Human Physiology
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Week - 06
Lecture - 02

Welcome, everyone, to another new class of human physiology. This week we are discussing our skeleton system. So, in the last class, we discussed bones, the different types of bones we checked, the mechanism of how bone formation happens, the different functions of bones, and the components of bones. And this class will discuss the joints. So, as you know, between two bones, we need to have a joint in order for proper and easy movement. If there are two connective bones without any joint, we will not be able to move the bones for proper movement and function.

So, joints are very important, and let us see in the class what different types of joints are present in our body and how they work. So, what different concepts will we cover in our joints class? As you can see, we will discuss what a joint is, different types of joints, the various types of movements, and then tendons, cartilage, fascia, and ligaments. So, tendons, cartilage, ligaments, and fascia are other connective tissues. So, in this class, not only will we go through the joints, but we will also see what other different connective tissues are present in our body.

So, what is a joint? A joint, also called an arthrosis, is a point of contact between two bones. and it can also be a point of contact between bone and cartilage or bone and teeth. The scientific study of joints is called orthology, and the study of the motion of the body is called kinesiology. Joint motion is referred to as orthokinematics. These are different terms; if you are interested, you can go through them in further detail.

But what are the functions of joints, as you can see, mostly the joints have an important role in the movement of body motion. Then it also provides structural support, and finally, it has weight-bearing applications; it supports body weight, and its joints also help create a lever action for pulling heavier weights. Types of joints, what are the different types of joints present in our body? So, you can see that structurally, mostly three types of joints are present. One is a fibrous joint, the second is a cartilaginous joint, and the third is a synovial joint. So, let us see one by one what a fibrous joint is, which is mostly like an immovable type of joint.

Connected by dense connective tissue. We will give the example later. Then what is a cartilaginous joint? It is a slightly movable joint connected by the cartilage. And then lastly, the synovial joint is a freely movable joint with a synovial cavity; it can mostly be seen near the knee area. And functionally, joints are kind of three types: synarthrosis, amphiarthrosis, and diarthrosis.

So, synarthrosis, amphiarthrosis, and diarthrosis. So, what is, what are these? So, synearthrosis is a kind of immovable joint that is like a fibrous type of joint, right? This is a fibrous type of joint. And then amphiarthrosis is a slightly movable joint. So, mostly, which are the slightly movable joints, like the cartilaginous joint. And then diarthrosis, which is the freely movable joint, is the synovial joint.

Then let us see different types of fibrous joints. So, we have this skull, and you can see that the fibrous joint permits little or no movement. So, basically, inside the skull, you can see that there is a suture-like connection right in between this part and this part of the skull. So these are dense fibrous collagen structures. They don't allow any types of movement.

They are mostly called sutures. Right. And then there are connective bones with the ligaments like the tibia and fibula, like this structure. You can see the tibia and fibula; in between, there is this dense cartilage connection. This is called syndesmoses.

And then gomphoses. And then, in the gomphoses, you can see there is a connection between the teeth and the jaw. So, this is the tooth, and there is a dense connection between the tooth and jaw, which is called gomphosis. So, there are three types of mostly fibrous joints: the sutures, which are present between the skull, and syndesmoses. Then syndesmoses, which is the connection of the bones between the ligament-like tibia and fibula, and then the gomphoses, which is the connection of teeth to the jaw.

Then there is a cartilaginous joint. So, you can see where the cartilaginous joint is located inside the long bone; you can see that this epiphyseal area and the diaphyseal area are present in between this cartilage of joints, and they are also near our hip bone. So, these are like the hip bones and the pubic area. So, this is where you can see the cartilaginous type of joint. So, both inside a long bone and near the hip bone, you can find a cartilaginous type of joint.

Then synovial joints, as you can see, have a unique characteristic because they are freely movable. and it contains a lot of fluid-like structures, which are synovial fluids; it helps to prevent any friction between the two adjacent bones. Mostly, it can be seen in the knee area; you can see here, right? Between the two knee bones, you can find this nice dense synovial joint and the fluid area, which has three components, mostly the synovial cavity. It is filled with synovial fluid for lubrication, which makes the joint freely movable. And then we have the articular cartilage area; this basically provides a cushion pad in order to prevent any friction between the two bones.

And then, finally, the joint capsules. It encloses the joint and provides stability. So, basically, this is a kind of capsular environment that encloses the joints and gives stability, structural stability, and integrity. Different types of movements of the joint. So, as you can see, there are a lot of movements, but few that I can show you.

So, gliding like for example, this is our wrist right. So, if we just do this type of motion, it is called a gliding motion. Then you can see this one over here: the abduction and adduction. So, basically, abduction and adduction are the movements of the bones; abduction is the movement of the bone away from the midline. So, if we do it like this and move our hand away from our midline, this is called abduction.

And if we move our bone toward the midline, it is called adduction. We have two other movements here mentioned as flexion and extension. So, what are these two? Basically, if we have this arm and we move it towards us, it is like flexion, and then if we extend it, right, if we increase the angle, it is called extension. So, these are different types of gliding. Like abduction, adduction, and then extension and flexion.

And finally, we can also rotate. So, if you extend your hand and make this type of rotating movement, this is called rotation. So, different types of joints play a very important role in

moving various components of our body, and each of the movements can be explored in detail, but all of these movements are very important, and certain bones and joints play a specific role in this type of action. Types of synovial joints. So, these are very important, like what different types of synovial joints we have.

So, the first one is the ball-and-socket joint. So, you can see the first one is a ball-and-socket joint. So, this consists of ball-like surfaces; see, this looks like a ball-like surface of one bone fitting into the cup-like structure of another bone. So basically, this ball-like structure fits one bone to another bone. And these ball-and-socket joints help in creating rotational movement, especially in our shoulder.

So we'll have ball and socket joints in the shoulder; we'll also have ball and socket joints in our hip area. And ball and socket joints help in a wide range of motion. The next are the hinge joints, right? So, the convex structure of one bone fits into the concave structure of another bone. So, basically, hinge joints have two structures: one is the convex structure of one bone that fits with the adjacent concave structure of another bone. Hinge joints produce an angular opening and closing motion.

It creates an angular motion and does not allow the bone to fold backward. So, basically, you can see the hinge joint in your leg, in your arm, and in your elbow; this will prevent your bone from going backwards. It can create only this angular type of movement. So, the hinge joint not only helps in terms of moving your adjacent bones to a particular angular function, it also maintains structural integrity and prevents over-bending of your bones in the wrong direction. And then, in a pivot joint, the rounded pointed surface of one bone articulates with a ring formed partly by another bone and mostly by the ligament, which helps with rotation; for example, in the neck joint and the forearm, you will find a lot of this type of pivot joint, as well as planar joints.

The articulating surfaces of the bone in a planar joint are mostly flat or slightly curved in nature, right? What does it do? It helps in terms of back-and-forth or side-to-side movement between the flat surface and the bones. Where can you find? You can mostly find it in the wrist area, right? So, this type of planar bone can be found in the wrist area. Then you will find condylar bones, condylar-type joints, and saddle joints, where these are mostly visible; for example, condylar joints are visible in this finger area, and you can also see the saddle joint in between the fingers. So, you will have a convex oval-shaped projection of one bone that fits into another oval-shaped depression of another bone, which is like the condylar type of joints. The example is like a wrist joint, and the saddle joints are mostly present in the fingers.

What does it do? It allows for flexion, extension, abduction, and adduction. So, all this type of finger movement is controlled by the saddle joints. So, condylar joints are present in the wrist, saddle joints are present in the thumb, or even in the fingers. Then after the joints, what are the other types of connective tissue, right? So, there are four different types of connective tissues; a little bit we will learn, like tendons, which are basically connective tissues that attach muscles to the bone; then cartilage, which provides cushioning, support, and joint movement; then fascia, which is basically a membrane-like layer; and finally ligaments, which connect bone to bone. So, tendons basically connect muscle to bone, and ligaments connect bone to bone, okay.

This is very important. So, the connection between bone and bone is called a ligament, and the connection between muscle and bone is called a tendon. Then you can see the tendons; this is a tendon structure that helps to connect the muscle and the bone, right? So, tendons are basically

tough, fibrous cords of connective tissue. It functions to connect muscles to bones. What is the structure? Primarily composed of collagen fibers arranged in parallel bundles. And what is the key role of tendons? It helps in terms of the transmission of force from muscle to the bones.

So, once the muscle contraction happens, that force needs to be immediately transferred from the muscle to the bone, and the tendon helps with that. Because unless this contraction goes to the bone, we will not be able to have a resultant movement, okay. A lot of examples show that the Achilles tendon connects the calf muscle to the heel bone. So, now that you know a little bit about tendons, let's discuss cartilage; these are smooth, elastic, and flexible connective tissues.

This lacks direct blood supply. This receives nutrients through the process of diffusion. And what is the general function of cartilage? It provides cushioning like a soft bed so that it can reduce the friction between two bones and the joint. Different types of cartilage are also present, such as hyaline, fibrocartilage, and elastic, and you can find them in different locations. For example, the thyroid cartilage near this Adam's apple consists of two fused plates of hyaline cartilage.

Okay. So, a different type of cartilage mostly provides structural cushioning to reduce the friction between the joints and the bones. And then fascia, fascia is like a sheet or layer of connective tissue that surrounds the muscles, organs, and other structures. Mostly, you can see fascia in every organ; basically, it is like a membrane-like structure, right? And what is it made of? It is made of collagen and elastic fibers, and what are their functions? It provides support, stability, and separation from outer fluids. It also helps in terms of movements like gliding, and it also helps maintain or influence posture and movement. Different types of fascia can be seen or found in the body, such as superficial, deep, or visceral.

Finally, ligaments which are very important. What is a ligament? Ligaments are the connections between bone and bone, right? Between one bone and another bone, this needs to be held off, and unless it is held in a proper kind of shape or area, the bones will have a huge amount of friction. So, what is basically a ligament? Ligaments are strong flexible bands of connective tissue that basically connect one bone to another bone. These are mostly like collagen and elastin types of fibers, and by connecting the two bones, they stabilize the movement; they also prevent excessive non-directional movement of the bone. What are different types of examples? So, this is a classic example and picture of our knees. You can see the upper part of the knee and the lower part of the knee; it has a few important ligaments.

So, the frontal part of the ligament, which is called the anterior cruciate ligament, and the posterior part of the ligament between the two bones is called the posterior cruciate ligament. The ACL, this is the ACL anterior cruciate ligament, and on the posterior side, you will find the posterior cruciate ligament, which is the PCL. Apart from that, you will see like A lot of cartilage, like this medial meniscus, is present to provide cushion-like support, and there are some lateral cruciate ligaments, mostly like the fibular collateral ligament, which you can see on this side and this side; these are kind of lateral cruciate-type ligaments. Most of the injuries of the sportsman happen in this ACL area. So, this is a very important anterior cruciate ligament, and you will hear about it from soccer players, cricket players, and rugby players; the majority of knee injuries occur in the ACL, in the anterior part of the connection, and if the injury happens, if there is a ligament here.

If it is a scale 1 or 2 tear, maybe at an early level and not a complete tear, then movement can still be achieved through physiotherapy and other exercises, such as strengthening the nearby muscles around the joints. But if the tear is almost 90 to 100 percent, then the patient has to undergo surgery. And they have to kind of have the doctor put a connective tissue type of layer to join both the bones so that the patient gets back to his natural and normal movement. So, ACL and PCL are both very important, but you have to remember that the ACL is the most common form of injury that occurs for athletes. Finally, some questions arise, such as: Do you know that the knee joint is the joint most vulnerable to damage because it is highly mobile in nature? Due to our walking, we have a lot of movement through our legs, and our knee joints are highly mobile, which presents a serious risk of injury if any misalignment occurs during our movement, whether walking or participating in sports.

And if any injury happens, you will sometimes find that there is water accumulation and signs of inflammation, which will enlarge the connective tissue area and cause your knee joint to become swollen. It is also called water on the knee. Basically, it is the accumulation of synovial fluid due to injury or any infection, and as I already said, the ACL injury, or the anterior cruciate injury, is the most common form of injury observed in cases of sports persons. Apart from that, there are meniscus injuries as well; of course, there is a chance of meniscus injury, but ACL injury is the most common form of injury. So, the activity question is what type of movement occurs during the chewing of food.

Try to go through the class lectures, read about it, and find out what exact type of movement can happen while you chew. That movement and different types of synovial joints and their movements are present in that slide where the table has been given. You can go through that table and identify this one. Thank you again. Thank you very much for attending another class in human physiology.

In this class, we have thoroughly discussed different types of joints. What are joints made of? What are the functions of the joints? And then we also saw different types of connective tissues, most importantly tendons and ligaments, and what different types of ligament injuries can happen. So, I hope you enjoyed the class. We will come back with another new class with you very soon. Thank you again.