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Temporomandibular Joint-Anatomy And Movement Disorders

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Abstract:

We know that when the mouth is closed or slightly open the head of the mandible lies in the articular fossa. In this position anatomically joint is stable and a blow on the chin causes fracture of the mandible rather than its dislocation. Posterior dislocation is also prevented by the strong lateral temporomandibular ligament. When the mouth is opened wide the head of mandible moves forwards and comes to lie just below the articular tubercle. This is the position in which Temporomandibular joint is highly unstable .A blow on the chin or even sudden opening of the mouth as in yawning can cause the head of the mandible to slip forward to the front of the articular tubercle. Once the joint is thus dislocated the mouth cannot be closed and this is known as locking of jaw in open condition. To reduce this dislocation the surgeon inserts both his thumbs into the mouth and exerts downward pressure on the lower molar teeth, simultaneously the mandible is pressed backwards. Generally this happens after an injury and leads to painful jaw movements along with clicking sounds during opening and closing of mouth. Temporomandibular Joints are foundations for dentistry, orthodontics and orthognathic surgery. If Temporomandibular Joints are not stable and healthy, there will be problem related to stability, occlusion, function and pain .

As we open the jaws, the condoyle normally comes forward, the fascia and the disc moves forward with it because it is attached to the ligament that is attached to the back the condyle, around the front and all along the sides. It secures the disc to the condyle. The most common thing we see in the Temporomandibular Joints problem is the disc slipping anteriorly, posterior, backward or laterally. But the most common shifting is in the anterior direction. Here we see the disc fold a little bit which cause pain because the patient is pressing on the bilaminal tissue in the centre but there is no pain or inflammation as there are no blood vessels. This may not make any noise because the mandible is already in contact with the bad part of the disc and may not make it forward to make noise so this is a silent joint but a displaced disc. The other is little more involved, here condyle and the articular disc is little bit forward which does not click and pop when this patient open because the condyle will come over the back end of the disc, if it does not click and pop and is stuck behind here, then it is called a closed lock. It gets trapped behind that disc and the patient can't open his/her mouth very wide. In another case the disc is anteriorly displaced out in front. On opening the condyle comes forward but the disc remains anteriorly displaced. This is an anteriorly displaced disc without reduction. In this there may or may not be pain, it won't make any noise. We see this in a number of disease entities.

Key words: *Temporo-mandibular Joint, Anatomy, Arthritis, Lock Jaw, Ankylosis, Luxation, Treatment*

1.Temporomandibular Joint-Anatomy And Movement Disorders

It is the joint formed between the head of the mandible and the articular fossa of temporal bone. This is a synovial joint of the Condylar variety. It is a complex joint as its cavity is divided into upper and lower parts by an intra-articular disc. The upper articular surface of the joint is formed by the Madibular fossa of the temporal bone. Anteriorly, the surface extends onto the articular tubercle. The posterior part of the surface is, therefore, concave downwards; and the anterior part is convex. The inferior articular surface is formed by the head of the mandible which is markedly convex anteropoteriorly and more gently convex from side to side. The articular surfaces are covered with white fibro cartilage (and not hyaline cartilage as in the most synovial joints; this is because the bones concerned ossify in membrane).

The articular disc is also made of fibrocartilage.Its upper surface is concavo-convex to fit the upper articular surface of the joint. Its lower surface is concave; the head of the mandible fitting into the concavity. The capsule of the joint is attached to the margins of the articular surfaces. The inside of the capsule is lined by synovial membrane. The lateral part of the capsule is strengthened by the lateral temporomandibular ligament. The upper end of this ligament is attached to the tubercle of the root of the zygoma and its lower end to the lateral aspect of the neck of the mandible .In addition the joint has two accessory ligaments (that are independent of the capsule and lie some distance away from it.)The sphenomandibular ligament is attached to the spine of the sphenoid and below to the lingual of the mandible .The stylomandibular ligament extends from the apex of the styloid process to the angle and posterior border of the ramus of the mandible .It is formed by a thickening of deep cervical fascia of the neck.

2.Articular Surfaces

- Upper: Articular eminence of the Madibular fossa of the temporal bone.
- Lower: Condylar process of the mandible.

3.Articular Disc

It is an oval fibro cartilaginous plate with concavo-convex superior surface and a concave inferior surface to accommodate the head of the mandible. It is thickened at the periphery to form annulus which is attached to the fibrous capsule. This divides the joint cavity into two parts:-

- Upper menisco temporal compartment – permits gliding movements.
- Lower menisco madibular compartment – permits rotary as well as gliding movements.

4.Function Of The Articular Disc Of Joint

- It reduces the friction between the two articular surfaces .It allows free sliding movements of the condyle preventing damage due to friction .This function is at the cost of slight instability of the joint.
- It aids in lubrication of the joint.

5.Relations Of TM Joint

- Anterior: Lateral pterygoid muscle, masseteric nerve and vessels.
- Posterior: Parotid gland, external auditory meatus, superficial temporal vessels, auroculotemporal nerve.
- Medial: Spine of sphenoid , sphenomandibular ligament ,auroculotemporal nerve, chorda tympani nerve, middle meningeal artery
- Lateral: Skin, fasciae, parotid gland, facial nerve.
- Superior: Middle cranial fossa.
- Inferior: Maxillary artery and vein.

6.Nerve Supply Of TM Joint

It is supplied by branches of mandibular division of trigeminal nerve namely:

- Auroculotemporal nerve.
- Masseteric nerve.

7.Blood Supply Of TM Joint

It receives branches from:

- Superficial temporal artery.
- Maxillary artery.

Veins run along the arteries and drain into pterygoid plexus of veins.

Lymphatic drain into upper cervical lymph nodes present around internal jugular vein.

8.Movements Of TM Joint

Movements	Mechanism of Movement	Muscles responsible
Depression	Gliding movement in menisco temporal compartment and rotary movement in menisco mandibular compartment.	-Lateral pterygoid -Suprahyoid muscles namely, geniohyoids, mylohyoid and digastrics.
Elevation	Reversal of depression.	-Masseter -Medial pterygoid. -Temporalis (middle and anterior fibres)
Protrusion	Gliding movements in menisco temporal compartment.	-Medial pterygoid. -Lateral pterygoid.
Retraction	Reversal of protrusion	-Posterior fibres of Temporalis. -Geniohyoids and digastrics.
Chewing (It involves vertical and lateral movements of the jaw)	Gliding movement in menisco temporal compartment of one joint and rotary movement in menisco mandibular compartment of other joint simultaneously.	-Alternate action of medial and lateral pterygoid of each side.

Table 1

9.Stability Of The Joint

The following factors maintain the stability of temporomandibular joint.

- Articular tubercles: These are present in the front and behind the mandibular fossa and prevent the slipping of the condyle of mandible.
- Lateral temporomandibular Ligament: It gives added strength to the capsule of joint posterolaterally and prevents the backward dislocation of mandible.

- Muscles: Protrusion and retraction are limited by the tension in Temporalis and lateral pterygoid muscles respectively.
- The position of mandible is most stable when the mouth is closed or slightly open.

We know that when the mouth is closed or slightly open the head of the mandible lies in the articular fossa. In this position anatomically joint is stable and a blow on the chin causes fracture of the mandible rather than its dislocation. Posterior dislocation (towards the external acoustic meatus) is also prevented by the strong lateral temporomandibular ligament. When the mouth is opened wide the head of mandible moves forwards and comes to lie just below the articular tubercle. This is the position in which Temporomandibular joint is highly unstable .A blow on the chin or even sudden opening of the mouth as in yawning (Involving sudden contraction of the lateral pterygoid muscle) can cause the head of the mandible to slip forward to the front of the articular tubercle. Once the joint is thus dislocated the mouth cannot be closed and this is known as locking of jaw in open condition. To reduce this dislocation the surgeon inserts both his thumbs into the mouth and exerts downward pressure on the lower molar teeth, simultaneously the mandible is pressed backwards.

The term derangement of the temporal Madibular joint is applied to the condition in which part of the articular disc gets detached from the joint capsule. Generally this happens after an injury and leads to painful jaw movements along with clicking sounds during opening and closing of mouth.

Temporomandibular Joints are foundations for dentistry, orthodontics and orthognathic surgery. If Temporomandibular Joints are not stable and healthy, there will be problem related to stability, occlusion, function and pain .As we open the jaws, the condoyle normally comes forward, the fascia and the disc moves forward with it because it is attached to the ligament that is attached to the back the condyle, around the front and all along the sides. It secures the disc to the condyle.

The most common thing we see in the Temporomandibular Joints problem is the disc slipping anteriorly, posterior, backward or laterally. But the most common shifting is in the anterior direction. Here we see the disc fold a little bit which cause pain because the patient is pressing on the bilaminal tissue in the centre but there is no pain or inflammation as there are no blood vessels. This may not make any noise because the

mandible is already in contact with the bad part of the disc and may not make it forward to make noise so this is a silent joint but a displaced disc.

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10.Condylar Resorption

This is commonly seen in teenage females. It occurs in teenage female as they go through puberty growth spurt. It is called Adolescent Condylar Resorption (AICR). In AICR, the breakdown is inside the bone. The head of the condyle collapse down on itself. Condyle decrease in all three planes of space but it maintains its normal fibro cartilage on the top. The common factor is having a displaced articular disc. The ratio between female to male is 8:1. In this patient have High Occlusal Plane Angle, High Madibular Plane Angle, and Retruded mandible in appearance. It gets progressively worse because there is an ongoing condylar resorption but is a slow process. This happens when kids are taking orthodontic treatment. It is used to be called Cheer Leader Syndrome. MRI is fairly classic most of times to make a correct diagnosis. It is sometimes hard to see the top of the condylar bone because it is really thin and weakened because the destructive process is down inside and so the head of the condyle just keeps collapsing downward from the occlusal function and the discs are all anteriorly displaced.

In this we should remove all extra tissue within the joint and put the disc back in place and at the same time we do orthognathic surgery. But there is a time frame after which it becomes so degenerative the only option is total joint prosthesis which is extremely unpredictable in this treatmen.

11.Condylar Hyperplasia

In this the lower jaw grows too much, this occurs in pubertal growth spurt and is supposed to be hormonally mediated. This growth can continue in mid 20's and jaw relationship gets worse in class III direction usually. Normally during pubertal growth years the distance between the top of condyle to the front of mandible, in female grows 1.6 mm per year while in males it grows by 2.2 mm per year, it stops later. In female the facial growth completes by 15 years of age and in males it is completed at 17-18 years of age.

In this we just take the very top part of the condyle out and put the disc back in place .Set the upper jaw forward a little bit , pull the chin back a little bit and end up with good occlusion.

12.Osteochondroma Or Osteoma

This is bit uncommon. It is like a tumour that grows in the condyle and the joint. It is unilateral problem where the condyle gets large on one side so the other side gets overloaded. Sometimes on the opposite side the disc gets displaced and patient gets pain. It causes the mandible to increase in vertical height and the mouth is unilaterally open wide. As the tumor grow it pushes the mandible down and to compensate vertical growth and the dentition also grow vertically to keep occlusion down and often the maxilla grow down also to get in proper occlusal plane.

We do condylectomy to get the tumor out, put the disc in place, then get the orthognathic surgery to get the jaw lined up, remove a part of mandible to get a better vertical facial balance and get the occlusion together.

12.1.Reactive Arthritis

Occur in any age and most comm. only in the 3rd decade of life. It is caused by venereal kind of disease process most common causes of reactive arthritis are clamydia, mycoplasm or ureaplasma. It is just a degenerative joint disease. It makes immune system worse. It causes joint pain, fever and fatigue. Condyle has lost a lot of volume in reactive arthritis. In some people they do not cause any effect but in some other they cause destructive damage in the joints.

They tend to collect in bilaminal tissues and they are around the vessels in there.

Sometimes, we just want to debride it and it would stop the disease process. But if the disc is displaced then take out the bilaminal tissue and put the disc back. But if there is tremendous destruction we have to do a total joint prosthesis.

13.Ankylosis

Where the joints get frozen. Most frequent cause of Temporomandibular joints ankylosis is traumatic injuries and infections in and about the joint .Other causes are:-

- Abnormal intrauterine developments
- Birth injuries(by forceps delivery)
- Trauma to the chin forcing the condyle against the glenoid fossa particularly with bleeding into the joint space
- Malunion of the Condylar fracture
- Congenital syphilis
- Rheumatoid arthritis
- Inflammation of joints
- Metastasis malignancies
- Inflammation secondary to radiation

Most cases occur before the age of ten years. Patient may or may not open the mouth depending upon the type of ankylosis. Ankylosis may be unilateral or bilateral. In unilateral the chin is displaced unilaterally and backward on the affected side because of the failure of the development of the mandible. When attempt is made to open the mouth chin deviates toward the ankylosed side. In bilateral ankylosis there is underdevelopment of the lower portion of the face, receding chin and micrognathia.

Temporomandibular Joints ankylosis is divided into two types:-

- Intra-articular ankylosis
- Extra-articular ankylosis

In Intra- articular ankylosis the joint undergoes progressive destruction of the meniscus with flattening of the Madibular fossa, thickening of the head of the condyle and narrowing of the joint space.

Extra-articular ankylosis result in a splinting of the Temporomandibular Joints by a fibrous or bony mass external to joint proper as in case of infection in surrounding bones or tissue destruction.

Fibrous ankylosis may be treated by functional methods. Treatment of ankylosis is surgical basically consisting of osteotomy or removal of the section of the bone below the condyle. In this case we remove the heterotrophic bone, debride it, use a total joint prosthesis and then take fat, harvest it usually from the abdomen and pack it around the prosthesis. This keeps the reactive bone from reforming. Orthognathic surgery is only done if indicated.

14.Rheumatoid Arthritis

It is a disease of unknown etiology. This is supposed to be an immune reaction to toxin and products of bacterial infection specifically streptococci in early ages of childhood. Slight fever, loss of weight, and fatigability, are the symptoms. Joint affected are swollen and patient complains about pain and stiffness. Movement of jaw during mastication or talking causes pain and may be limited because of periarticular stiffness. Stiffness is commonly in the morning.

Rheumatoid arthritis in children (Stills disease), when it involves Temporomandibular Joints, may cause malocclusion, of the class II division I type with protrusion of maxillary incisors and an anterior open bite. Rheumatoid arthritis also causes deformation of the mandible characterised by shortening of the body and reduction in height of the ramus due to failure of the growth centre in the Condylar area.

There is no specific treatment of Rheumatoid Arthritis although administration of cortisone may benefit in some cases. In cases of limitation of motion of jaw and deformity condylectomy is necessary.

15.Luxation and Subluxation

Dislocation of the Temporomandibular joint occur when the head of condyle moves anteriorly over the articular eminence into such a position that it cannot be returned voluntarily to its normal position.

Luxation of the joint refers to complete dislocation while Subluxation is a partial or incomplete dislocation. Luxation may be acute owing to a sudden traumatic injury resulting in fracture of the condyle or, more frequently, only in a stretching of the capsule, usually at the point of attachment for the external pterygoid muscle into the capsule. There is often some tearing of the tendon at the insertion point or having the mouth opened too widely, as by a dentist extracting teeth or by an ENT surgeon removing the tonsil or through injudicious use of a mouth prop.

Luxation is characterised by a sudden locking and immobilisation of the jaw when the mouth is open, accompanied by prolonged spasmodic contraction of the temporal , Internal pterygoid and ,masseter muscles with protrusion of the jaw.

Treatments is reduction of a dislocated condyle accomplished by inducing relaxation of the muscles and then guiding the head of the condyle under the articular eminence into its normal position by an inferior and posterior pressure of the thumbs in the Madibular molar area.

Connective tissue autoimmune diseases:-

Can cause significant destruction in the joint and only way to treat these is with total joint prosthesis.

16.Conclusion

Temporomandibular joint diseases show a variety of causes, and their treatment varies according to cause and factors involved like age, sex, immunity, and habits like smoking, chewing tobacco, dentures, etc. Pain in and around temporomandibular joint should be taken seriously, proper history, examination, radiological investigations are necessary to reach a correct diagnosis and treatment.

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