key Terminologies

Welcome to this video on biomechanics. In the last week we saw some basic introduction to mechanics. In this video we will be looking at the human body as a biomechanical system and some basic terminologies.

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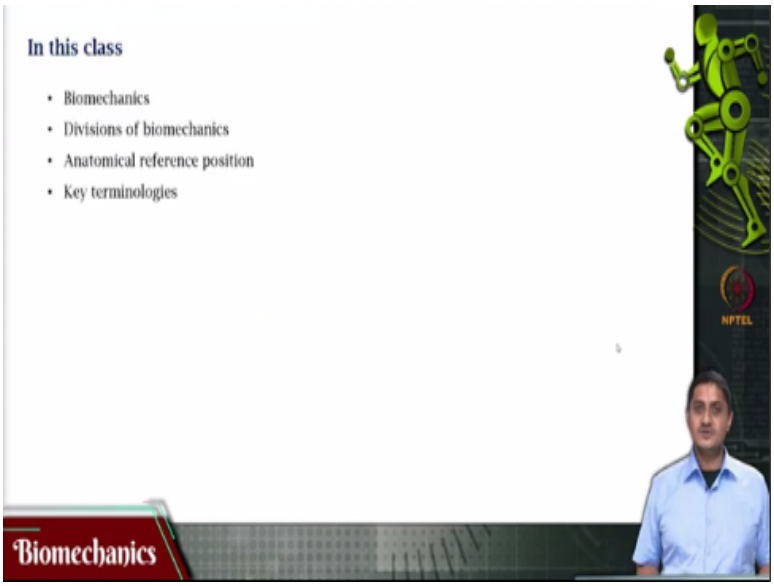

So, in this video, we will be focusing on the definition of biomechanics. What are the divisions within biomechanics? What is the anatomical reference position and some key terminologies?

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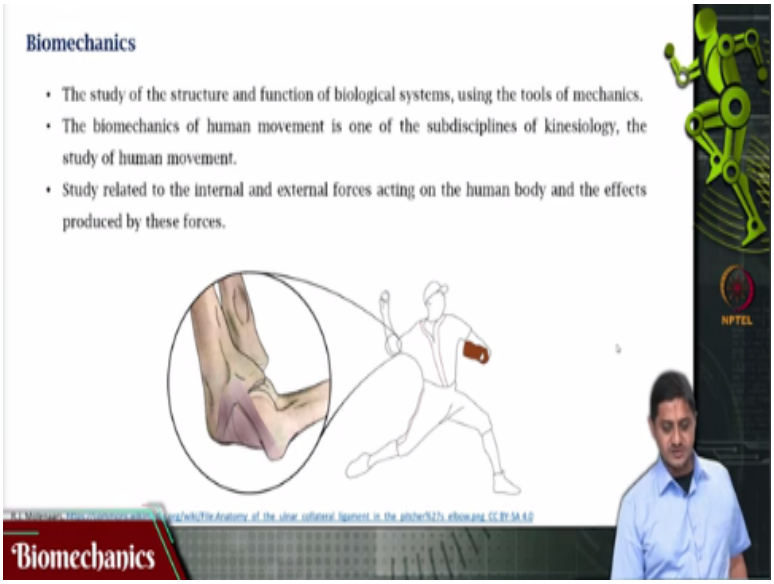

So, what is biomechanics? In the last week although we started with the course on biomechanics the last week has been entirely focused on building the foundation for mechanics. So, that was more of engineering mechanics are an advanced version of high school physics. So, now we formally start biomechanics, what is biomechanics. So, biomechanics is the study of the relationship between structure and function in biological systems using tools of mechanics.

This is one definition. So, essentially structure function relationships. So, if this is the kind of structure you have how would; it work if this is the kind of work that you want to have what must be the structure. Remember almost always this is the kind of studies that get done in the broad field of biomechanics. Almost always we are interested in the relationship between structure and function and how complexity arises as a function of both structure or morphology or anatomy and physiology or function.

So, this is at the core of the biomechanics area. The other definition of biomechanics is that biomechanics is the study of internal and external forces that act on the human body and the effect that these forces have on the human body. So, this may be forces are the movements that may be caused by the forces. So, biomechanics may be considered to be a subfield in the broad field of kinesiology, kinesiology means the study of movements.

So, when we say biomechanics of human movement you are referring to it as a sub discipline of kinesiology which is the study of human movement.

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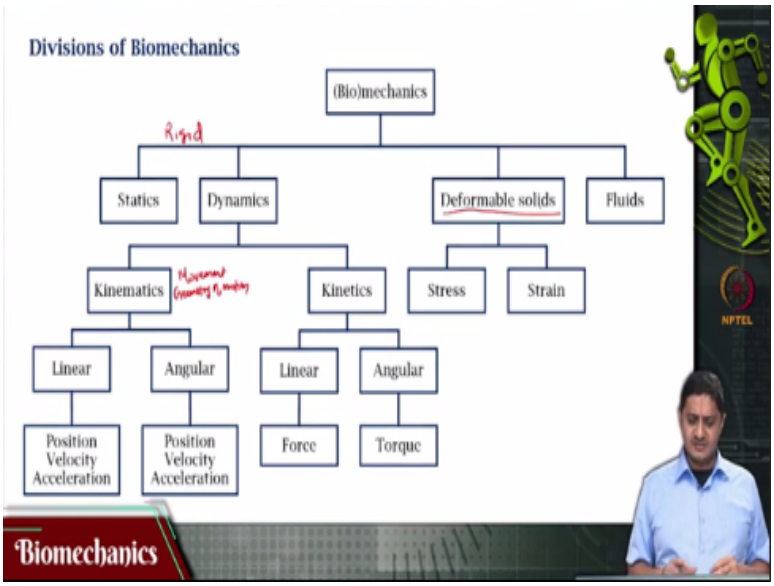

Mechanics itself can be subdivided into many branches statics, dynamics which is essentially rigid body mechanics. So, these two can be rigid body mechanics then you have deformable bodies and then you have fluids. Within dynamics we have movement itself or the geometry of motion and the forces that cause these moments are kinetics. And kinematics and kinetics can be classified into two types linear and angular.

And within kinematics you have positions, velocities and accelerations rather displacements, velocities and accelerations. Likewise, an angular kinematics you have angular displacement, angular velocity and angular accelerations. Kinetics can also be divided into two types you know that for linear and angular. In linear you have force and in angular you have torque. So, far this considers body under study to be a rigid body.

That is whose size does not change as a function of the applied forces also. But suppose there is a deformation that happens. When a force is applied there is a change in this then these types of solids are called deformable solids. Within deformable solids we are interested in studying the stress and strain and the relationships between stresses and strains and then you have fluids. This is the broad division of mechanics itself.

But here we are interested in biomechanics it turns out that biomechanics also has almost all these divisions. So, without a need for me to repeat all these things essentially biomechanics also has statics, dynamics, deformable bodies bio fluid mechanics. So, in this course we will be primarily focusing on statics and some dynamics restricting our attention to kinematics of human movement.

And some amount of discussion of deformable bodies will happen but it will not be too detailed. And we will not be focusing on bio fluid mechanics. So, this is the broad outline of this course that we have.

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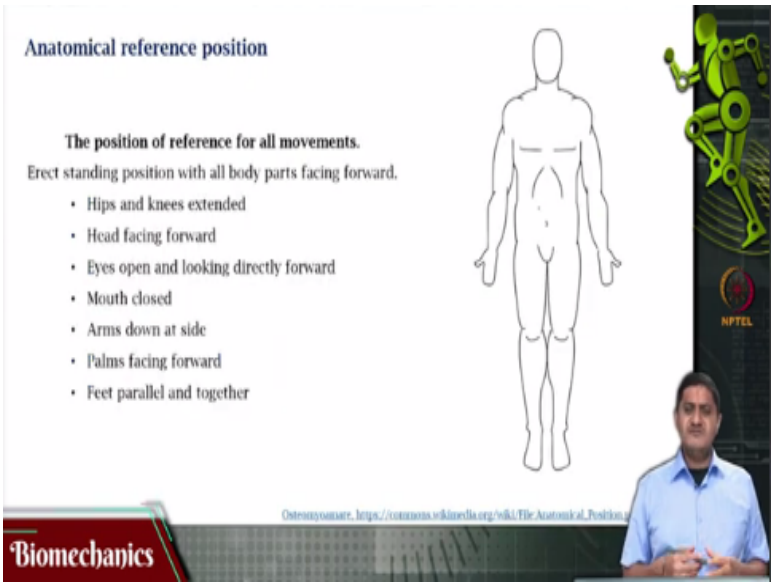

When we study biomechanics, we are interested in studying or describing movements with respect to a reference. So, the position of reference that is used for all movements is called anatomical reference position. That is when you are facing with your two pumps when you are standing with your arms on the side with the two pumps facing outside like this like I am now standing, you can see my two pumps.

So, this is to make it a bit more clear this is an erect standing position with all the body parts facing forward the parts of the body that are forward must face forward, hips and knees are extended. So, I am not bending at the hips or knees, head is facing forward, my face is towards

like this it is not bent like this or like that it is not on the sideways it is just facing forward. Eyes open and looking directly forward, my eyes are like this and not like this.

My mouth is close I am not sure when I was showing the anatomical position my mouth was closed. But in the anatomical position my mouth must be closed. And the arms are down on the side, palms are facing you, feet are parallel and together. So, like this man here; this outline of this human here is standing. This position is the anatomical reference position and any movement that we will describe will be with reference to this anatomical position so very critical.

So, any movement that we describe in future that we talk about in future in that this will be this particular posture or this particular position of reference will be used as the basis to compare some terminologies and directional terminologies.

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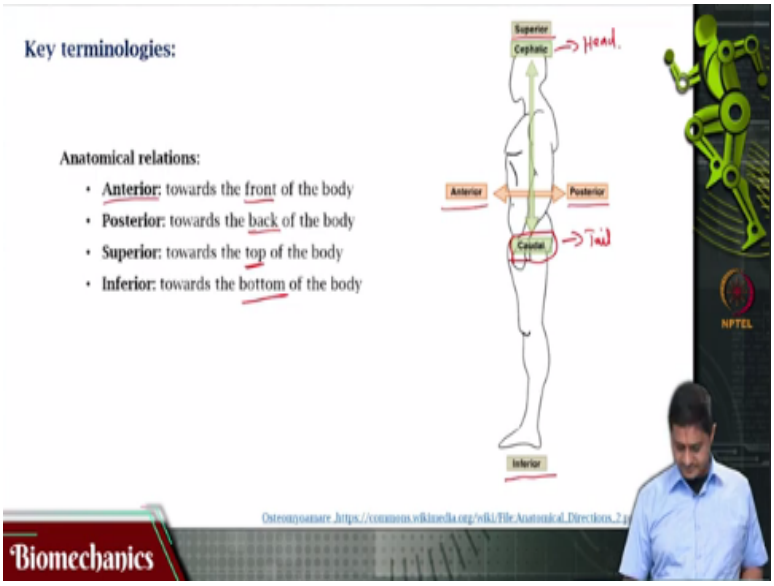

One difference so I am standing like this that is the front side of the body and then there is the back side of the body. The front side of the body is called anterior, that is towards the front of the body anterior. The back side of the body is called posterior it is towards the back of the body then I can also classify this as towards the top of my body or towards the head side of the body or towards the leg or the foot side of the body.

The head side is called superior and the legs side is called inferior. Superior means towards the top of the body, inferior means towards the bottom of the body or towards the leg. Also, sometimes we are interested in classifying the movements as to whether it is closer to the head or whether it is closer to the tail. Although humans do not have a tail, we do have a tailbone. So, those parts of the body that are closer to the tail are called caudal, closer to the tail.

And those parts of the body that are closer to the head are called cephalic is what is written. This is with reference to the directions. So, we have let us go back. So, we have anterior, posterior we have superior inferior, we have cephalic and closer to the tail. But we are not done because of the three dimensions we only looked at two of the dimensions front back and up down. What about left and right something that we have not seen that we will see in the next slide.

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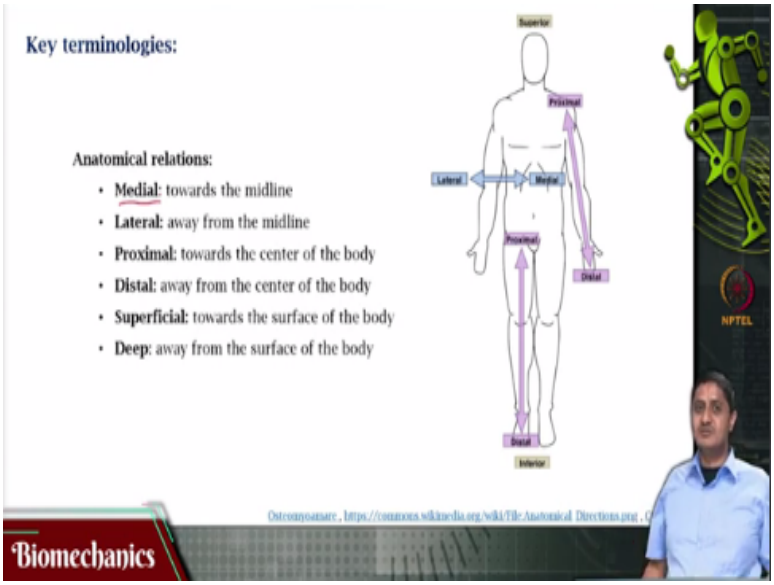

Towards the midline of the body, it is called medial that makes sense medial is towards the midline, lateral means on the side or away from the midline. So, when I am standing like this my chest is medial and my hands and arms are on the lateral side. So, lateral means on the side the one that is closer to the mid lane of the body is medial. Then we are interested in discussing how close a particular part of the body is to the centre of the body.

This is suppose I am extending my arm like this. The shoulder is the closest to the midline of the body or the centre of the body when compared with the elbow that is when someone is working

closely with another person you would say that they are working in close proximity. Proximity means what in the neighbourhood nearer that is what it means. So, when you say like this the shoulder is considered a proximal joint when compared with the elbow.

The other way of saying this is when compared with the shoulder the elbow is further away from the centre of the body that is it is distal to the shoulder. Note that this is a relative reference term. Now let us look at the shoulder, elbow and the wrist joints all these three joints. The elbow joint is distal to the shoulder joint but when compared with the wrist joint it is more proximal. When I am keeping like this the elbow is more proximal when compared with the wrist but it is more distal when compared with the shoulder.

So, a given joint may be considered proximal or distal depending on what is the reference that you are using to discuss that. So, proximal means closer to the centre of the body, distal means away from the centre of the body. Superficial means what something that is on the surface, superficial. Some tissue some parts of the body are found deep inside the body that means that they are away or found deep inside the body.

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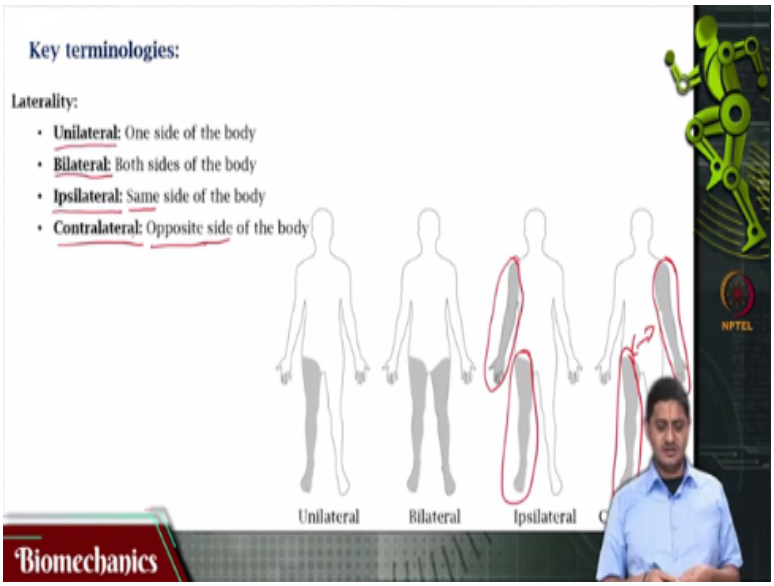

Sometimes when referring to sides of the body there are some terminologies that are used. One is when something happens only on one side of the body that is called unilateral, uni means one lateral means side. Unilateral means something that happens only on one side of the body. If

something happens on both sides of the body if there is pain that happens on both sides of body then you call it as bilateral, bi means to later means two sides, bilateral means two sides.

If ipsilateral means something that is happening on the same side of the body. For example, this arm the right arm and the right leg are ipsilateral, ipsy means the same side, you see lateral means same side. Contralateral means contra means on the opposite side lateral means side. The left hand and the right leg or the left hand and the right leg are contralateral to each other likewise the right hand and the left leg are contralateral to each other.

So, those that are found on the opposite side are called contralateral, contra means on the opposite side contra means something that is opposite. Ipsy means something that is on the same side.

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So, with this we come to the end of this video. So, in this video we have seen what is biomechanics and how it is defined within the sub field of kinesiology. The divisions of mechanics and the divisions of biomechanics and what is the anatomical reference position. Terminologies in terms of directions and in terms of body positions something that we have discussed. Thank you very much for your attention.