Biomechanics
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Lecture - 04
Joints in Human Body

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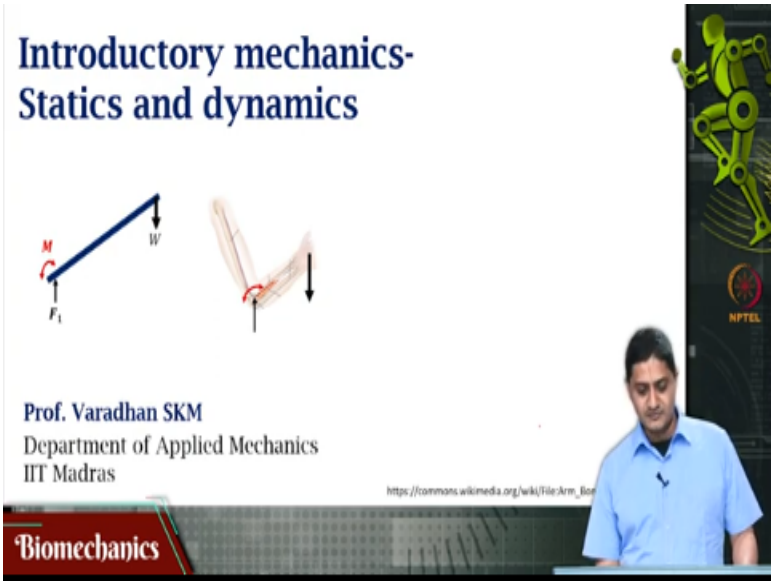

Welcome to this class on biomechanics where we have been focusing on introductory mechanics and statics and dynamics.

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Specifically, we will be focusing on joins in the human body under types of joints. We will take some examples of the types of joints that are present in the human body and write out the number of degrees of freedom for these joints.

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In mechanics or in machines that are used in daily life we classify the movements that these joints can make based on that we classify them as different types in two different types and each one of them you know will come out with different degrees of freedom. Now one type of joint that you can see simple joint is the hinge joint. In this case the moment is restricted in the counter clockwise direction like this are in the clockwise direction like this perpendicular to that point.

It can rotate, it can go down like this or like that you can rotate like this for example. How many degrees of freedom that does this joint have? And it cannot perform any other translations remember in all these joints there are no translations that are involved only rotations and it does not rotate about any other axis it only rotates about this axis so one rotation that it performs. So, this is a joint with a single degree of freedom one degree of freedom joint number of degrees of freedom one.

It is an example of a hinge joint in the human body. You can take a few seconds and think about do we have a hinge joint? Remember when you are thinking about this do not imagine the hinge joint that you will have in a door or in a gate. Imagine the function is there a part of your body where rotation is restricted about only one axis and there is no rotation possible in any other axis and only rotation is possible in that joint.

Do we have such a joint in the human body? The answer is yes. The simplest example that we can give is the case of the elbow joint. I am having the elbow joint I am making that rotation; this is the only rotation that it can make. It cannot for example rotate so it is right now it is able to rotate about an axis that is passing through the elbow like this and it is able to do that rotation. It cannot you know it seems like we are able to do this movement.

This so called supination pronation or this is pronation and this is supination but this is not happening exactly at the elbow joint it is not technically not a degree of freedom from this joint. So, this is an example of the hinge joint in that case. So, another simple example that you can think of is the knee joint. So, I can write out the example, knee elbow. The other case is the case of a saddle joint.

In this case what happens is that rotation can happen in either so rotation can be by this object or by this body or rotation can happen in this direction for the body on top for the object on top. So, there can be two rotations, one is for the lighter colored object the other is for the slightly darker colored object. Both of these will rotate in an axis that is perpendicular to them. So, there will be two rotations that are possible.

Other examples of this that are occurring in our body there are two rotations that can happen. The answer is yes. The simplest example is the case of the metacarpophalangeal joint in the fingers. So, I am having I can do that this is also called as the flexion and extension. And I can do that remember it is not the same as what I did previously in this case I am doing a moment that is in the plane of the pump is called abduction adduction, so that is possible.

Now what about the ball and socket joint? In the case of the ball and socket joint that is movement that is possible within the socket so the ball can rotate about any axis but it cannot translate within the socket it can rotate. This is you know this appears weird do we really have a ball that rotates within a socket in our body that appears you know amazing if this can be true but we do have two such very important joints in our body.

One is the shoulder joint let me write this out this is the MCP joint of the fingers this is the shoulder joint and the hip joint. And one more case is this case where the rotation is happening in this, this is slightly different from the case of the hinge joint but this also has only one degree of freedom. This also has only one degree of Freedom slightly different from the case of the hinge joint this is called as a pivot joint, example is the neck.

My neck is rotating about a pivot I can look to my right and I can look to my left there is a pivot within which the rotation is happening. The restriction is about that, so that is the neck joint. Also let us remember that the number of degrees of freedom in the case of the saddle joint is 2; Because there can be two independent movements and in the case of the shoulder joint it can be 3, because the ball can rotate in three different directions but cannot translate. So, the degrees of freedom; is 3 technically.

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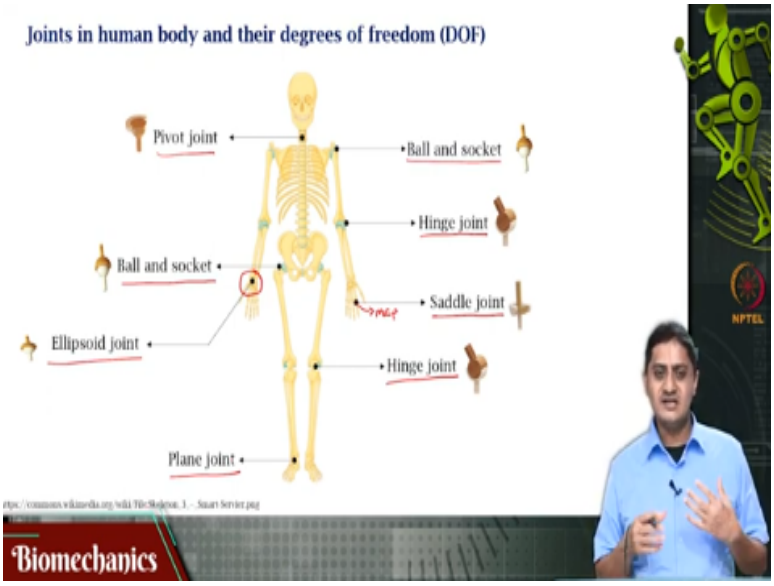

Let us take a look at the various joints in the body and classify them. We just took a look at the neck and we said that is a pivot joint, we took a look at the shoulder and we said that is a ball and socket joint and the hip is a ball and socket joint the elbow is an hinge joint and we said that the fingers metacarpophalangeal joint of the finger is a saddle joint but the more distal joints in the fingers are hinge joints.

So, this is the MCP joint it is a saddle joint. And then the knee joint is a hinge joint what we have not described is the case of the wrist which is actually an ellipsoid joint and the case of the ankle which is a plain joint which we will discuss in slightly more detail when we are discussing problems and theory related to these joints. Let us take a couple of examples and see them in slightly more detail.

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One is the hinge joint so I just described the hinge joint are the distal interphalangeal joint are the proximal interferential joint as a hinge joints this is the example, say only one degree of freedom the rotation is happening about one degree of freedom. But in the case of a saddle joint which is this joint the metacarpal phalangeal joint I can do that movement see the see how this movement is happening it can move it is performing a complex movement that can be decomposed into two movements.

So, it is performing that so essentially there is a moment similar to this moment just the fraction extension and also an abduction reduction that it is doing. So, this is the case of the hinge joint and the saddle joint.

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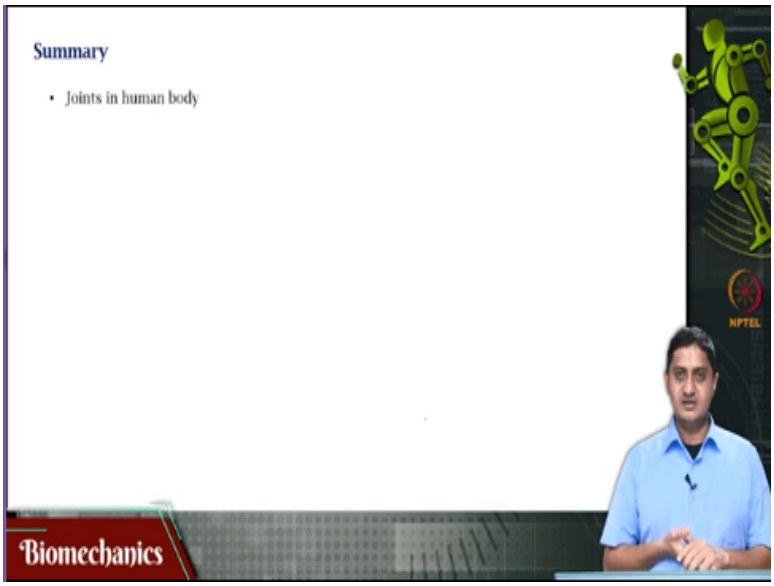

So, with this we come to the end of this video on the various types of joints that are present in the human body. Thank you very much for your attention.