Oral Biology
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Lecture - 12
TMJ Anatomy and Function

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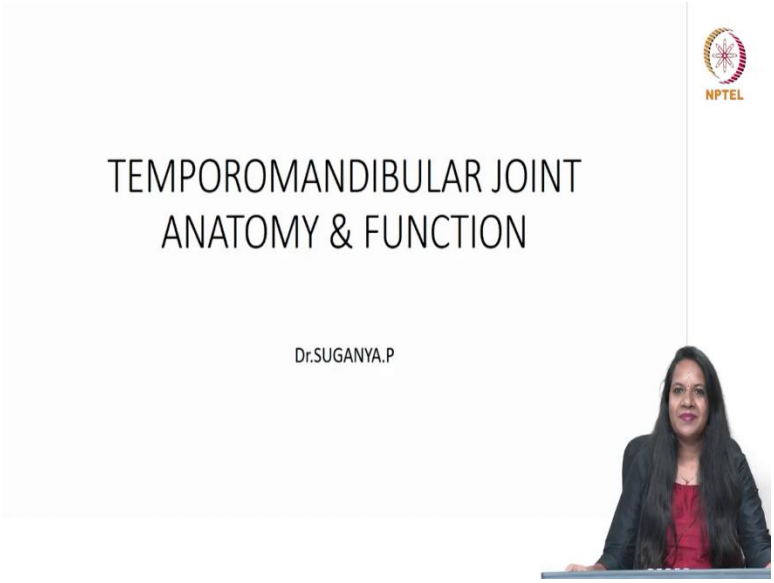

Hi everyone. Welcome to an interesting topic Temporomandibular Joint, Anatomy and Function.

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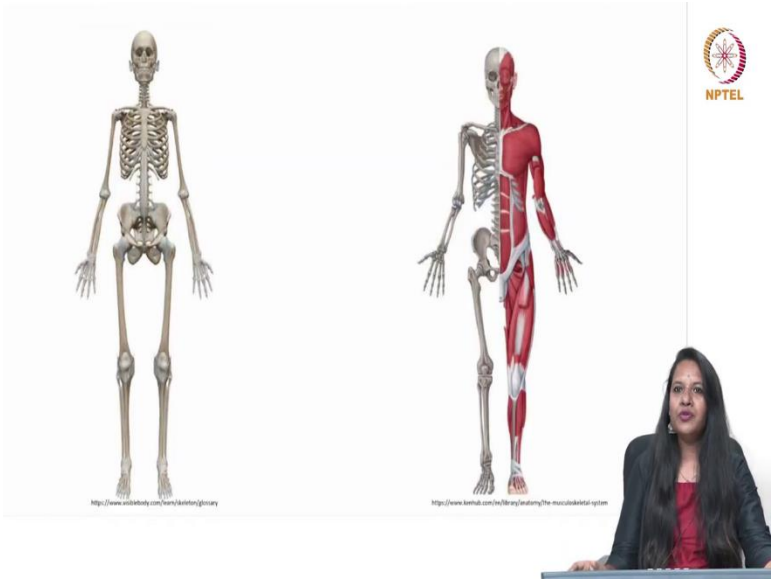

Our human skeletal system is a complex structure composed of 206 bones with attached tendon ligament and muscle.

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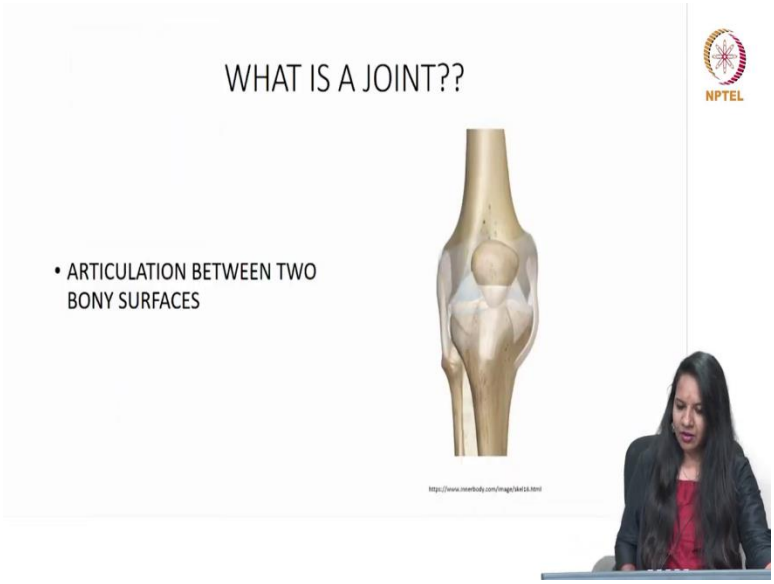

A joint is an articulation between two bony surfaces that holds the two skeleton together and helps in the movement.

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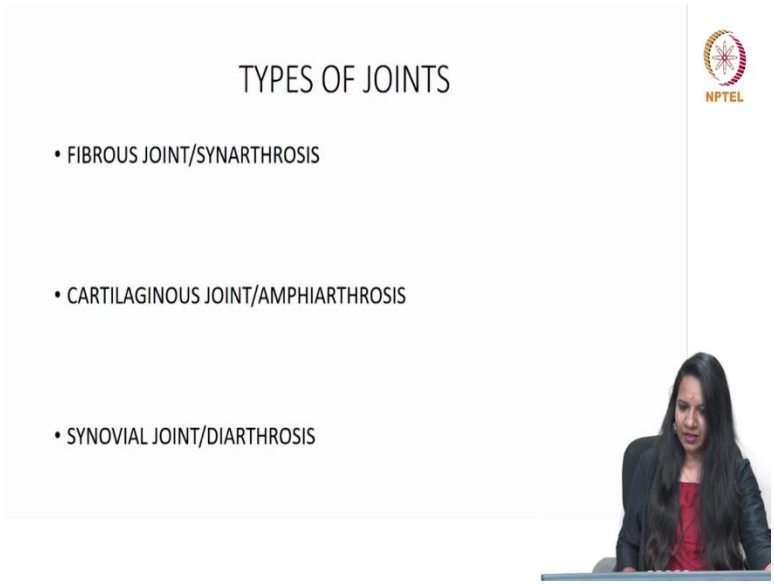

We have basically three types of joint. The one being the fibrous joint, otherwise known as synarthrosis; cartilaginous joint, otherwise known as amphiarthrosis and finally, synovial joint which is otherwise called diarthrosis.

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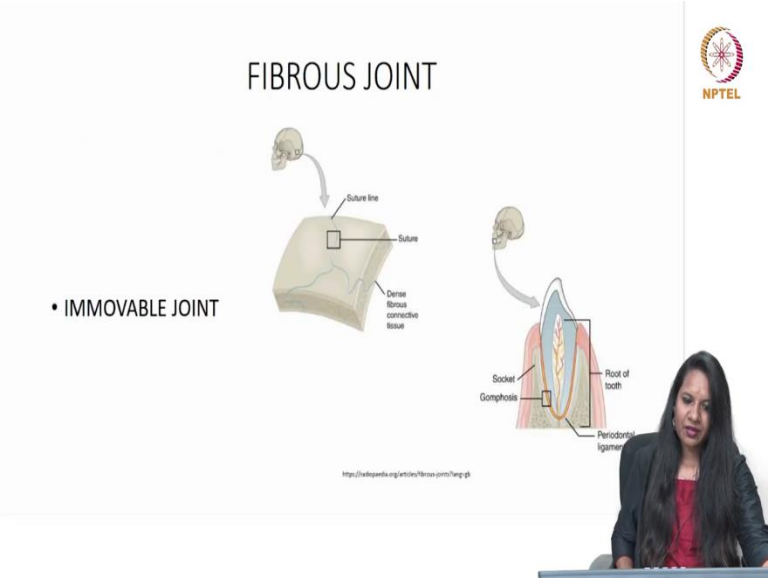

The first one being the fibrous joint. It is an immovable join. So, the two skeletal system is joined by the dense fibrous collagen tissue. For example, suture line in between the skull and tooth which is anchored by the periodontal ligament in the alveolar bone.

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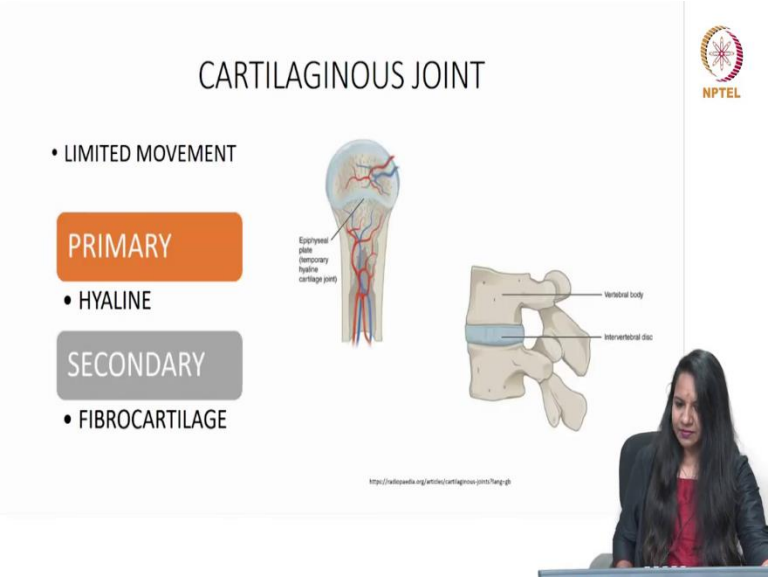

Then, comes the cartilaginous joint which has limited movement. Limited movement in the sense, it is more movable when compared to fibrous joint and less movable when compared to synovial joint. It is of two types; primary and secondary. In primary, the two bones were joined by a hyaline cartilage and they are present in between the ossification centre of the long bone; whereas, in secondary, the bones were compressed by fibrocartilage pad in between them which is seen in intervertebral discs.

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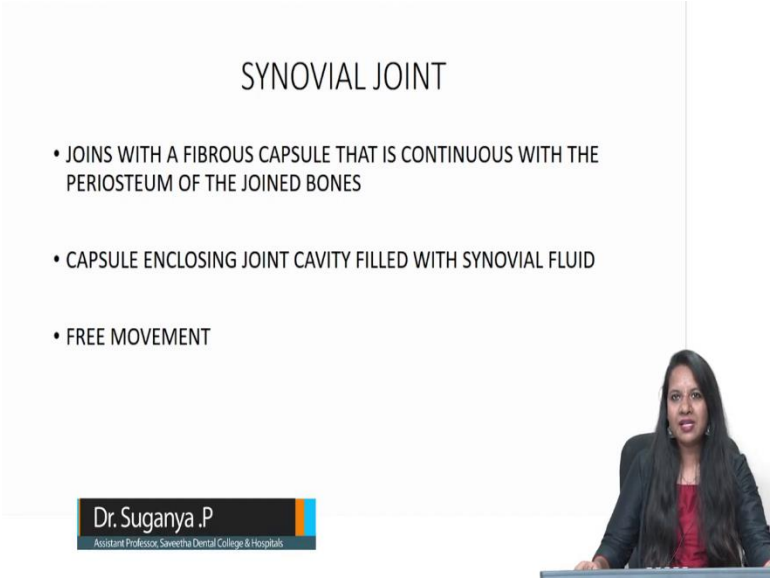

Moving to the synovial joint, a synovial joint permits free movement and this joint is nothing but the extension of the periosteum of the joined bones and it has a capsule enclosing the joint cavity which is filled with the lubricant known as synovial fluid.

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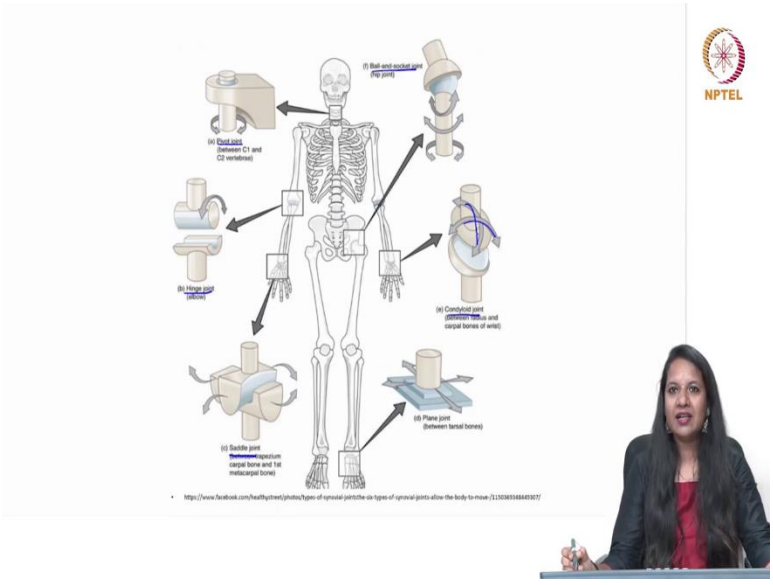

These are the types of synovial joint. The first one being the pivot joint that is one bone rotates over the other. Example is the atlantoaxial joint which permits rotation of head. The second is the hinge joint, where there will be movement in a single plane that is flexion and extension in a single plane like a door - Example elbow.

The third one being the saddle joint that is the two surfaces reciprocally concave or convex in shape resembling a saddle. Example is the thumb joint. The fourth one is the ball and socket - It permits all types of movement except gliding. Example hip bone. Condylar joint which is a modified form of ball and socket and it permits movement in two perpendicular axis. The last one is the plane joint which promotes gliding or sliding action and it is present in the tarsal bone.

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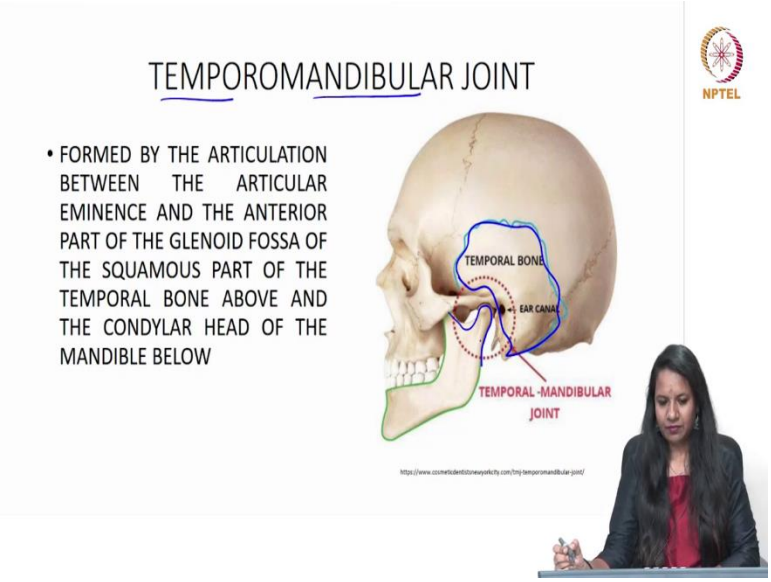

Now, moving to our topic temporomandibular joint; so, as the name suggests it is an articulation between the temporal bone and the mandibular bone. It is formed by the articulation between the articular eminence and the anterior part of the glenoid fossa of the squamous part of temporal bone above and the condylar head of the mandible below that is the articulation between the temporal bone.

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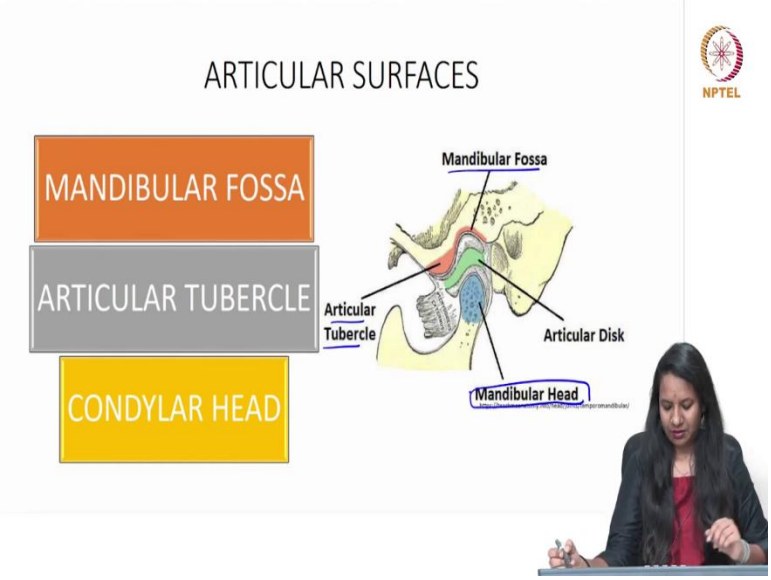

So, the articulation between these bones is known as temporomandibular joint. So, there are three articular surfaces in this joint. The first one being the mandibular fossa and the second one is the articular tubercle and the third one is the condylar head otherwise known as mandibular head. These three surfaces are the articular surfaces of the temporomandibular joint.

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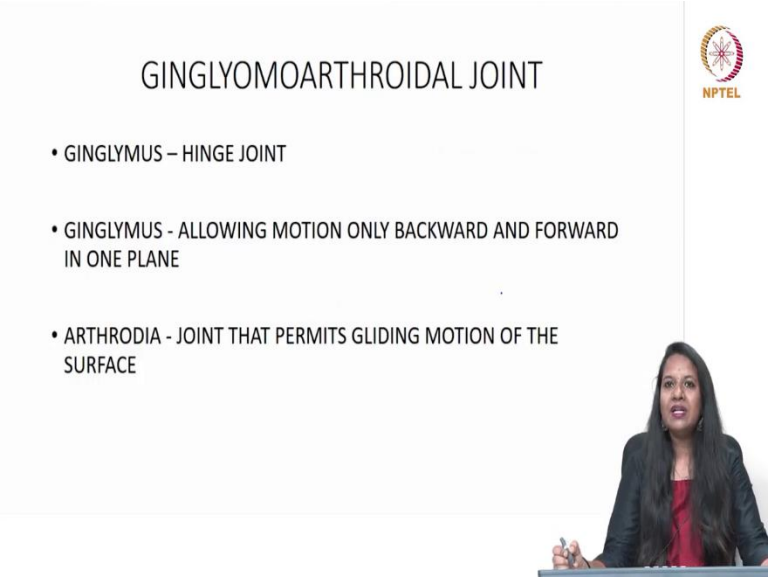

So, we have already seen three types of joints. So, what type of joint is a temporomandibular joint? It is a ginglyomoarthroidal joint. Ginglymus means hinge joint that is it moves in a single plane that is forward and backward in one plane and arthrodia means the joint that permits gliding motion on the surface. So, thus, it permits both, it is called as ginglyomoarthroidal joint.

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It is bicondylar and ellipsoid variant similar to that of the knee articulation that is both right and left will function together.

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TMJ has its own unique features. It is the last joint to develop in about 7th week in utero and it is bilateral diarthroses that is it the right and left will function together.

The articular surface is covered by fibrocartilage rather than hyaline cartilage and these joints and the articular surfaces will have a rigid end point of closure – they comprises teeth whose shape and morphology influences the jaw movement.

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It develops from two distinct blastema; that is one from the temporal, the other from the membranous ossification of the condyle as depicted in this picture. The green color denotes the temporal area and the red color denotes the mandible. So, it is formed from two distinct blastema to form as a joint.

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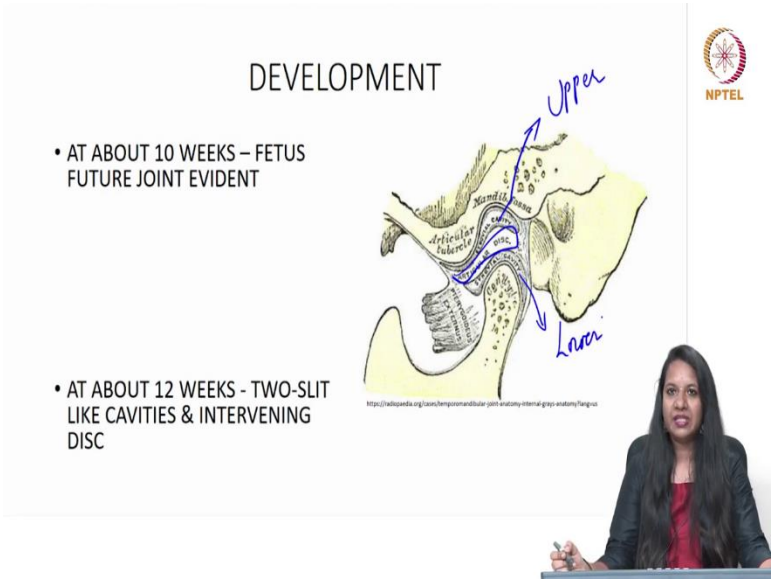

Moving to the development. Fetal future joint is evident only about 10 weeks and at 12 weeks, two-slit-like cavities under intervening disc is formed. This is an intervening disc which separates this into the upper and the lower cavity and this will happen at about 12 weeks.

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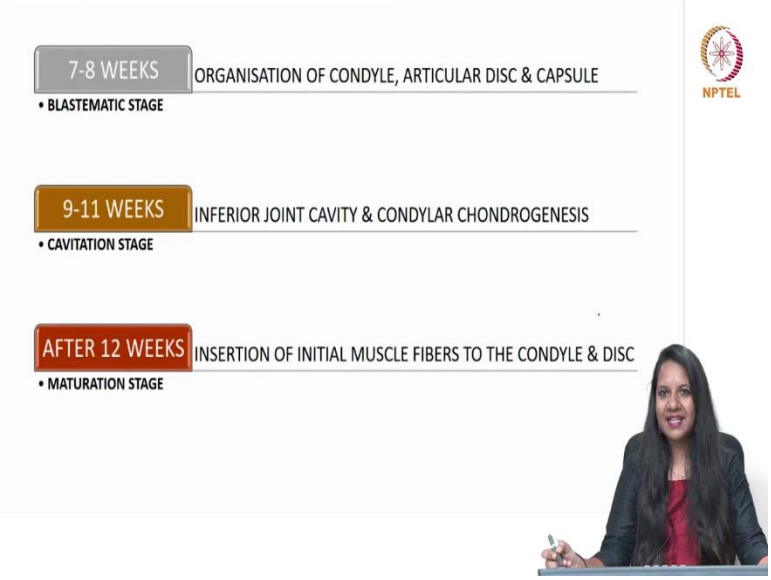

The first stage is the blastematic stage, which occurs between 7 to 8 weeks corresponding to the organization of condyle, articular disc and the capsule. The second one is the cavitation stage which occurs between 9 to 11 weeks which leads to the formation of inferior joint cavity first and then, moving to the condylar chondrogenesis. The last stage is the maturation stage which occurs after 12 weeks which is evident by the attachment of the initial muscle fibers to the condyle and disc.

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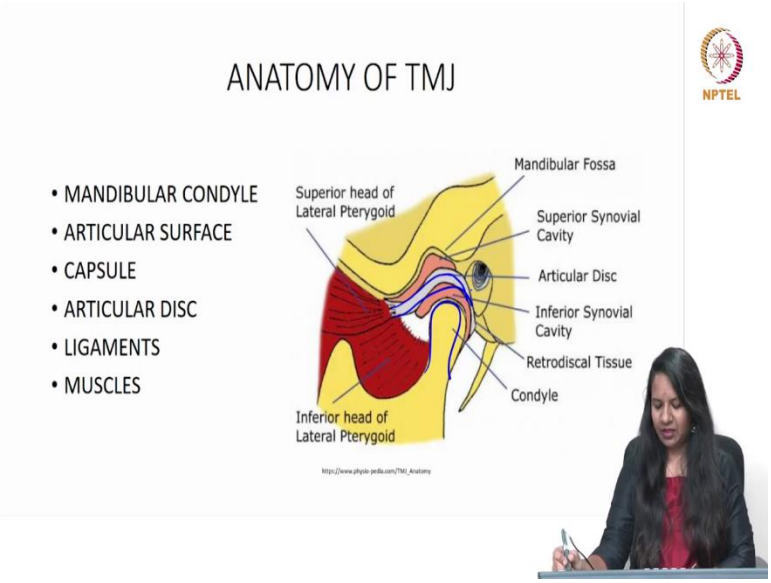

Moving to the anatomy of TMJ. So, the TMJ consists of mandibular condyle and an articular surface, with a capsule, articular disc and its own ligaments and muscles which permit various movements of the TMJ.

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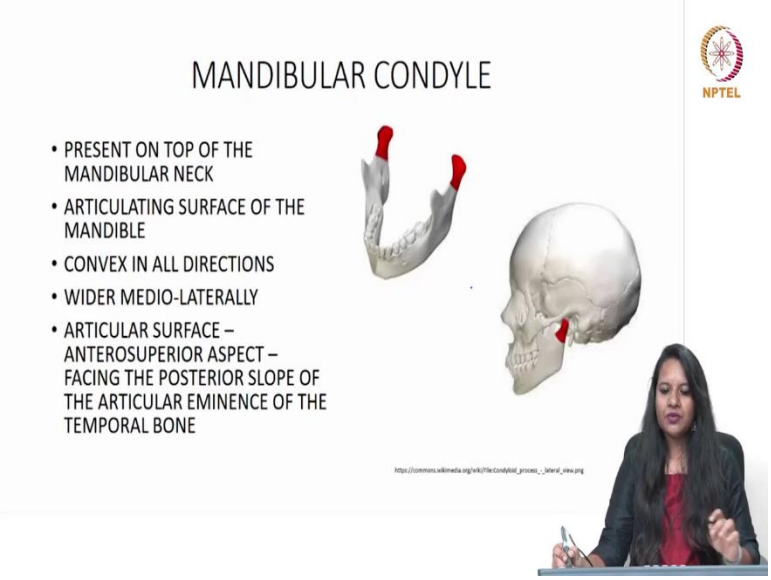

So, first one being the mandibular condyle. The condyle is the present on the top of the mandibular neck ok. It is convex in all directions and it is wider medio laterally. And the articular surface is the anterosuperior aspect, facing the posterior slope of the articular eminence of the temporal bone.

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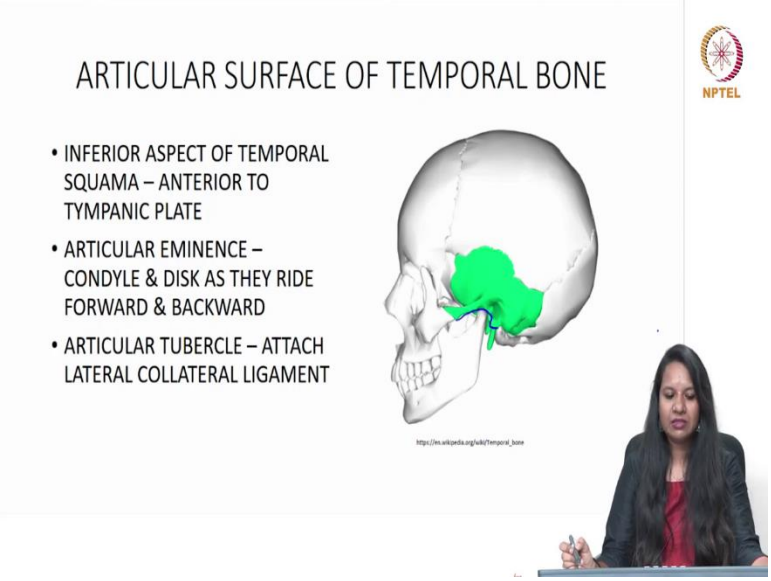

Next moving to the articular surface of the temporal bone. Articular surface means the one which has a contact with the other bone & it is the inferior aspect of temporal squama anterior to tympanic plate.

It has an articular eminence, where the condyle and disc ride forward and backward and it is called articular tubercle. It is a bony projection which gives attachment to the lateral collateral ligament, which is one of the ligament which helps in the movement of the mandible.

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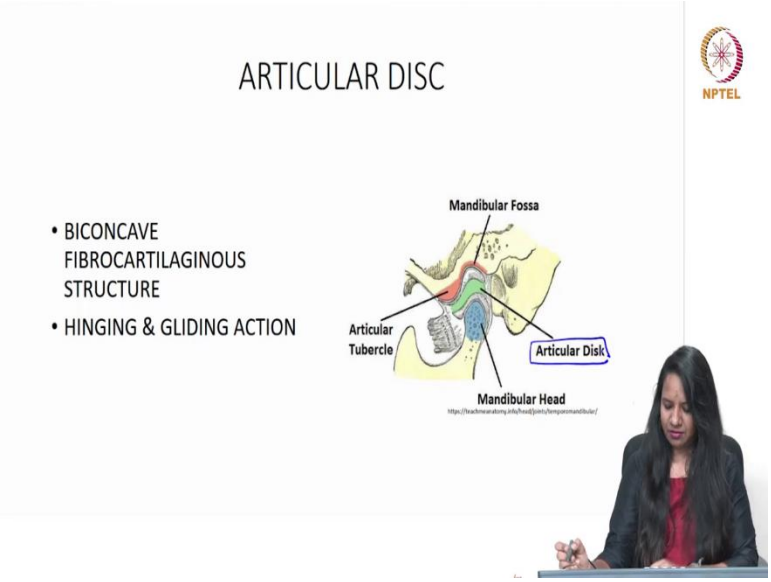

Moving to the articular disc, it is a biconcave fibrocartilaginous structure which helps in hinging and gliding motion.

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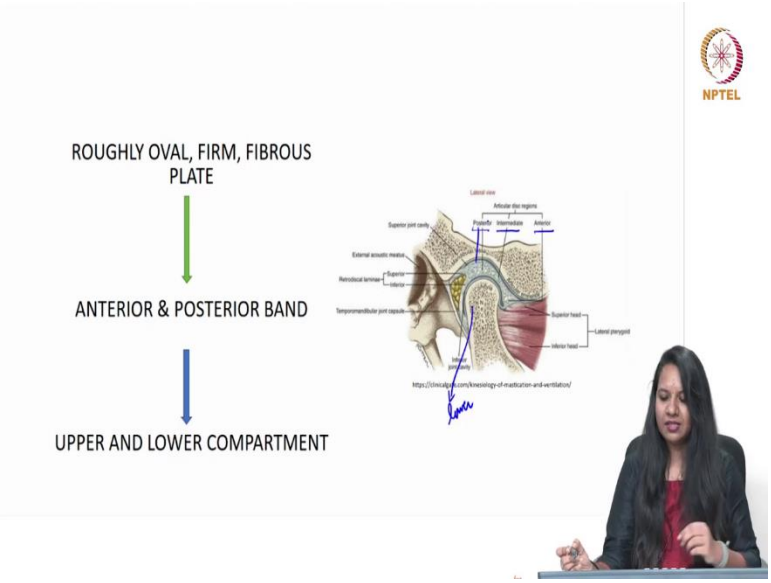

So, it is roughly oval, firm and it is a fibrous plate which is divided into thinner anterior and little bit thicker posterior with an intermediate zone. The anterior is 2 mm in thickness; the posterior is 3 mm in thickness; whereas, the intermediate zone is 1 mm in thickness. This divides the whole cavity into upper and lower compartment.

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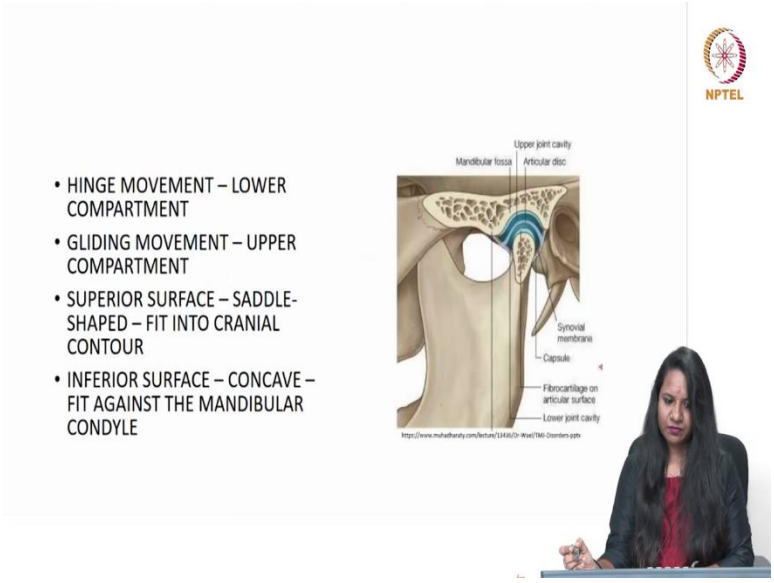

The lower compartment will take care of the hinge movement and the upper compartment will take care of the gliding movement. Hence, its the superior surface which directly fits into the contour of the cranium that is the temporal bone; whereas, the inferior surface is concave which fits to the mandibular condyle.

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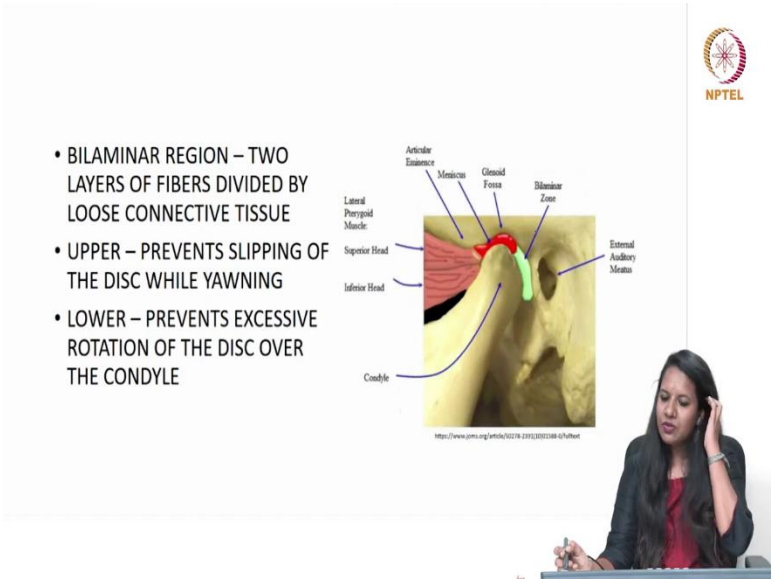

There is a region most posteriorly which is highly innervated and it is highly vascularized known as bilaminar region, otherwise called as retrodiscal tissue which consist of two layers of fibers divided by loose connective tissue. Each fiber has its own unique function. The upper fibers will prevent slipping of the disc while yawning and the lower fibers will prevent excessive rotation of the disc over the condyle. This green area in the picture is the bilaminar zone that is the most posterior area of the articular disc.

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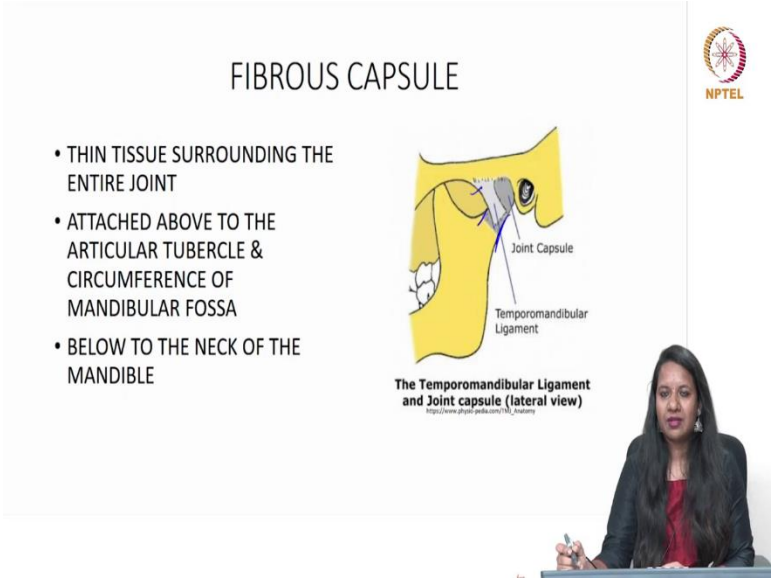

Fibrous capsule is a thin tissue surrounding the entire joint. It is attached above to the articular tubercle and below to the neck of the mandible.

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This capsule is reinforced more laterally by an external TMJ ligament. Thus, limiting destruction and posterior movement of the condyle on the sideways & on the medial and lateral, it blends with condylodiscal ligament.

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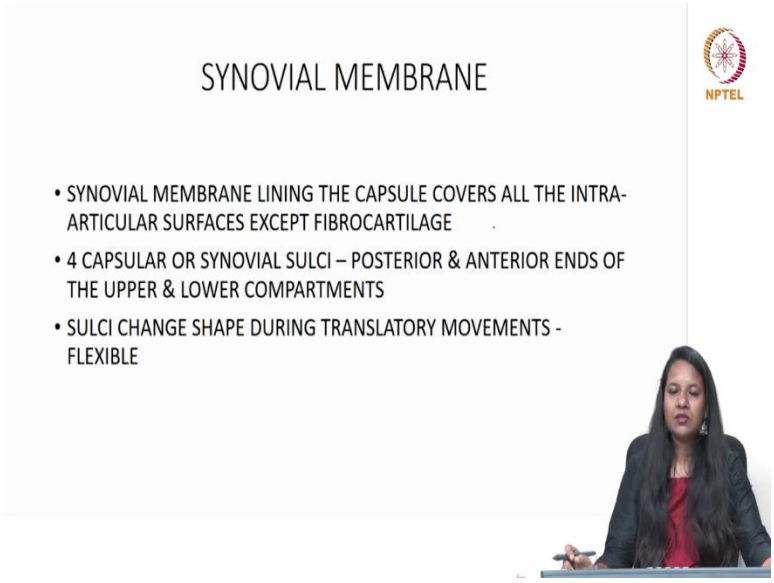

Synovial membrane is a lining which covers all the intra-articular surfaces except fibrocartilage. Hence, it has 4 capsular or 4 synovial sulci. That is one in the posterior and anterior and in the upper and lower compartments. So, totally 4 in number. These sulci change shape during translatory movements and hence, it has to be flexible to adapt the functional changes of the joint.

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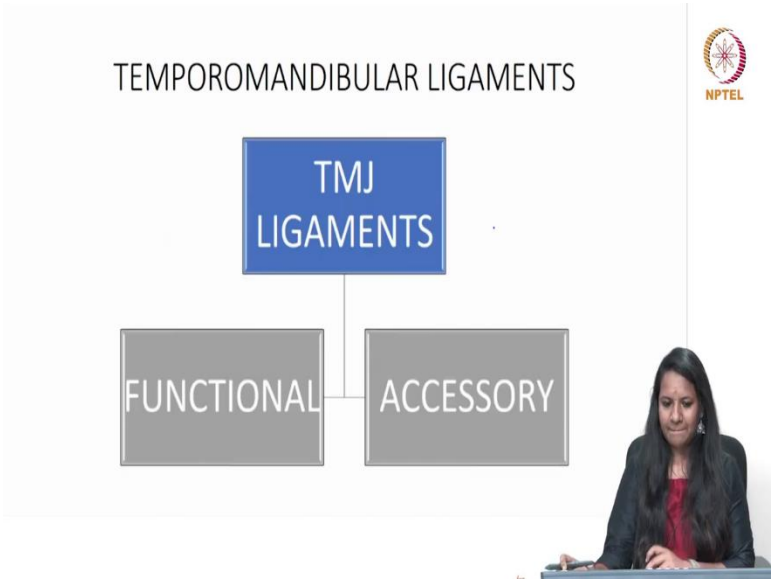

Moving to the temporomandibular joint ligaments, it is of two types; either functional or accessory.

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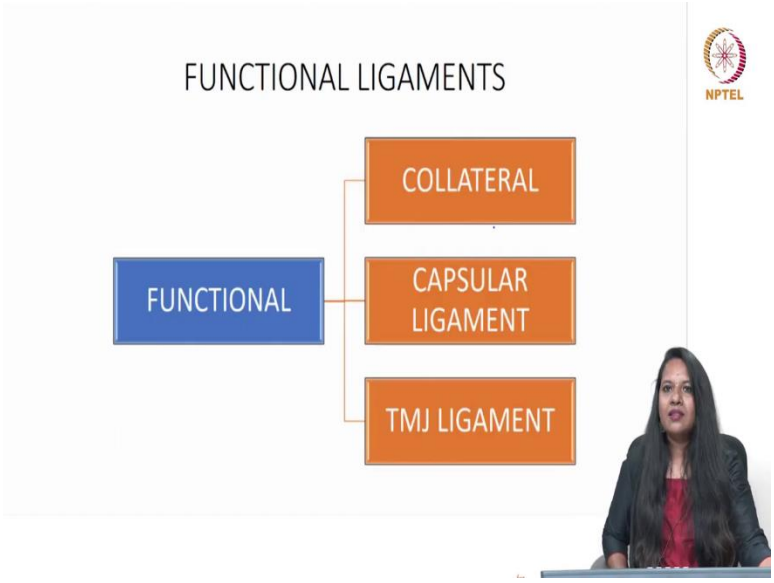

The functional ligaments of the TMJ are collateral, capsular and TMJ ligament itself.

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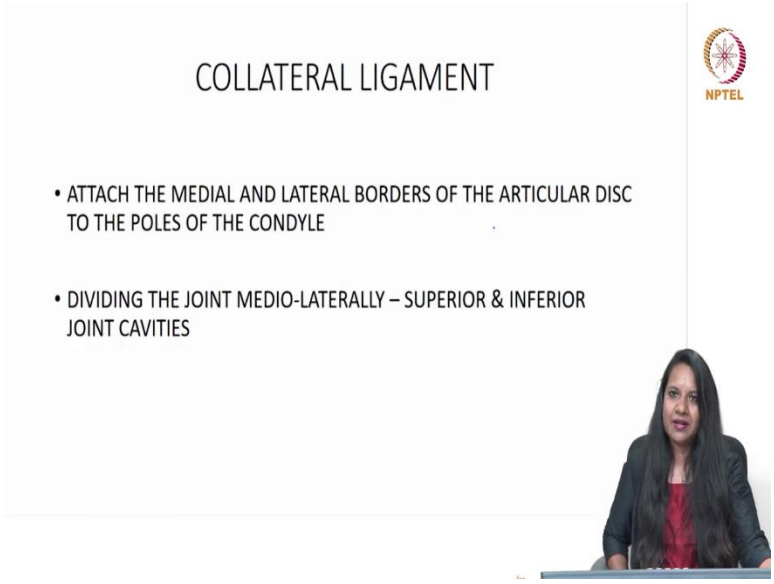

The collateral ligament attaches the medial and lateral border of the articular disc to the poles of the condyle. That is the medial border of the articular disc is getting attached to the medial pole of the condyle and the disc; lateral border of the articular disc getting attached to the lateral pole of the condyle. So, it divides the joint medio laterally into superior and inferior joint cavities.

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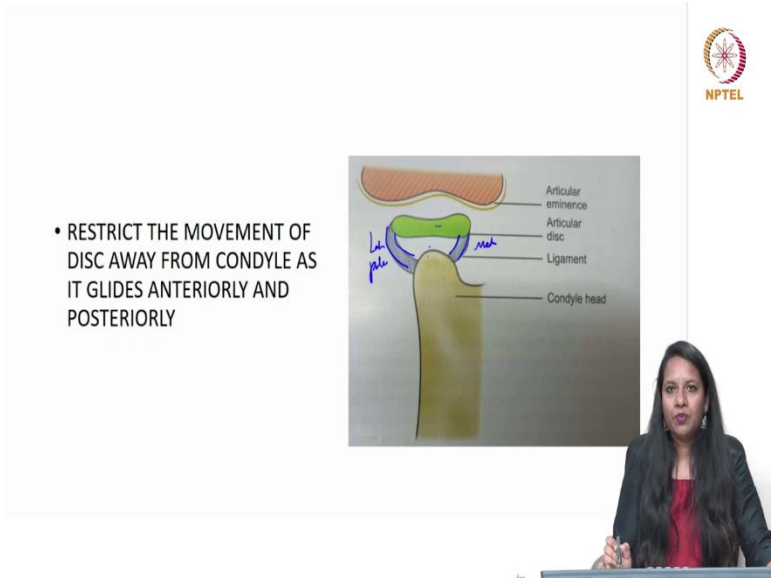

The function of this is to restrict the movement of disc away from the condyle as it glides anteriorly and posteriorly, it will prevent the separation of disc from the condyle.

This picture shows the collateral ligament which is getting attached to the articular disc. So, this will prevent the separation of this articular disc from that of the condyle during movement.

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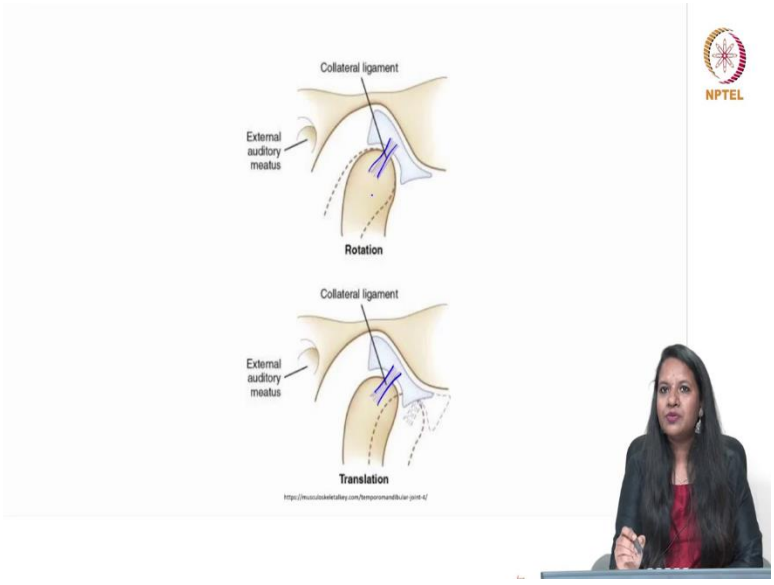

The collateral ligament will inhibit the separation of the disc from that of the condyle during protrusive movements.

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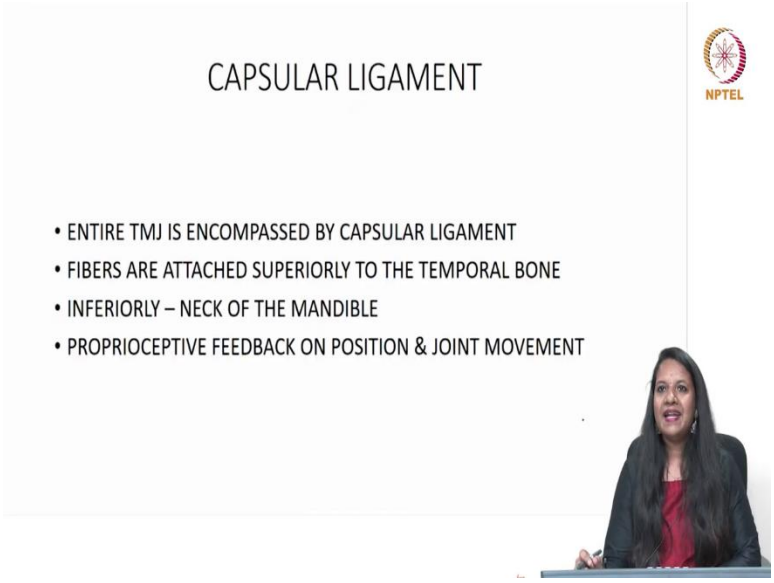

Then, comes the capsular ligament; the entire TMJ is encompassed by the capsular ligament. These fibers are attached superiorly to the temporal bone and inferiorly to the neck of the mandible. They have proprioceptive feedback on position and joint movement.

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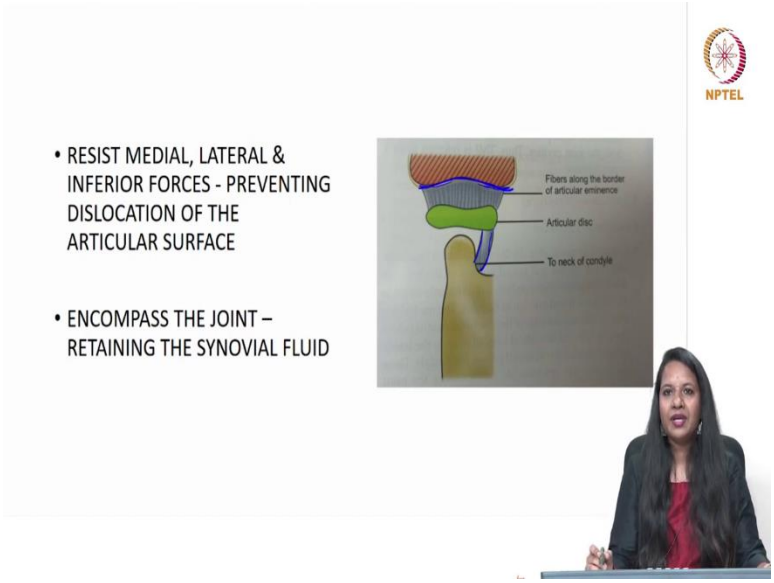

So, it resists medial, lateral and inferior forces preventing dislocation of the articular surface. It also encompasses the joint retaining the synovial fluid. This picture clearly mentions the upper attachment to the temporal fossa and the lower attachment to the neck of the condyles. Since it encompasses the whole TMJ, it withholds the synovial fluid within it.

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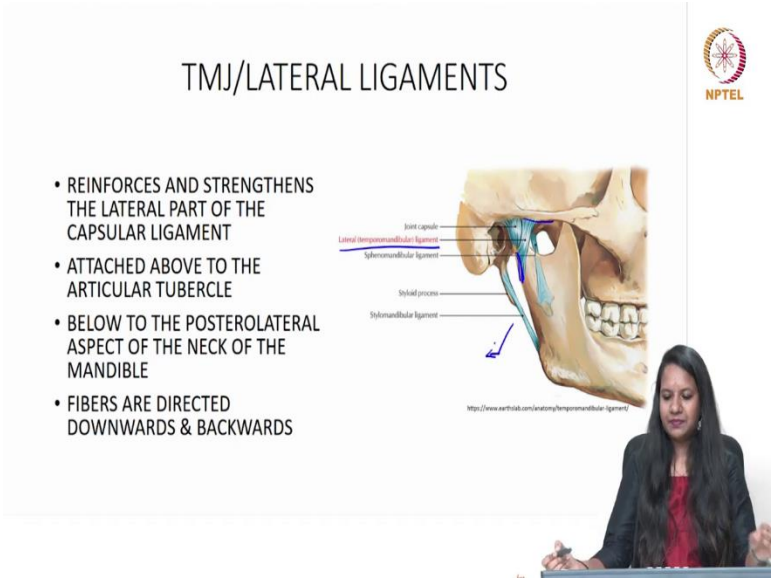

Then, comes the TMJ ligament, otherwise called lateral ligament. It reinforces and strengthens the lateral part of the capsular ligament. It is also attached above to the articular tubercle and below to the posterolateral aspect of the neck of the mandible & the fibers are directed downwards and backwards.

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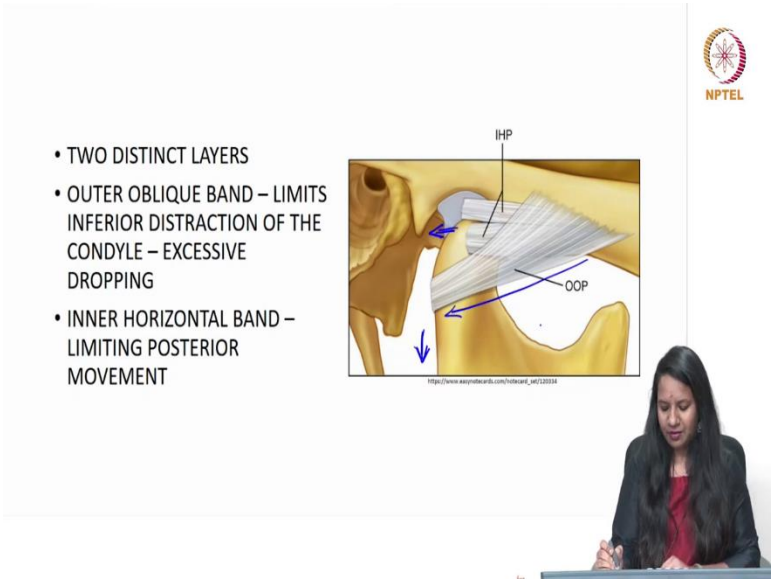

It has two distinct layers - outer oblique band and inner horizontal band. Again, these two fibers have its own unique function. The outer oblique band limits the inferior destruction of the condyle that is excessive dropping of the jaw and the inner horizontal fibers will limit posterior movement. Thus, outer oblique will limit the inferior distraction; whereas, the inner horizontal will limit the posterior movement of the jaw.

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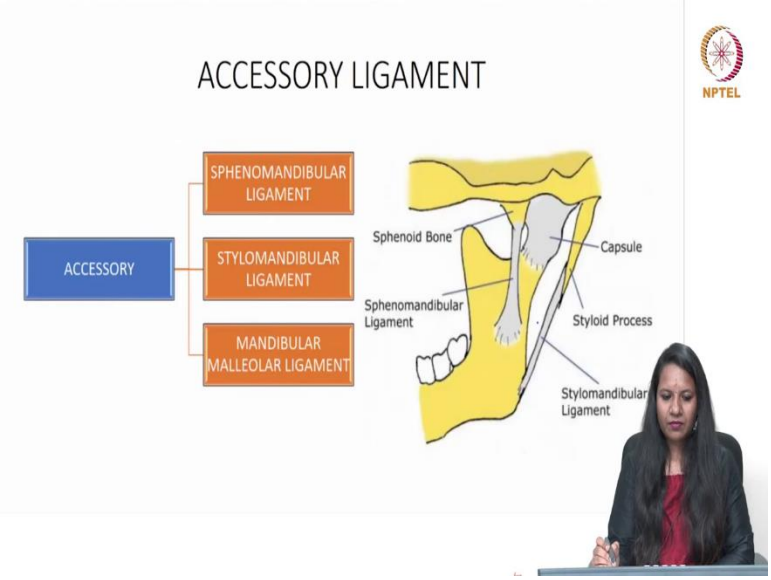

Now, coming to the accessory ligaments, the accessory ligaments include sphenomandibular, stylomandibular and mandibular malleolar ligament.

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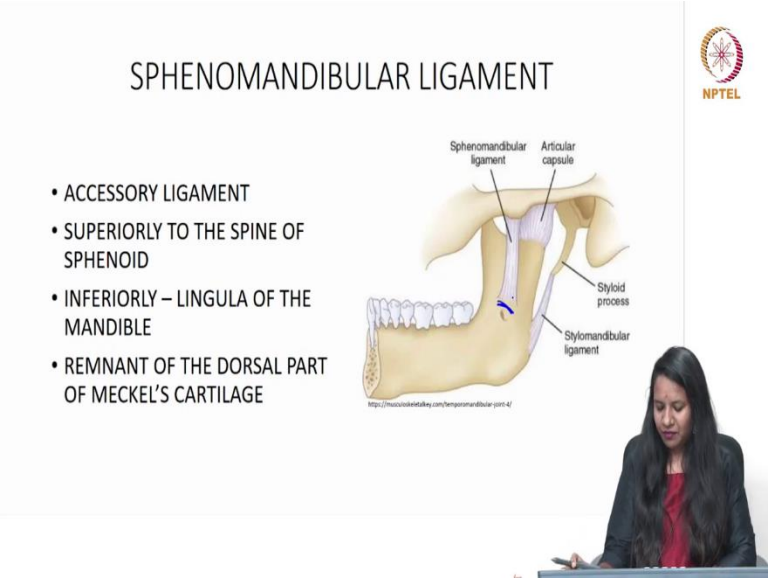

The first one being the sphenomandibular ligament. As the name suggests, it is attached to the spine of sphenoid. Anteriorly, to the sphenoid and to the lingula of the mandible inferiorly. It is nothing but the remnant of the dorsal part of the Meckel's cartilage. It is one of an accessory ligament of TMJ.

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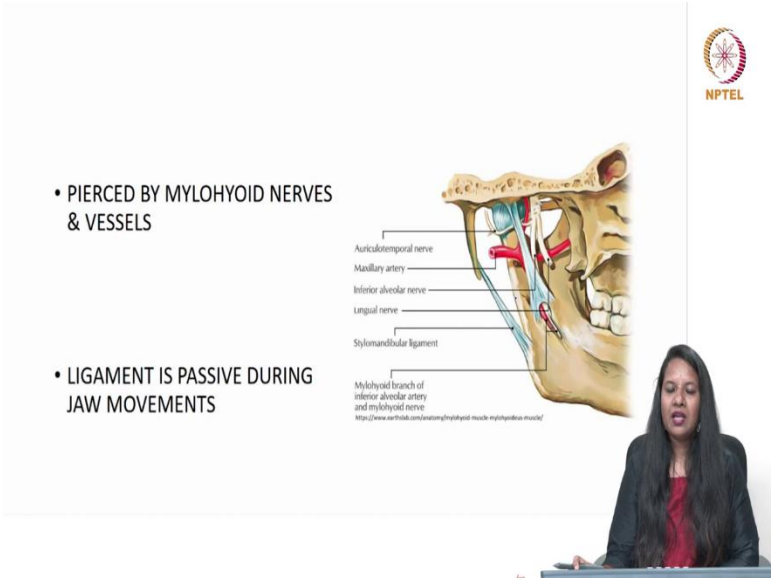

It is pierced by mylohyoid nerves and muscles and it is very passive during jaw movements. Hence, it is called as accessory ligament.

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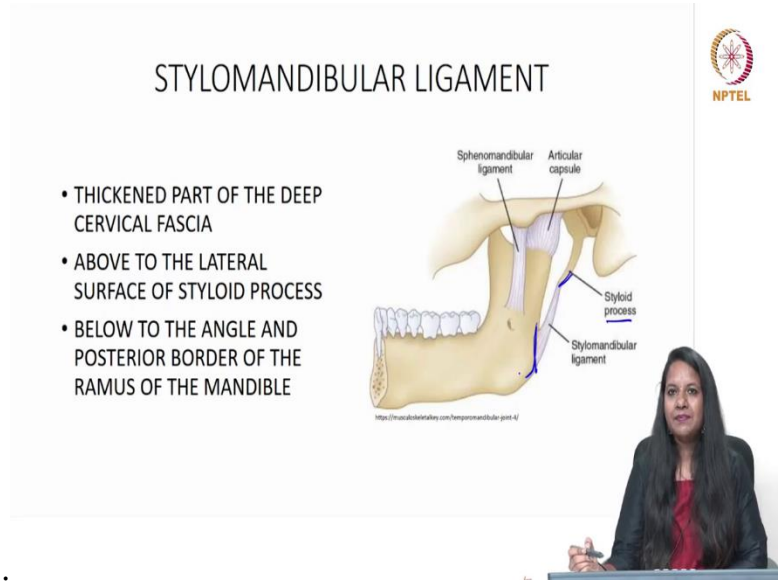

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Then, comes the stylomandibular ligament. It is originated on the lateral surface of the styloid process and it is inserted to the posterior border of the ramus of the mandible and it is nothing but the thickened part of the deep cervical fascia.

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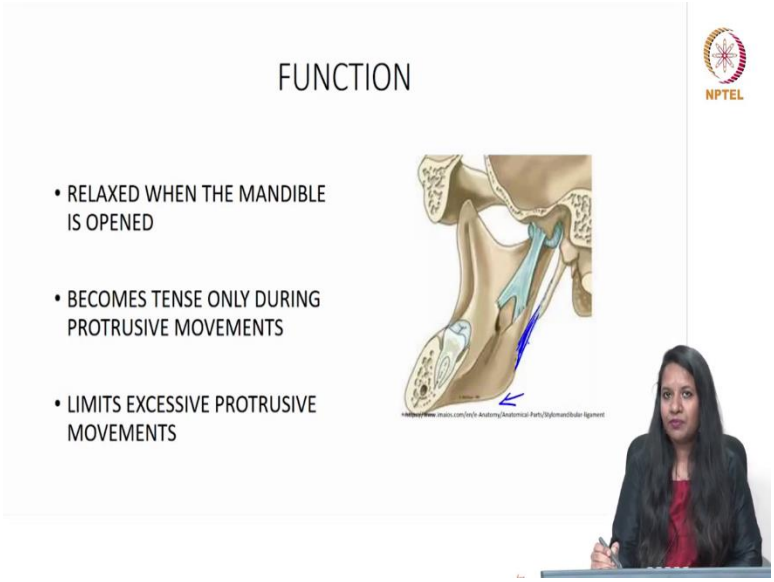

So, it is relaxed when the mandible is opened and it becomes tense only during protrusive movements. It limits excessive protrusive movements. It is protecting the excessive protrusive movement; whenever there is excessive protrusion, this ligament will prevent the mandible moving too much forward.

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Then, comes the mandibular malleolar ligament. It is a fibroelastic tissue with ligamentous qualities. It originates from the neck and the anterior part of the malleus. Malleus is a small bone which is present in the middle ear, it is inserted into the capsule disc and the sphenomandibular ligament.

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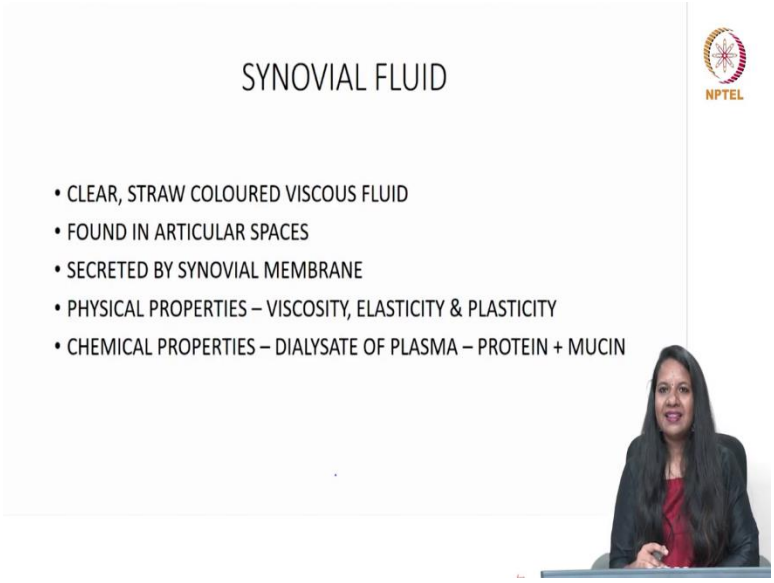

Synovial fluid is a clear straw coloured viscous fluid which is found in the articular spaces. It is secreted by the synovial membrane. The viscosity, elasticity and plasticity of this fluid is well-defined and it is nothing but the dialysate of plasma which consist of protein and mucin.

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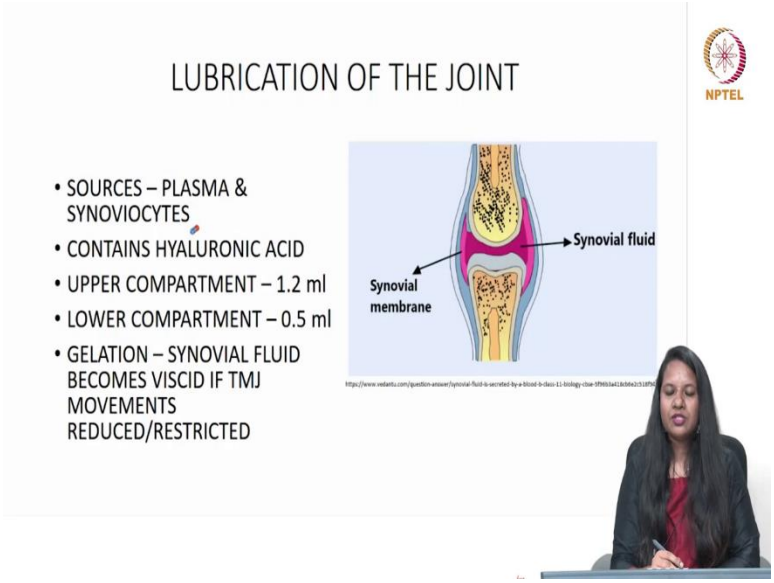

So, the sources of this synovial joint are the plasma and the synoviocytes, which is present in the synovial membrane. It contains hyaluronic acid making it more viscous. The upper compartment consists of 1.2 ml of synovial fluid; whereas, the lower compartment consists of 0.5 ml of synovial fluid. There is a process called gelation, where the synovial fluid become more viscid, that is it will be sticky in consistency, if the TMJ movements were reduced or restricted, which could be seen in the older age.

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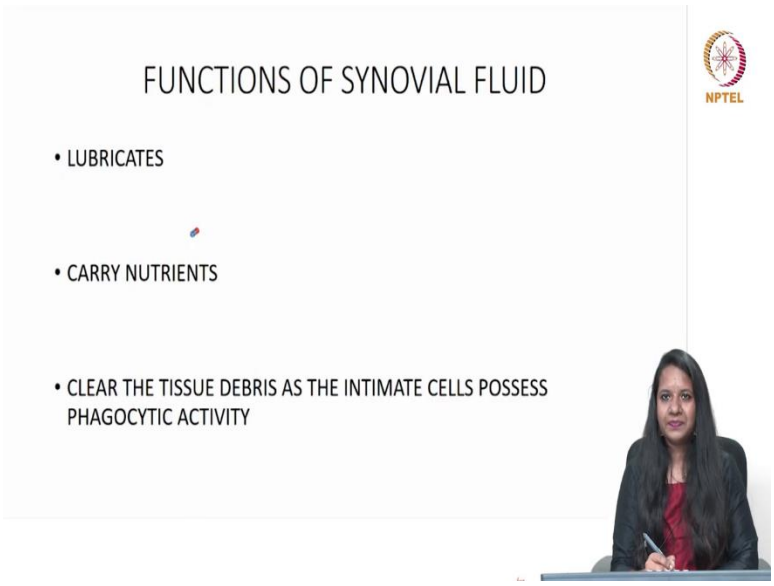

What are the functions of this synovial fluid? This lubricates the articular surfaces and it carry nutrients to the avascular regions. It clears the tissue debris which is caused by the wear and tear as the intimate cells possess phagocytic activity.

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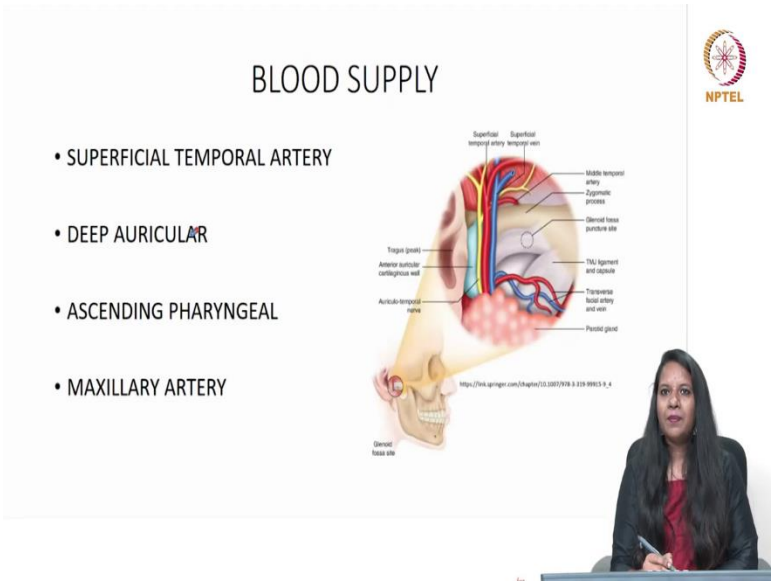

The blood supply of TMJ is superficial and the avascular areas of the articular disc were provided nutrition by the synovial fluid. The blood supply is mainly by the superficial temporal artery and the other branches were the deep auricular, ascending pharyngeal and maxillary artery which are the branches of external carotid artery.

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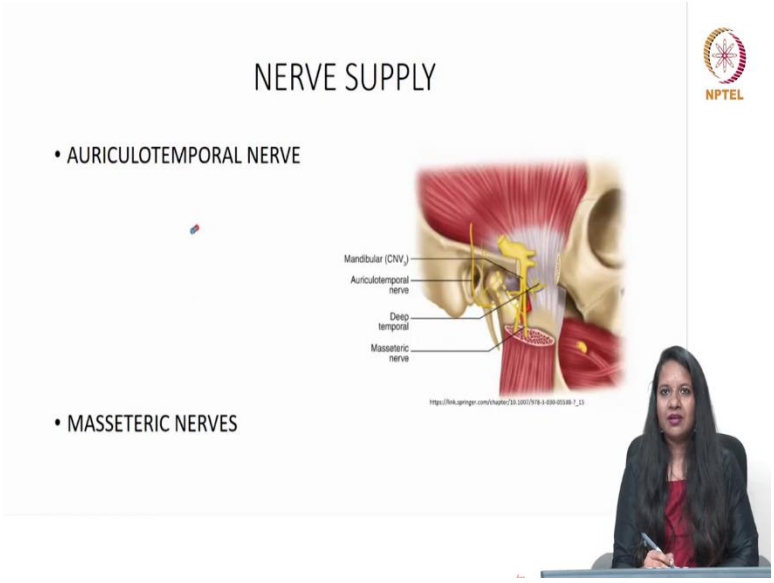

The nerve supply is mainly by the auriculotemporal and the masseteric nerve which are the branches of the mandibular nerve.

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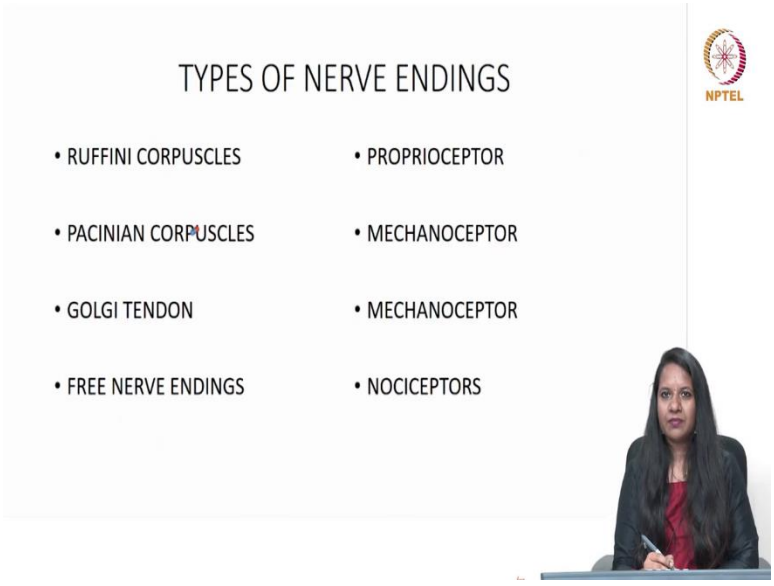

Types of nerve endings - TMJ has four types of nerve ending namely Ruffini corpuscle, Pacinian corpuscle, Golgi tendon and Free nerve ending. Ruffini corpuscle respond to sustained pressure and it is a slow adapting receptor; whereas, the pacinian corpuscle is a fast-adapting receptor which can even sense a minimal pressure change.

Golgi tendon is a sense organ which tells the muscle how much tension it has gone through. When the tension of the muscle is too much, this Golgi tendon sends impulse and it will inhibit the further function of the muscle and prevents its injury. Free nerve endings act as a nociceptor that is it carry pain sensation.

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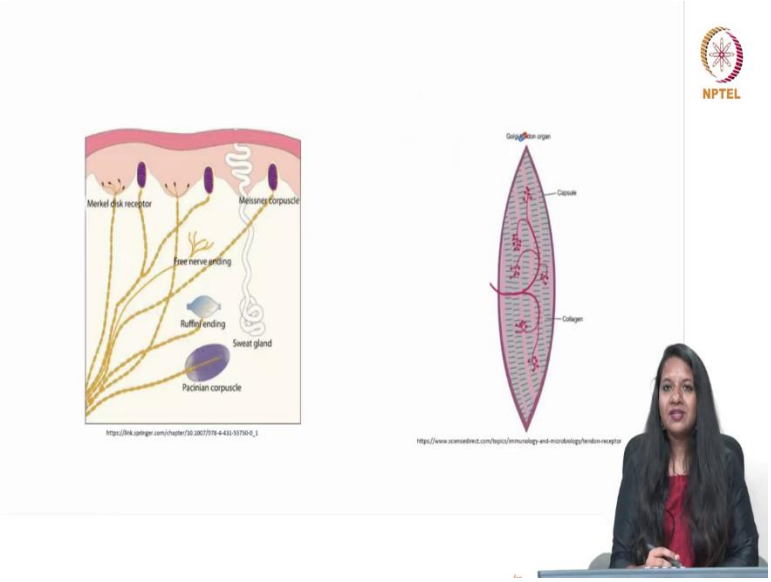

So, this picture clearly shows how a ruffini endings, pacinian corpuscle, free nerve ending and a Golgi tendon look like. So, this TMJ has all these four nerve endings and thus, it is very protective inhibiting the devastating movements of the mandible.

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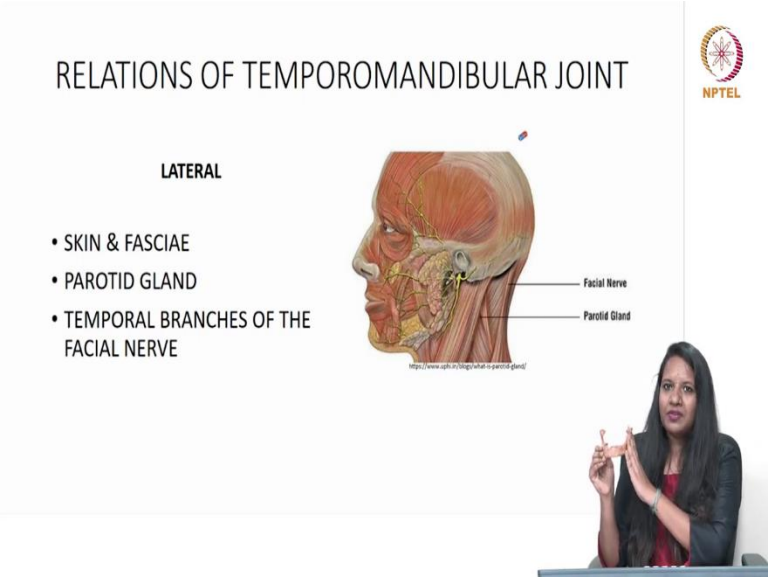

Moving to the relations of the temporomandibular joint. Relation is nothing but what are all the structure present on the sideways, above, below and in front and in the back of the TMJ. Lateral means away from the midline. So, the one which is present on this side (away from the midline) is the lateral aspect and the one which is present towards the midline is the medial aspect.

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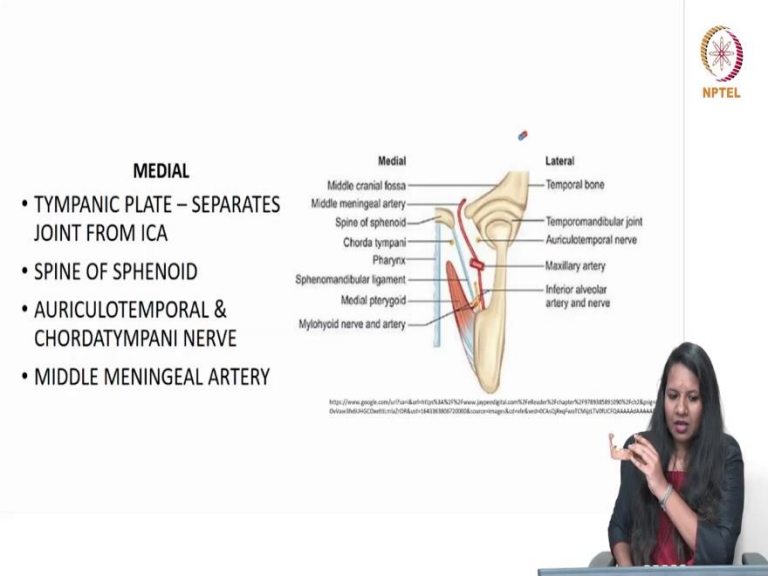

So, on lateral side, we could see skin, fascia and after that parotid gland and temporal branches of the facial nerve; whereas, the medial portion consist of the tympanic plate, spine of sphenoid, auriculotemporal nerve and chordatympani nerve and the middle meningeal artery.

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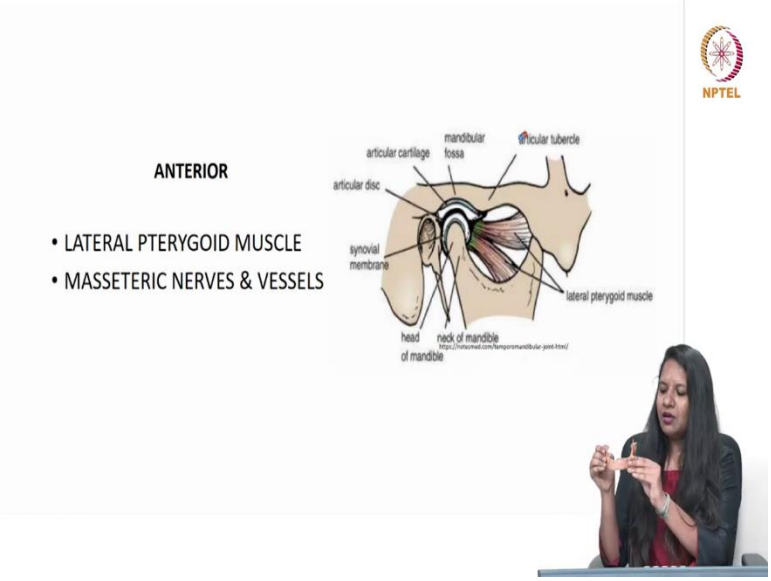

Then, what is present in the anterior? Anterior in the sense in the front; so, in the front we have lateral pterygoid muscle and masseteric nerves and vessels.

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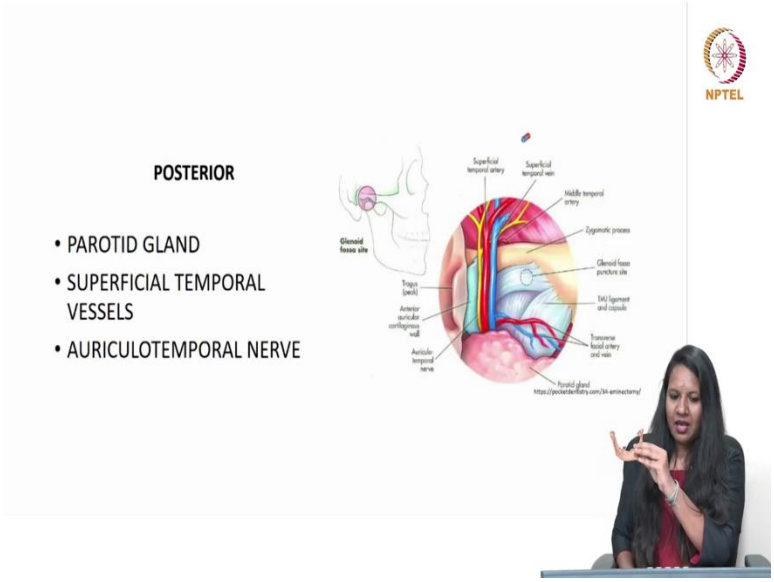

And the posterior, what is present behind; behind is the superficial temporal vessels, auriculotemporal nerve and the extension of the parotid gland.

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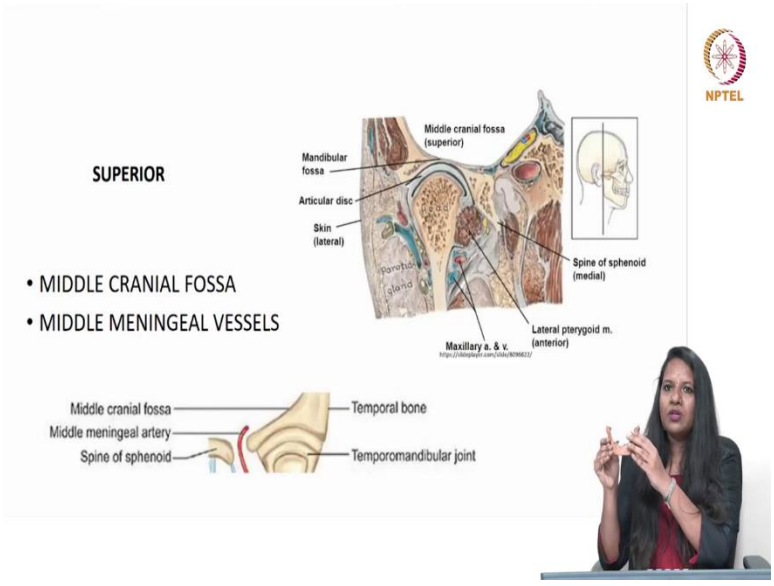

And what is present above? Above that is superior, it is the middle cranial fossa and the middle meningeal vessels.

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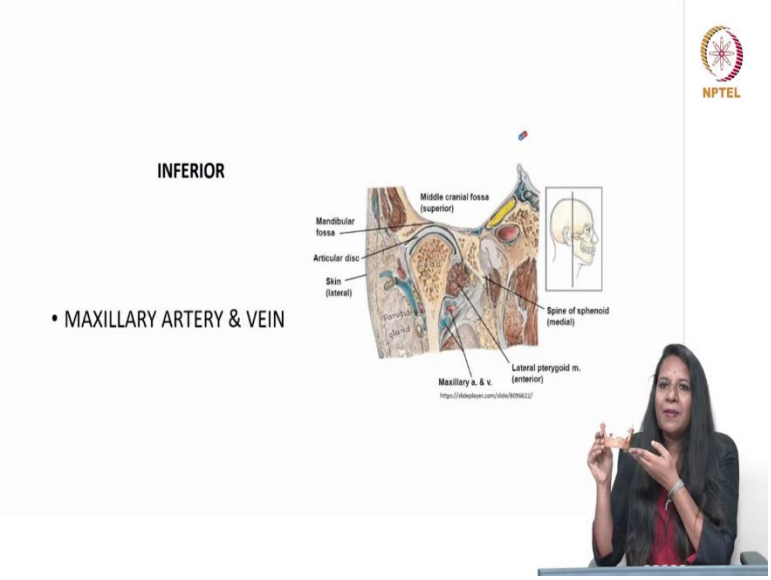

And below is the maxillary artery and vein. So, these structures were the relations of the temporomandibular joint. It is important to know these relations because any of the abnormalities within this relation can mimic as a TMJ pain.

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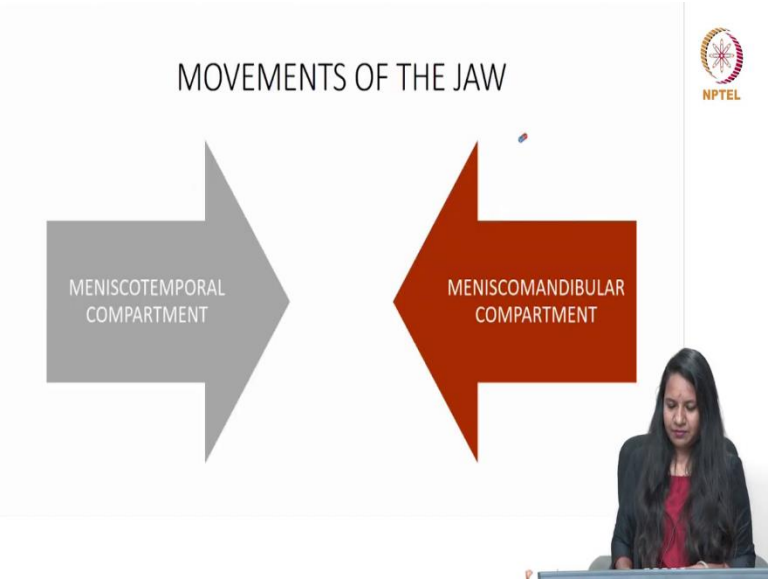

Now, moving to the movements of the jaw. The movement of the jaw is divided into meniscotemporal compartment and menisco mandibular compartment. Meniscus is nothing but disc. So, the movement which occurs between the disc and the temporal bone and the movement which occurs between the disc and the condylar head of the mandible.

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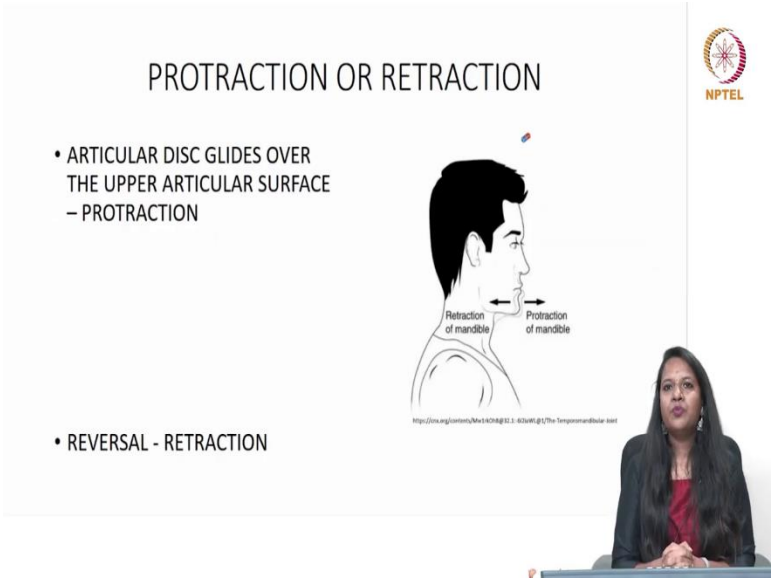

The first movement is the protraction or retraction. Protraction means forward movement of the mandible and the retraction means backward movement of the mandible. That is when the articular disc glides over the upper articular surface, it is called protraction and reversal of that is called retraction.

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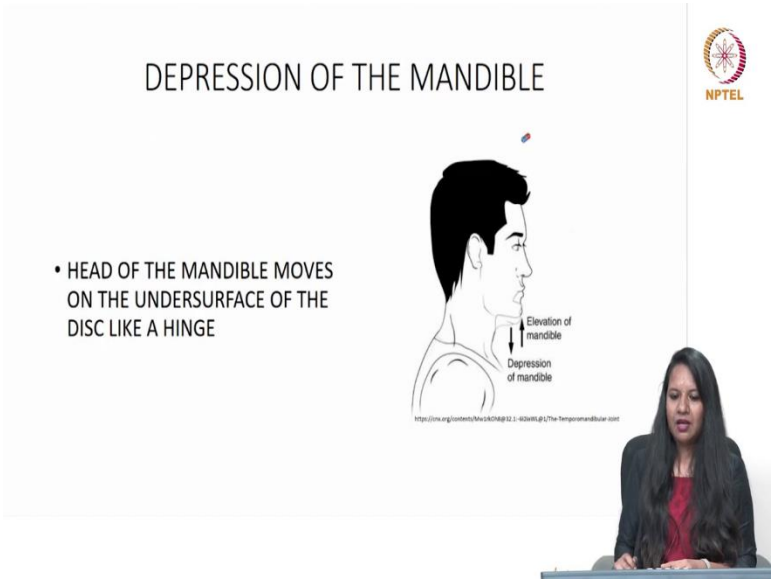

Next is the depression of the mandible. Kindly note the arrow marks given in the picture. Depression is nothing but the opening of the jaw. So, the head of the mandible moves on the under surface of the disc like a hinge.

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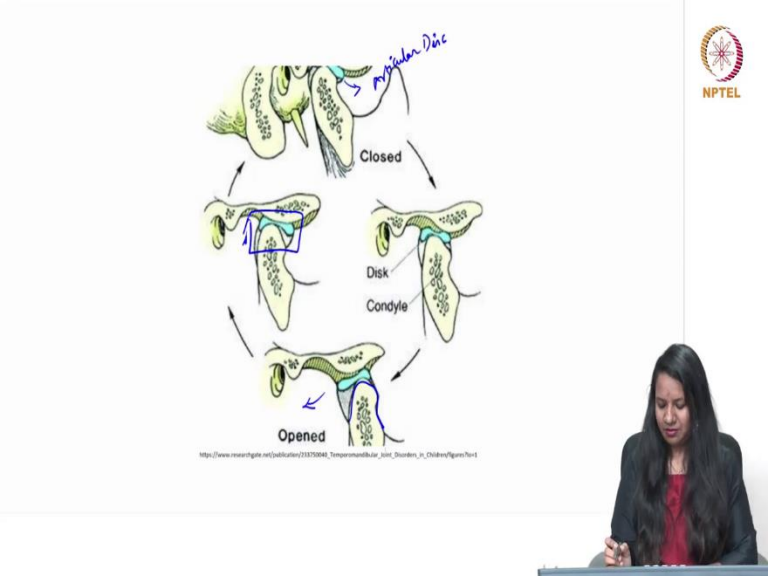

In this picture, kindly note the position of the condyle and the blue colored structure that is the articular disc. So, when the mandible is opened, the posterior rotation of the articular disc along with that of the condyle occur and again, when it is closed, it comes back to the normal position.

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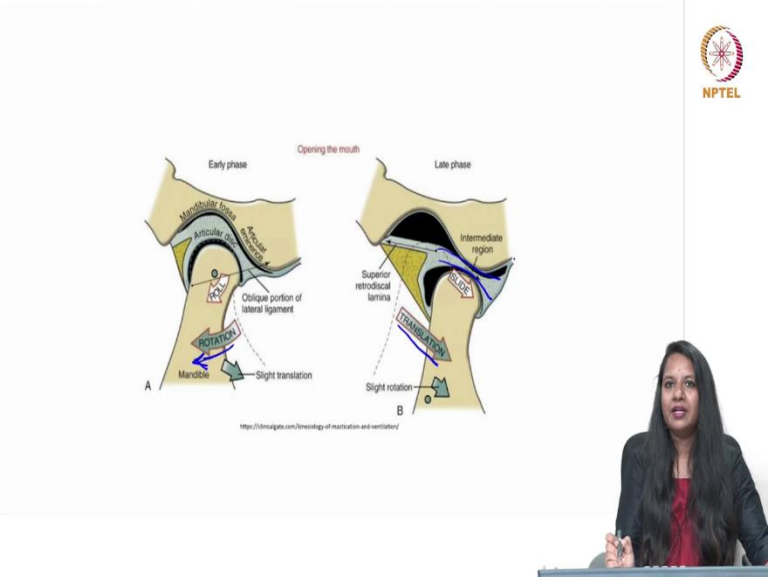

And in this picture, it is again clearly mentioned when the jaw is opened, the first movement is the rotation. So, when the condyle is rotated posteriorly, it is opened wide, then occurs a translatory movement, that is the articular disc translates over the temporal bone. This is the articular disc which slides over the temporal bone.

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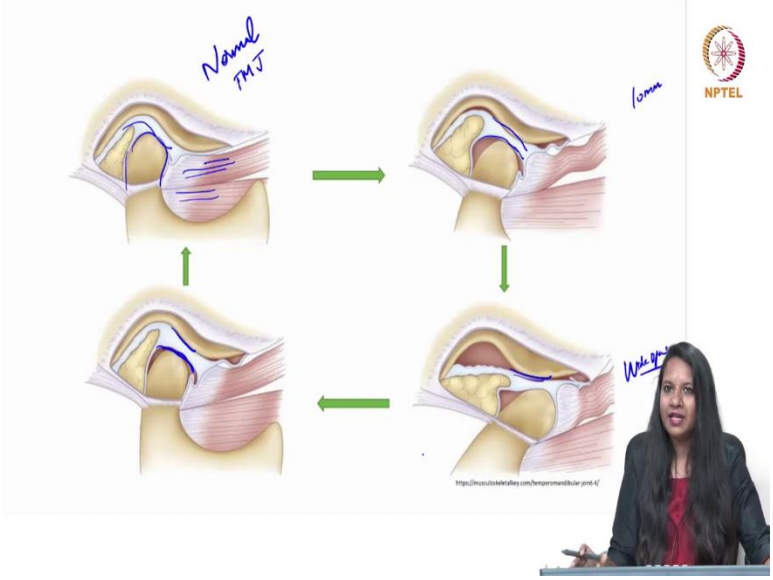

This picture clearly shows you the movement. The first is the normal TMJ at resting stage. Please note the muscles attached. At 10 mm of opening that is when mouth opens at around 10 mm, the articular disc is rotated posteriorly with that of the condyle and when there is wide opening, there occurs translation movement also. The translation movement of the articular disc over the temporal surface and again, when it is getting closed, the articular disc will be rotating anteriorly with that of the condyle to hold into the normal position.

So, this is the normal movement of TMJ during mouth opening and closing. It is mainly by the articular disc and the condyle. The first initial opening is by the rotation and the wide opening is by the translation of the articular disc over the temporal bone.

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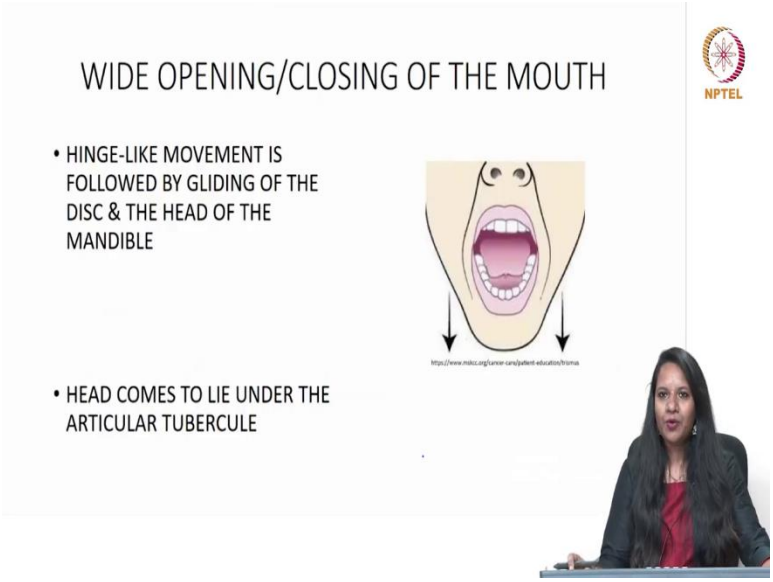

Wide opening or closing of mouth - it is a hinge-like movement formed by gliding of the disc and the head of the mandible. Condylar head comes to lie under the articular tubercle.

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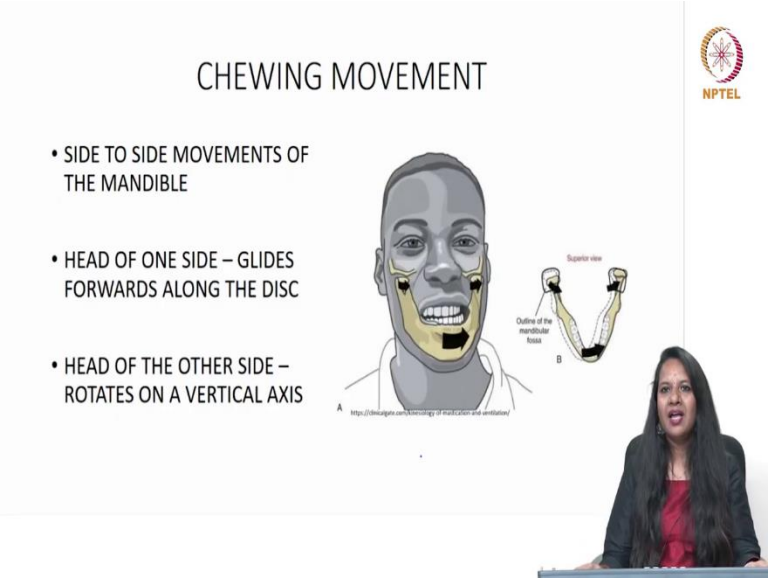

Chewing movement is nothing but side to side movement of the mandible, where the head of one side glides forwards along the disc and the head of the other side will rotate on a vertical axis. For example, if we want to move our jaw to the right side, then the right side condyle should rotate and the left side condyle should glide over the articular disc.

So, when we want to move it to the left hand side, then the condyle of the left side should rotate. So, whichever side we want to move, that side condyle should rotate and the other side condyle should glide forward along the disc.

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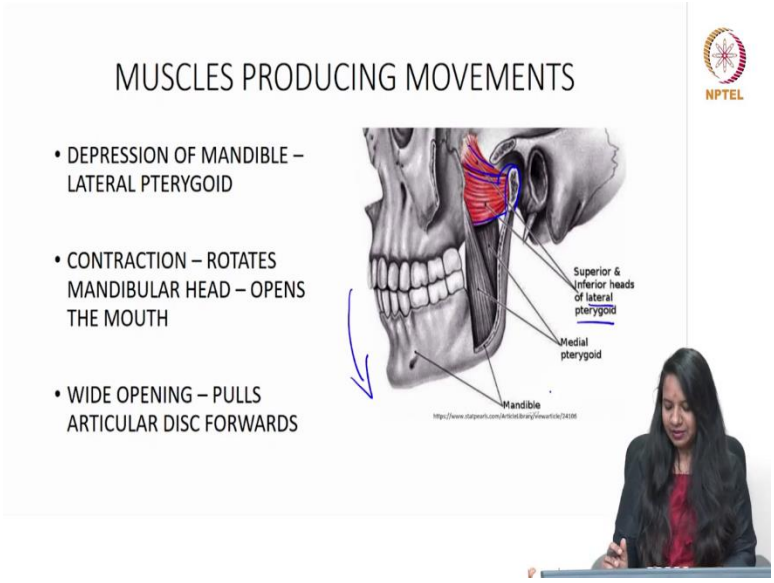

Now, moving to the muscles. The movements of the mandible are protrusive, retrusive, depression and elevation. So, what are all the muscles causing these movements? Depression of the mandible that is opening of the jaw is mainly taken care by the lateral pterygoid muscle. Contraction of this muscle rotates the mandibular head and opens the mouth. Wide opening will pull the articular disc forwards.

So, you can see the attachment. This is the lateral pterygoid muscle which is red in colour which is attached that muscle & help in the rotation of the condyle. Again, wide opening means it will pull the articular disc also forward.

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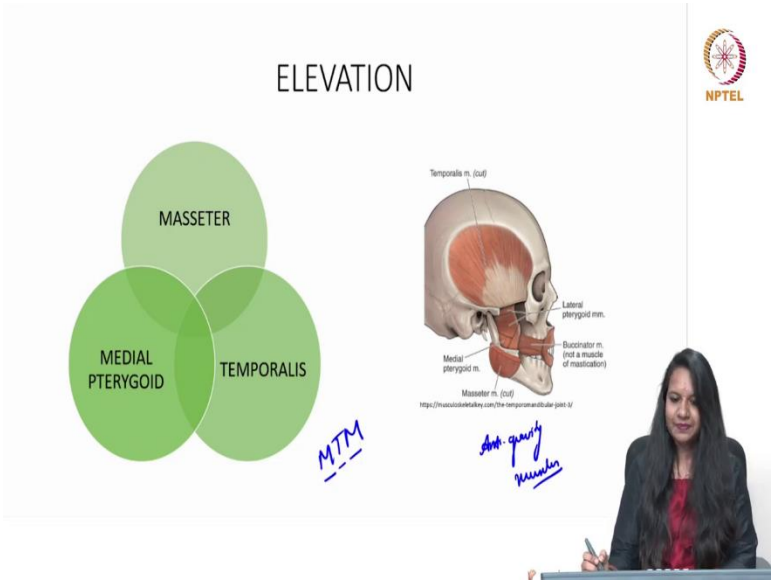

Then, comes the elevation; elevation means closing of the mouth. They are also called as anti-gravity muscles. Remember MTM - Masseter, Temporalis and Medial pterygoid, these were the elevators; they elevate the mandible and helps in closing of the jaws.

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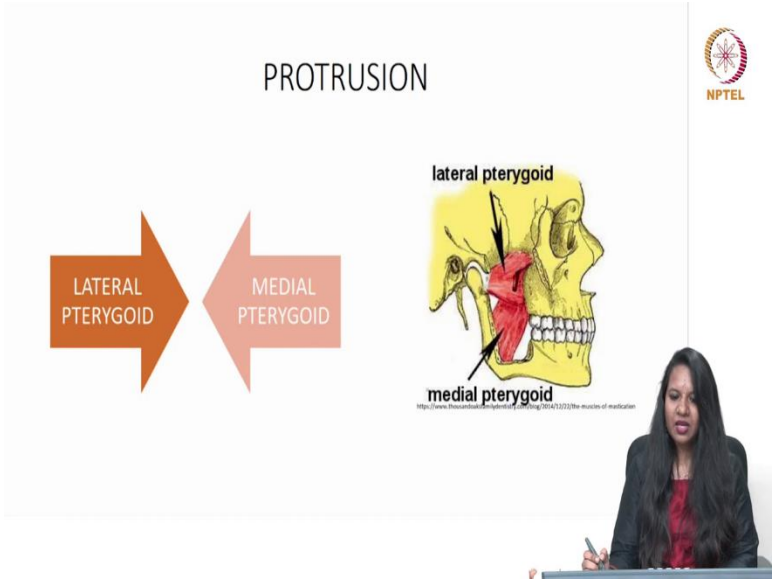

Then, comes the protrusion; protrusion is the forward movement of the mandible which is taken care by the pterygoid muscles. So, both lateral pterygoid and medial pterygoid together work for the protraction of the mandible.

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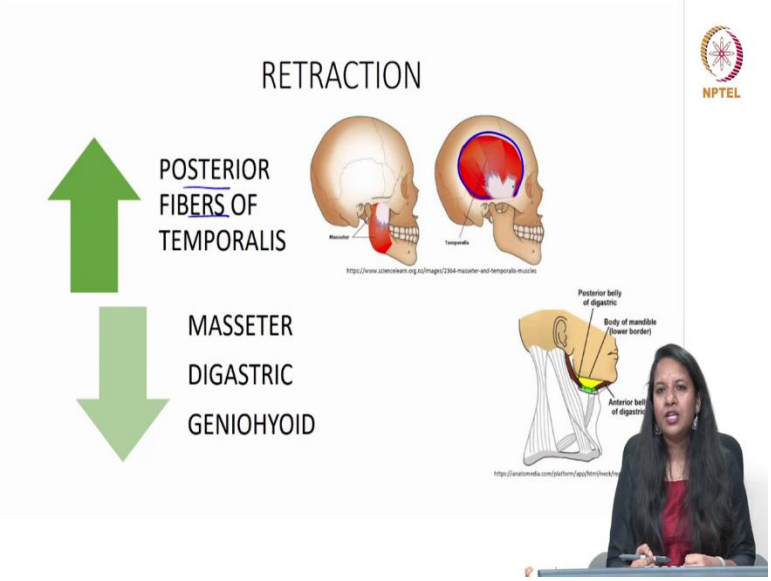

Then, comes the retraction. Retraction is mainly taken care by the posterior fibers of the temporalis which is a fan shaped muscle. This is temporalis and too much of posterior movement is limited by the masseter, digastric and geniohyoid muscles.

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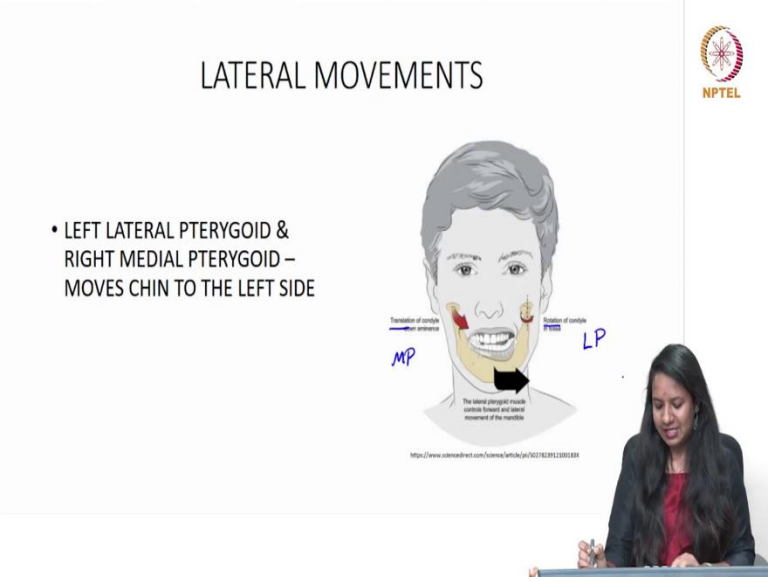

Now, the lateral movements - when you want to move your chin to the left hand side, the condyle on the left hand side should rotate which is taken care by the lateral pterygoid; whereas, the right side should glide which is taken care by the medial pterygoid. So, left lateral pterygoid and the right medial pterygoid will move the chin to the left side.

So, it is clearly given in this picture. If you want to move it to the left side, there is rotation of the condyle which is taken care by the lateral pterygoid muscle and this translation is taken care by the medial pterygoid muscle and hence, the mandible move towards the left hand side.

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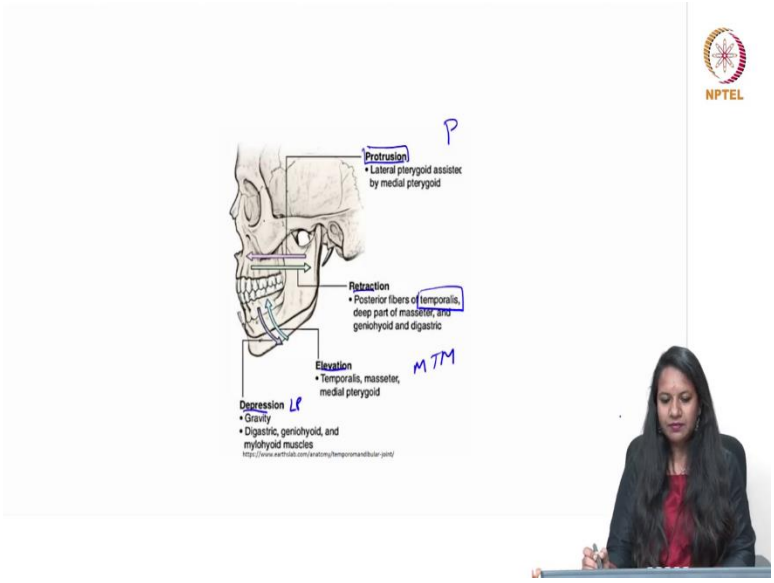

So, this is the summary of these movements. Protrusion - Pterygoid muscle. So, it is lateral pterygoid and the medial pterygoid. The retraction is mainly by the fan shaped muscle that is temporalis. Elevation, remember MTM; it is masseter, temporalis and medial pterygoid. Depression is taken care by the lateral pterygoid.

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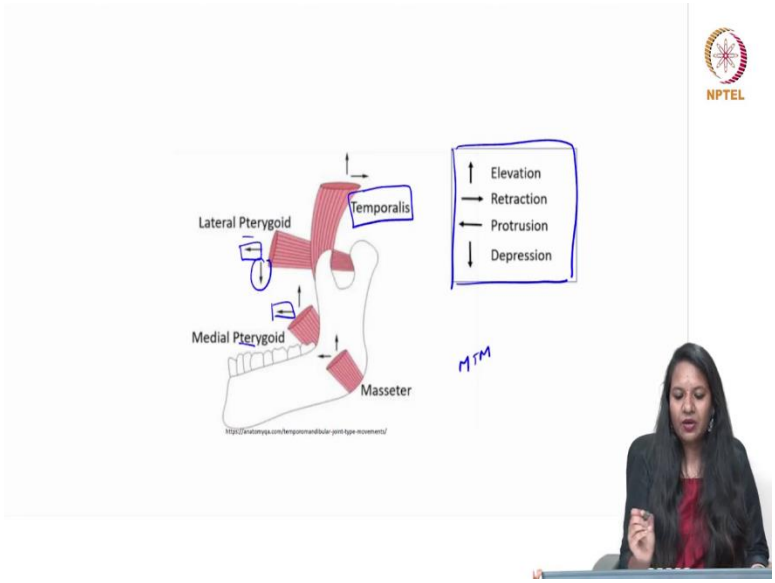

So, the picture is given with the arrow mark so that it will be easy for you guys to understand. So, the muscle that elevates, that is which closes is again MTM that is masseter, temporalis and medial pterygoid. Retraction is mainly by the posterior fibers of the temporalis. Protrusion is mainly by the two pterygoid muscle that is lateral and medial pterygoid and the depression is mainly taken care by the lateral pterygoid.

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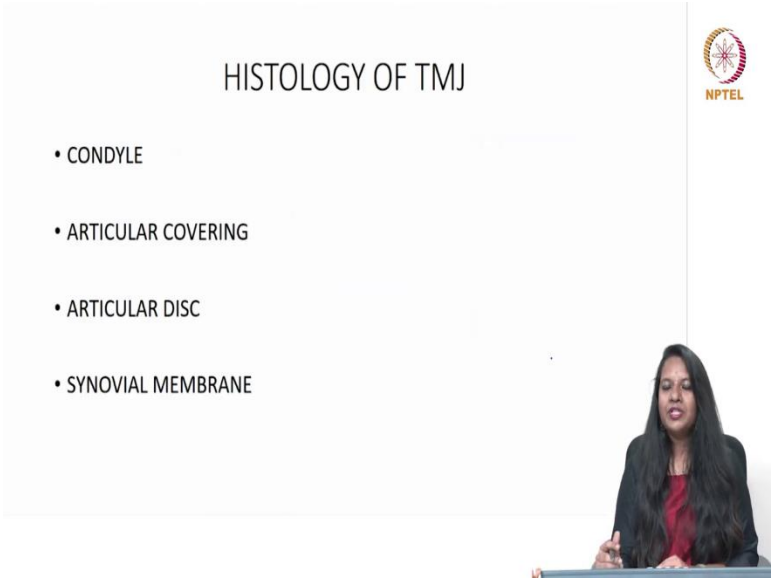

Moving to the histology of TMJ. How does this TMJ looks under the microscope? We will see one by one.

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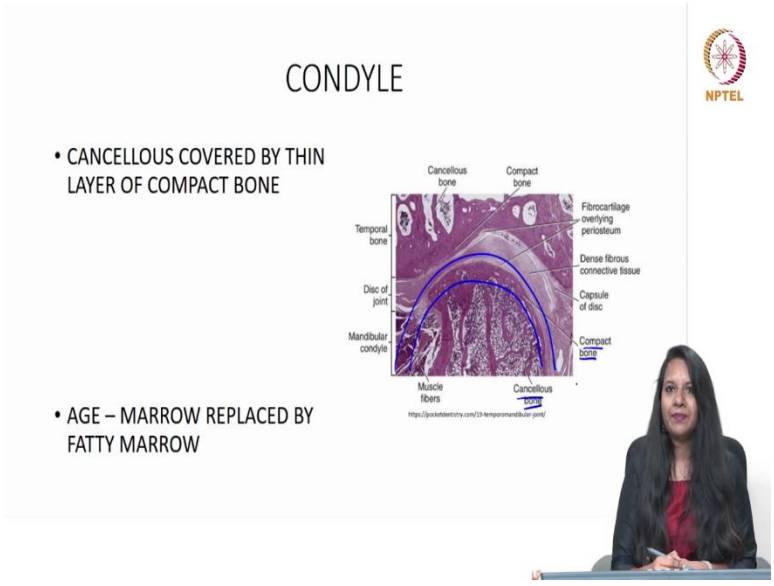

The first one being the condyle. This is the condylar area which is composed of cancellous bone covered by a thin compact bone. With advancing age, this marrow is replaced by fatty marrow.

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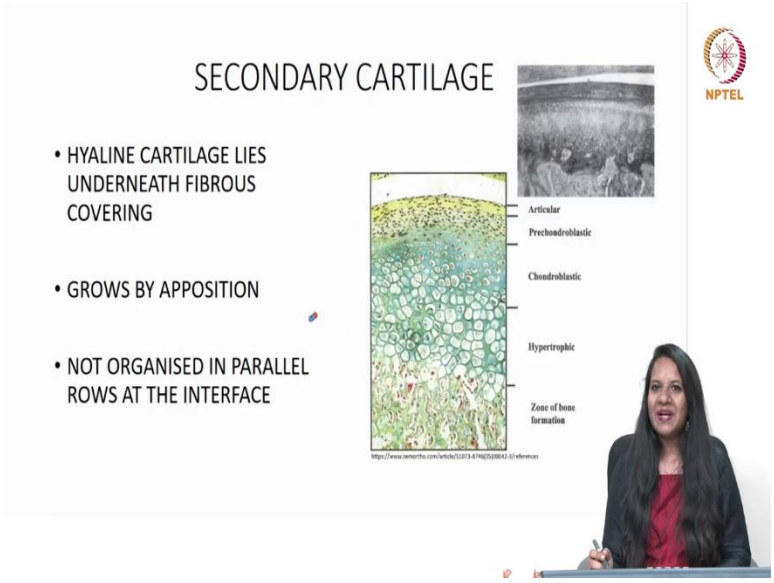

Then, comes the secondary cartilage which is formed during the period of growth. Hyaline cartilage lies beneath the fibrous covering and the secondary cartilage grows by apposition. It is not organized in parallel rows at the interface between the bone and the cartilage.

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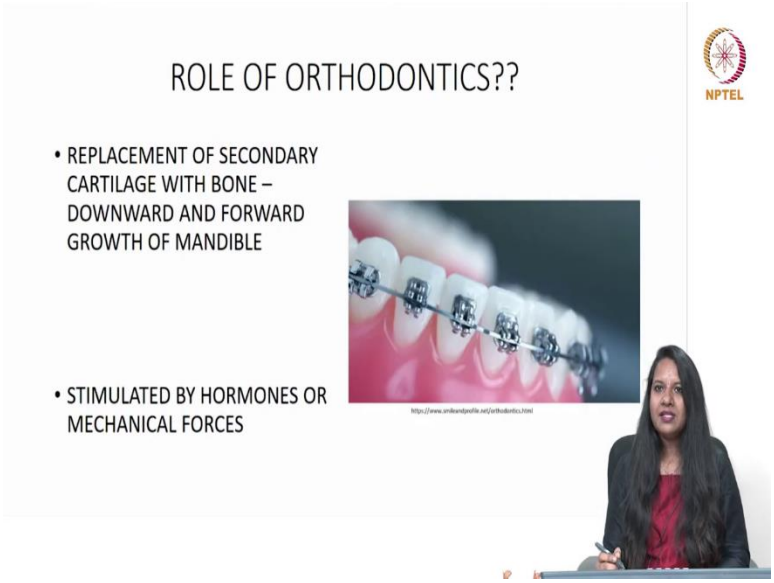

What is the use of this secondary cartilage in orthodontics? Replacement of the secondary cartilage with bone permits downward and forward growth of the mandible which is stimulated internally by hormones and externally by the mechanical forces by means of functional appliances which is used in orthodontics to move the mandible downward and forward.

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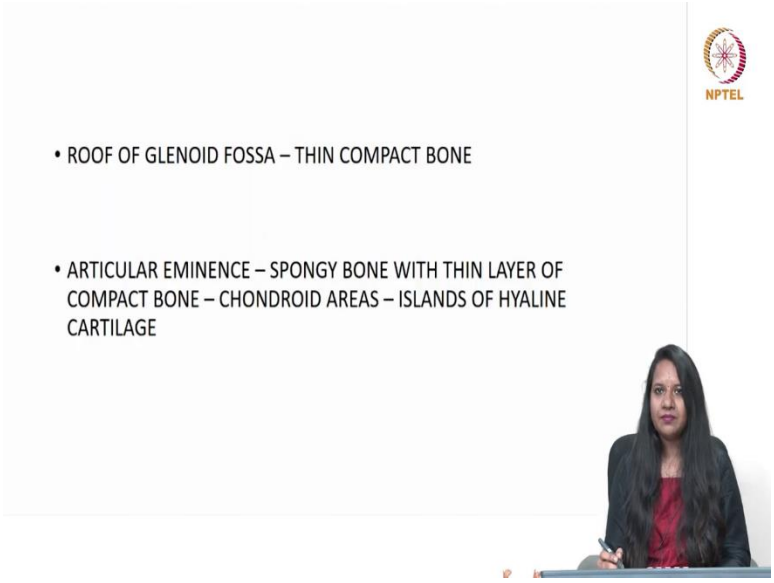

Then, roof of the glenoid fossa is just the thin compact bone and the articular eminence is a spongy bone within a thin layer of compact bone, it also has chondroid areas and islands of hyaline cartilage.

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Moving to the articular fibrous covering, it is covered by fibrous tissue unlike other synovial joints. The fibrous layer covering the mandibular condyle and the fibrous layer covering the articular surface of the temporal bone and articular eminence.

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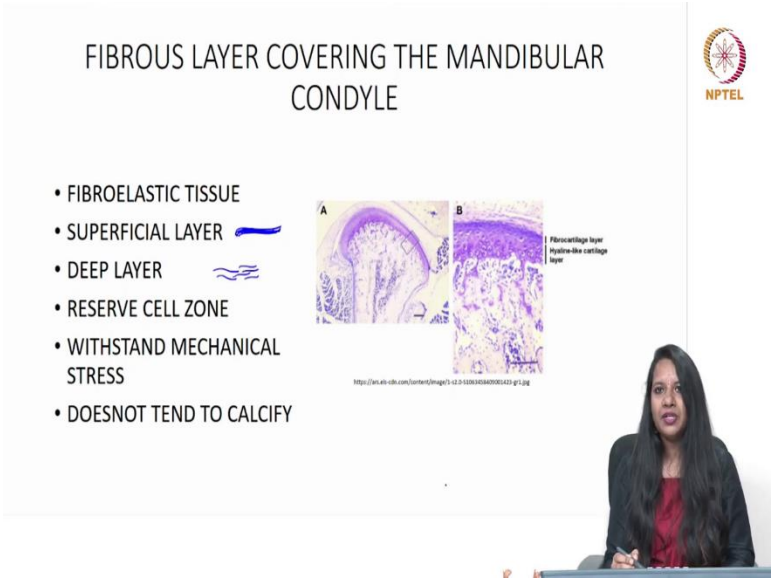

So, the fibrous layer covering the mandibular condyle is a fibroelastic tissue. It has two layers; superficial and deep layer. In the superficial layer, the collagen fibers are arranged as bundles; in the deep fibers, there are less collagen fibers when compared to superficial layer and it also has a reserve cell zone which withstand mechanical stress and it do not tend to calcify.

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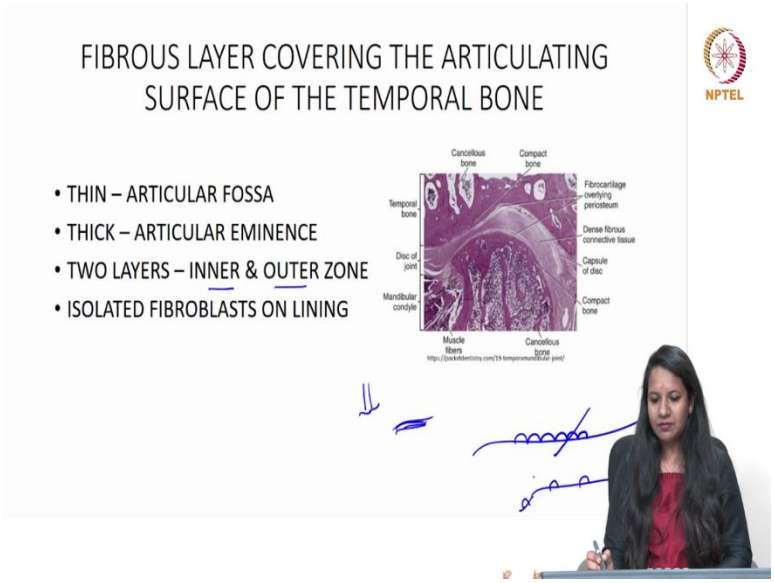

The fibrous layer covering the articular surface of the temporal bone is thin in the articular fossa and thick in the articular eminence and it has two layers inner and the outer zone. In the inner zone, the fibers were perpendicular to the long axis and in the outer zone, they all run parallel over the bony surface and over the lining, the fibroblast were not continuous. They were just isolated which can be identified by its long cytoplasmic processes.

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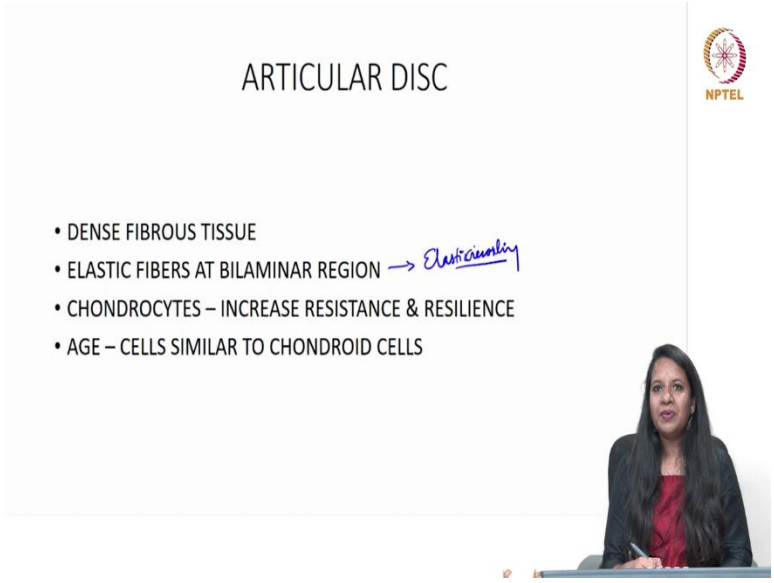

Articular disc is a dense fibrous tissue and it has elastic fibers at the bilaminar region responsible for the elastic recoiling, that is it retracts the mandible during the initial phases and it has chondrocytes which increase the resistance and resilience with advancing age. Cells similar to chondroid cells will be present in the articular disc.

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There is an area in TMJ with limited reparative capacity. It is the soft tissue covering the articular eminence, mandibular condyle and large central area of the disc because it is devoid of blood vessels and nerves and nutrition is mainly supplied by the synovial fluid and this part is has the limited reparative capacity.

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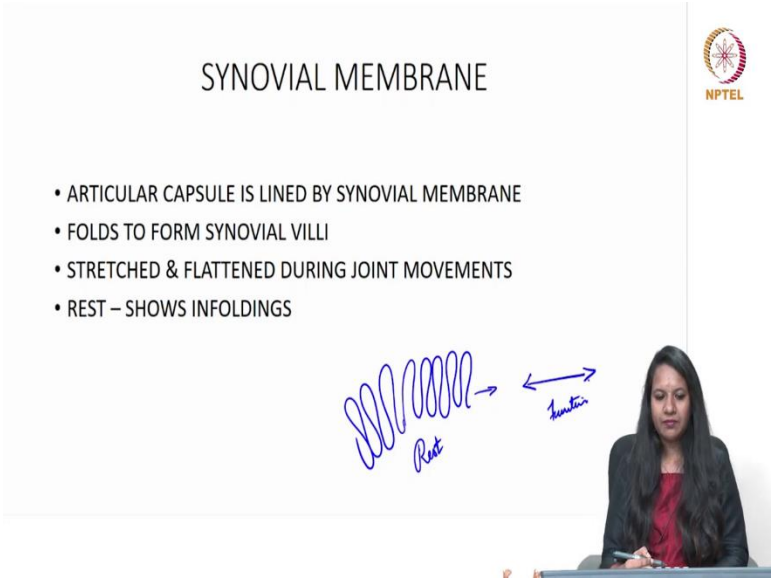

Then, the synovial membrane - The articular capsule is lined by the synovial membrane. It folds to form synovial villi. During joint movements, these villi will be stretched and flattened. And in rest, they show infolding. So, the appearance of this synovial membrane at rest is with folding and during function, it is stretched and it becomes flattened.

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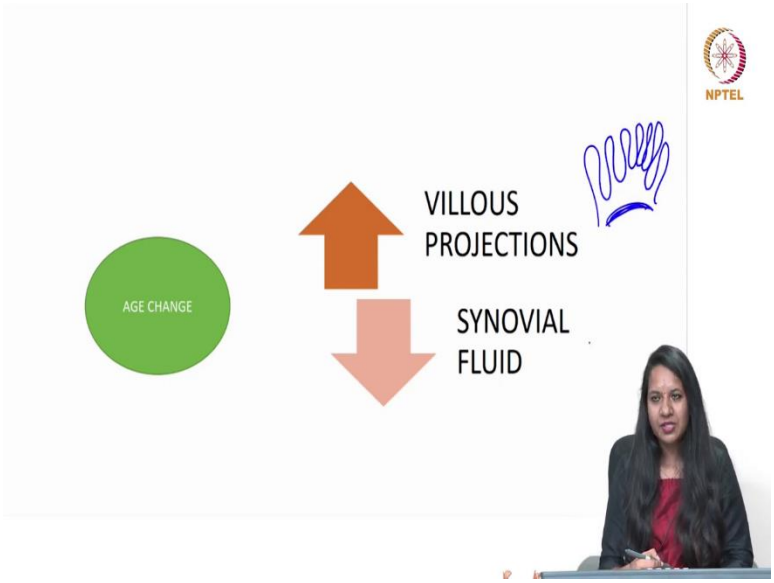

With advancing age, these villous projection will increase with thickened basement membrane and decrease in the synovial fluid is noted.

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There are three types of cells; the type - I, type - II and type - III. The type - I cells are rich in rough endoplasmic reticulum and they are called fibroblast like or B-cell or secretory S-cell; the type - II cells were rich in Golgi complex and ribosomes and has lesser number of rough endoplasmic reticulum, they are called macrophage like or A-cell and type - III cell is the intermediate - it shares the morphology between type A and B.

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Now, whether TMJ is a weight bearing joint is under debate. The presence of wavy collagen fibers and the chondroitin sulphate will subject the TMJ to compression loads which tells us that it is a weight bearing joint; whereas, the absence of cartilage suggest that TMJ is not a weight bearing joint.

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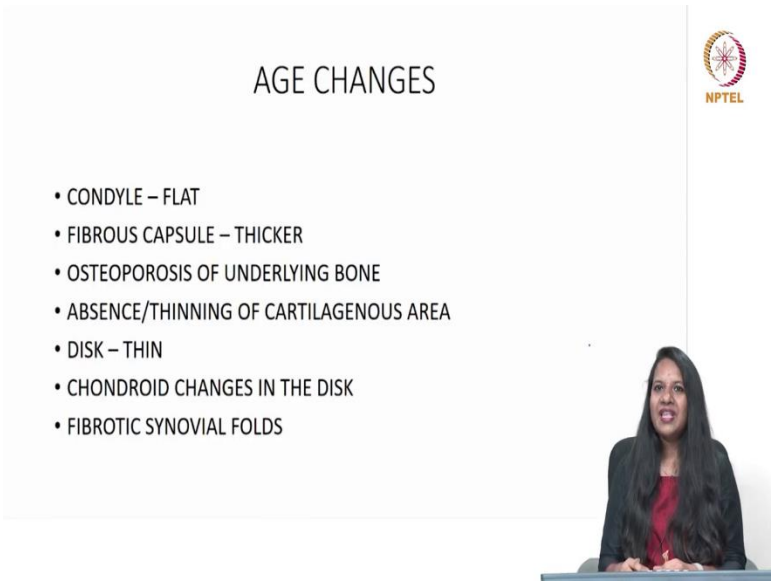

With advancing age, there are various changes that happen in the temporomandibular joint. The condyle is convex on all directions; but with advancing age, this condyle will appear flat and the fibrous capsule will become thicker and there occurs osteoporosis of the underlying bone and there will be absence or thinning of the cartilaginous area. The disc will become thin, synovial fluid will become less with increase in the fibrotic synovial folds and chondroid areas will be noticed in the disc.

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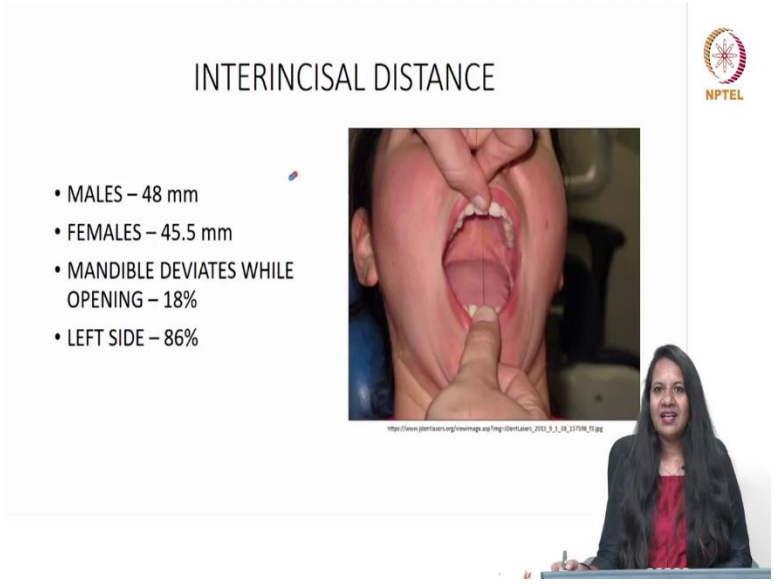

Next is the inter incisal distance. It is the distance between the upper central incisor and the lower central incisor, that is the measurement of the opening of the jaw. In males, it is around 48 mm; in females, it is around 45.5 mm. The mandible deviates while opening in 18 percent of population and in 86 percent of population, the mandible deviates to the left side. The inter incisal distance is

very important because any TMJ pathology may lead to limited mouth opening and restricted mandibular movements.

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Do joint produce sounds? Yes.

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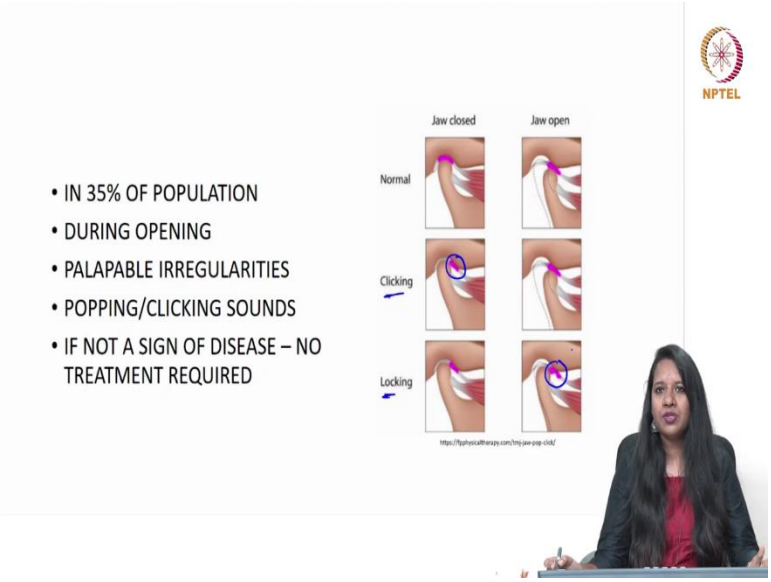

In 35 percent of population while opening, the joint produce sounds. When we palpate, there will be more irregularities in the temporomandibular area and there will be popping or clicking sounds. If it is not a sign of disease, then no treatment is required.

The first picture shows the normal position of the condyle and the articular disc while opening and closing of the jaw; whereas, in the clicking, the articular disc will get slipped from its position that is heard as clicking during the closing of the TMJ and in case of locking, the morphology of the articular disc itself is altered and it will not move back to its normal position.

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Moving to the clinical consideration, what are all the pathologies occur in the TMJ? It could be either developmental, degenerative, inflammatory, traumatic, metabolic or neoplastic.

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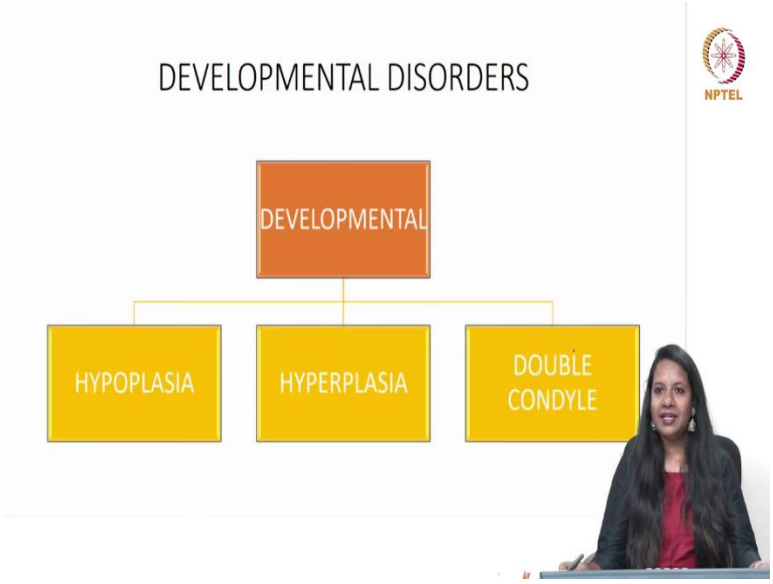

Under developmental disorders - hypoplasia, hyperplasia or double condyle. Hypoplasia of the condyle is the underdeveloped condyle. So, clinically, the body of the mandible will be short. In

hyperplasia, there will be excessive growth of the condyle. So, there will be lengthening of the body of the mandible. Double condyle is where the condyle is divided by the anteroposterior by a groove. The reason for this could be the condylar fracture or due to the muscle attachment to glenoid articulating fossa at times.

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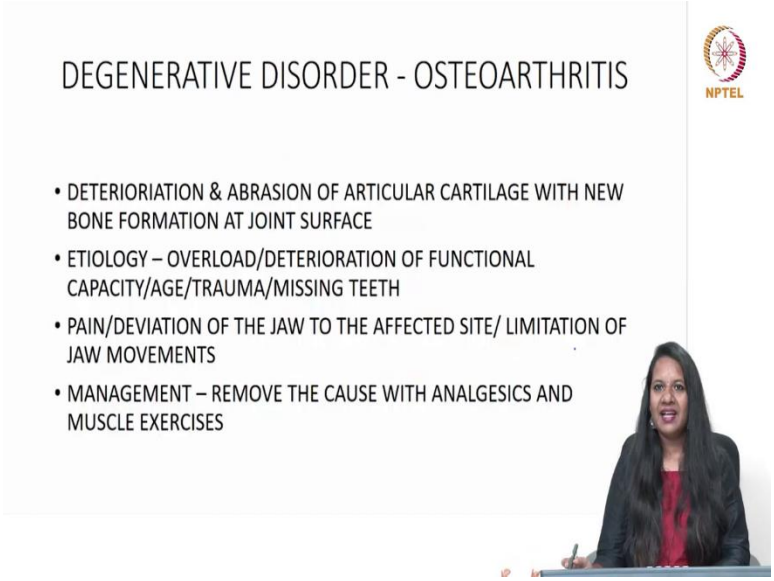

Next is the degenerative disorder - osteoarthritis. It is nothing but the deterioration and abrasion of articular cartilage with new bone formation at joint surface. So, it could be either due to overload or due to the deterioration of the functional capacity or age or trauma or missing teeth. Since it is the only joint with rigid enclosure, the shape and the morphology of the tooth will have an influence on the joint movement. Hence, the missing teeth over a chronic period led to osteoarthritis. So, the patient will have pain and there will be deviation of the jaw to the affected site with limited jaw movements. The management is to remove the cause with analgesics and muscular exercises.

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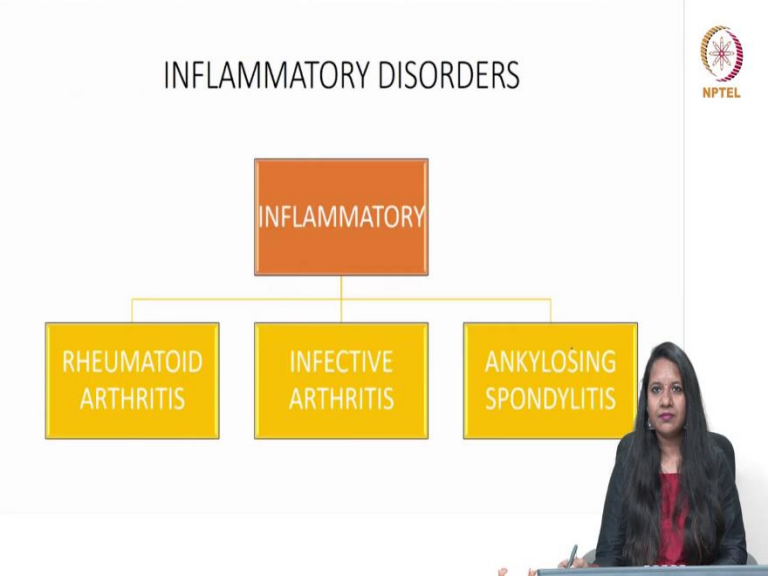

Inflammatory disorders are rheumatoid arthritis, infective arthritis or ankylosing spondylitis. Rheumatoid arthritis is a debilitating disease that leads to erosion of bony components secondary to granulomatous involvement of the synovial membrane and there is effusion of synovial fluid leading to joint swelling.

Stiffness with pain is the most common complaint of the patient. Infective arthritis is where the direct spread from the microorganisms will delimit the movement of the mandible; otherwise, the infection might spread from the first molar or premolar or from the middle ear infection. Ankylosing spondylitis is where the condyle is eroded with flattening of the articular eminence which leads to the limited mandibular movements.

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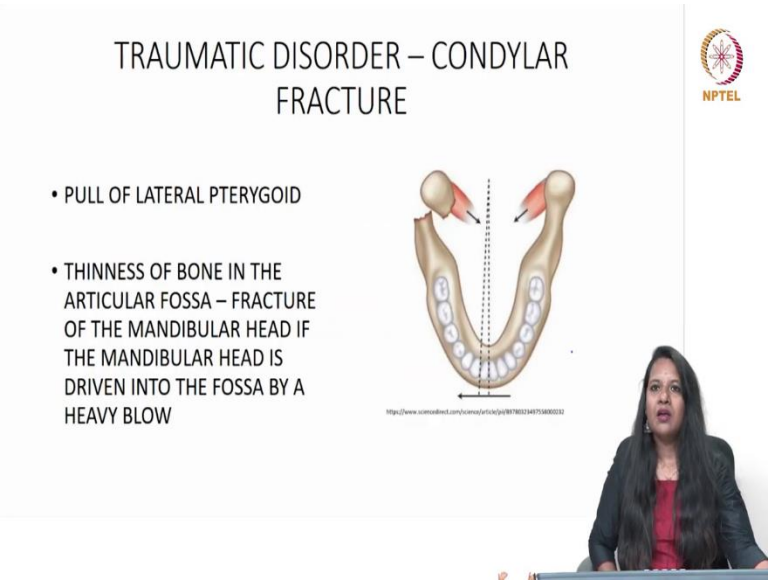

Now, moving to the traumatic disorder that is the condylar fracture. It is mainly due to the pull of the lateral pterygoid medially and inferiorly. The thickness of the bone in the articular fossa leads to the fracture of the mandibular head if the mandibular head is driven into the fossa by a heavy blow.

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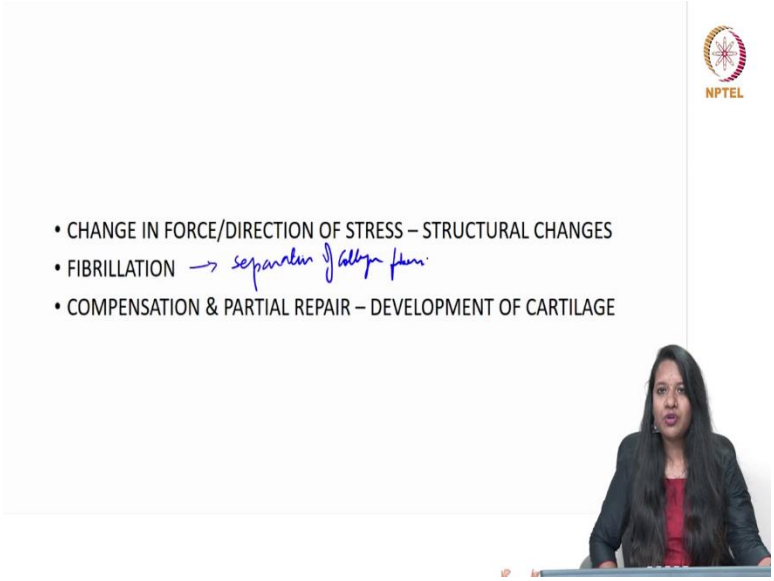

Change in force or direction of stress leads to structural changes. The first one being fibrillation, which is the separation of the collagen fibers and the compensation and partial repair is done by the development of cartilage.

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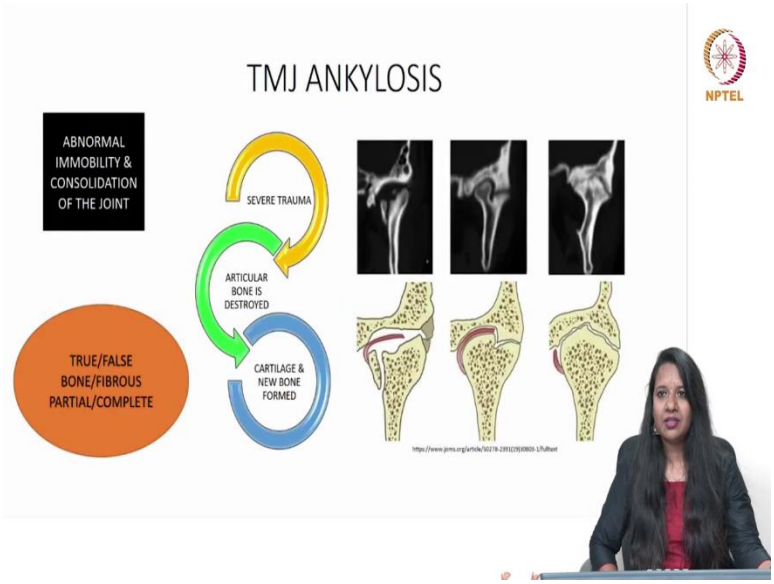

Ankylosis in Greek means fusion of body part. It is an abnormal immobility and consolidation of TMJ. So, it could be either true or false, bone or fibrous, partial or complete. If the reason for the ankylosis is present within the temporomandibular joint, then it is called as true ankylosis and when it occurs due to any other pathological condition outside the joint, then it is known as false ankylosis.

If the articular surfaces were joined by bone, then it is known as bony ankylosis and if it is formed by fibrous, then it is known as fibrous ankylosis. If the articular surfaces were completely joined, then it is known as complete ankylosis or if it has been partially joined, then it is known as partial ankylosis. So, mainly, it is due to the severe trauma, where the articular bone is destroyed leading to the cartilage and new bone formation as given in this picture.

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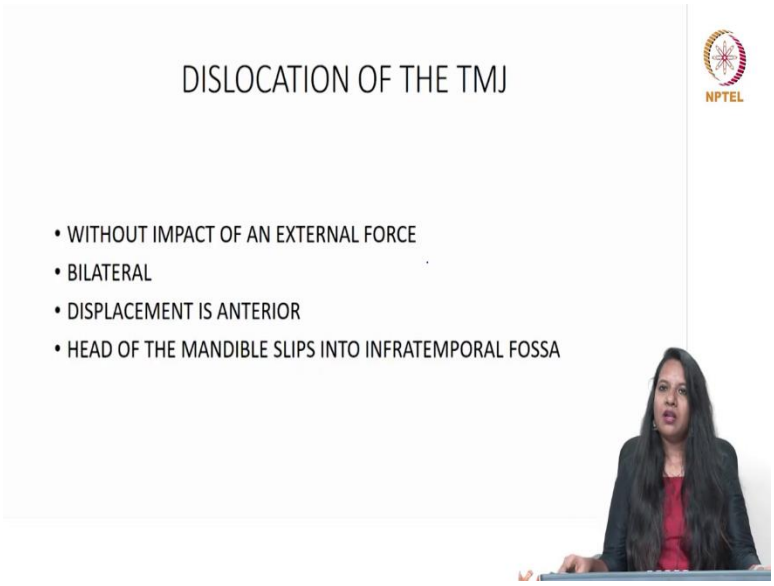

Now, dislocation of the TMJ; it will occur without any impact of an external force. It is usually bilateral and the displacement is mostly anterior, that is the head of the mandible will slip into the infra temporal fossa.

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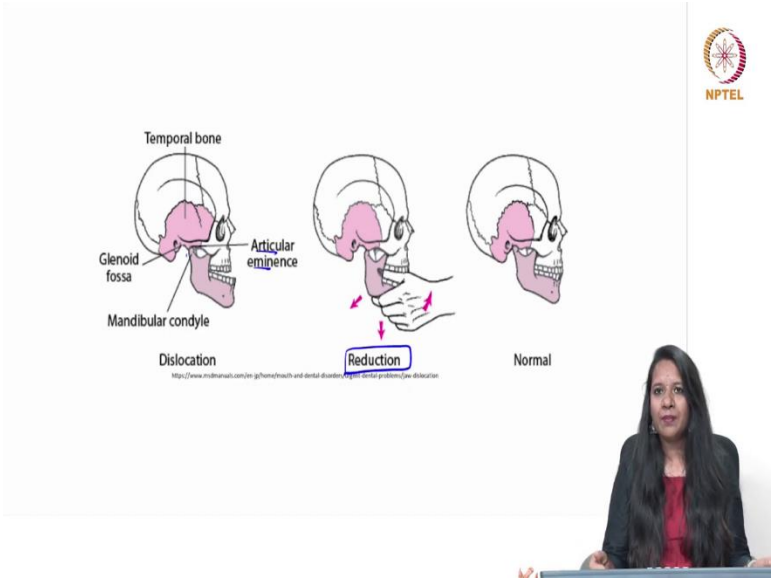

So, in this picture, the mandible condyle has been moved forward over the articular eminence. It occurs due to excessive yawning. So, the process where the mandible has been put back in position is known as reduction, where the thumb finger has been placed on the molar and the mandible is pushed backward.

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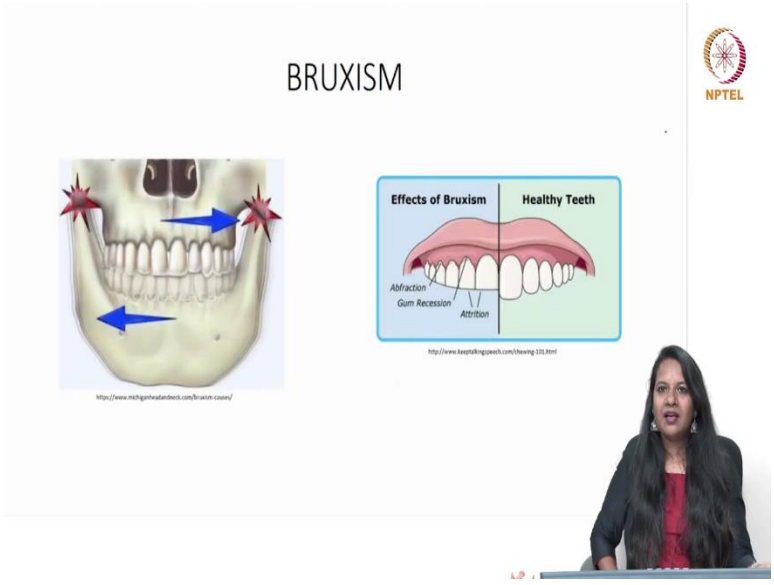

Bruxism is a repetitive jaw muscle activity characterized by clenching or grinding of teeth. In a normal individual without bruxism or any other para functional habits, the jaw will be open at rest. It is just around 20 minutes in a day the tooth will come in contact while speaking, swallowing and eating; whereas, in bruxism patient, the tooth is always clenched which will also damage the TMJ and its muscular attachments.

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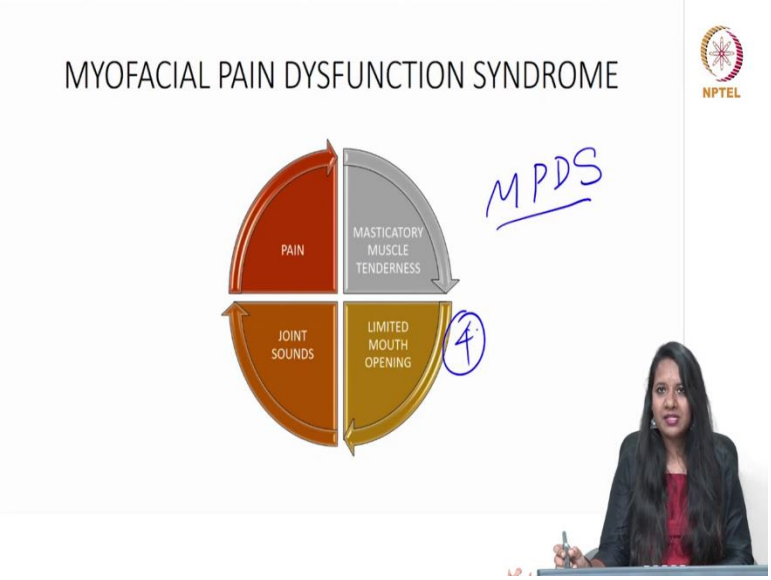

There is a syndrome related to temporomandibular joint. It is Myofascial Pain Dysfunction Syndrome, shortly called as MPDS which is characterized by these four criteria - pain in the joint, masticatory muscle tenderness, limited mouth opening, with joint sounds.

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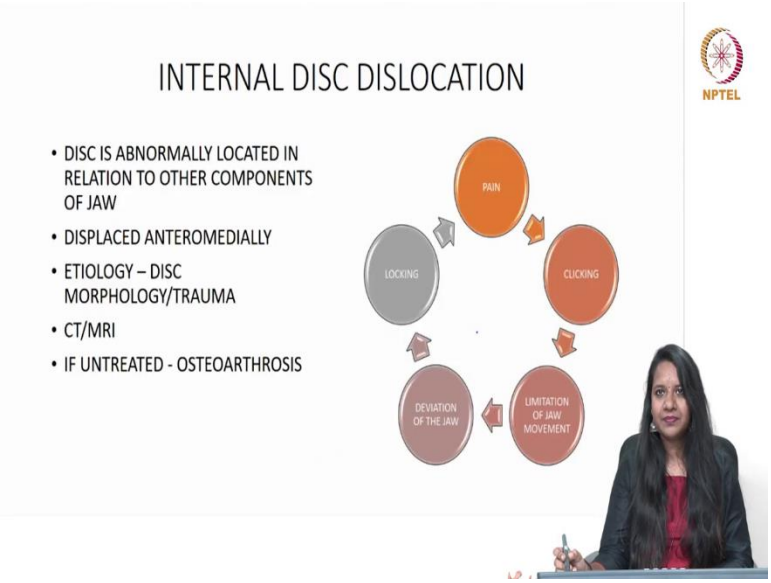

Next is the internal disc dislocation. Disc is abnormally located in relation to other components; most commonly, it is dislocated anteromedially. It could be either due to the trauma or it could be either related to the disc morphology, which can be evaluated by CT or MRI scan. If it is untreated, it leads to osteoarthrosis which is the degeneration of the soft tissues. So, it causes pain, clicking, limited movement of the jaw, deviation of the jaw and locking.

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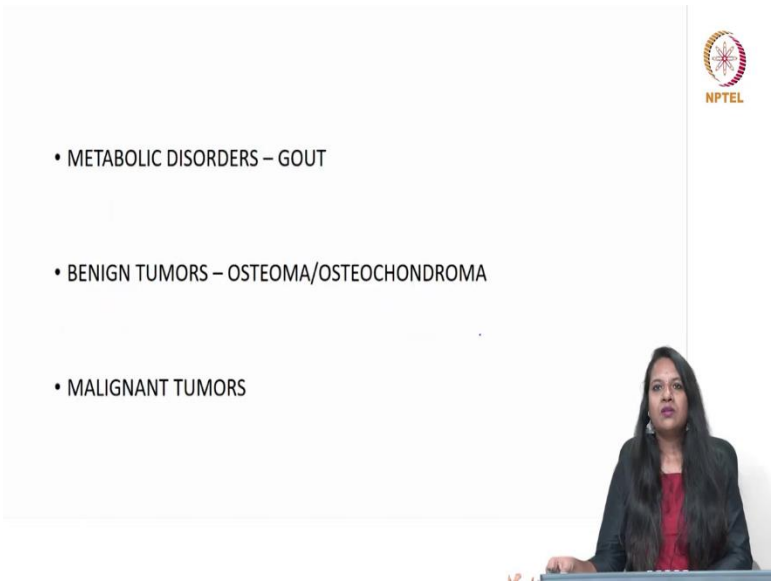

The metabolic disorders such as gout leads to the swelling of the joint and pain in TMJ. Benign tumors such as osteoma and osteochondroma and the malignant tumors in the TMJ also lead to the restricted mouth opening, pain and tenderness over the TMJ area. Thus, TMJ joint is a peculiar joint with its own anatomy and function.

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These are my references.

Thank you.