

Posterior Disc Displacement in Temporomandibular Joint

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ABSTRACT

Disc displacement is one of the most common type of Temporomandibular joint arthropathy. The precise alignment of condyle–disc assembly is important for the proper functioning of temporomandibular joint. Posterior disc displacement is a condition in which disc tissue is located between the posterior surface of the condyle and post glenoid tubercle. Clinical symptoms of Posterior disc displacement includes lack of occlusion on the affected side, deviation of the mandible, pain on palpation, and large or nearly average mouth opening or interincisal distance. The etiopathogenesis of this condition is idiopathic. However, different predisposing factors include, trauma, forceful wide opening like yawning, lack of anterior prominence of the disc, disc adhesion, and perforation of the disc. This review article enlightens on the etiology, clinical features and treatment options of posterior disc displacement in temporomandibular joint, to help clinicians in proper diagnosis and treatment planning of the condition.

Keywords: Posterior disc displacement, Temporomandibular joint, Disc displacement

INTRODUCTION

Temporomandibular joint

Temporomandibular joint is a type of synovial joint, formed by the articulation of mandibular condyle and temporal bone, which acts as a modified hinge (FIG 1a).^[1] As a ginglymoarthrodial joint, it allows for hinging movements in one plane and at the same time, gliding movements in the second

plane. TMJ is the only joint of the human body that harbours a growth center, resulting in perpetual need for cooperation between the left and right joints.^[2] The articular surfaces involved in TMJ are the mandibular fossa of temporal bone, and the head of mandibular condyle. The bones that make up the TMJ are covered with a layer of fibrous cartilage. Between the mandibular condyle and the mandibular fossa there is a dense fibro cartilaginous oval articular disc also called TMJ disc or articular disc. This disc divides the joint cavity into superior and inferior compartments.^[3] The articular disc serves as a nonossified bone, thus permitting complex movements of the TMJ.^[4] Articular disc plays a major role in jaw function by aiding stress distribution and lubrication in the TMJ.^[5] The articular disc of the TMJ is a fibrocartilaginous component that acts as a load absorber and aids in the relative motion between mandible and the surface of temporal bone.^[6]

Embryology

Embryologically, during the eighth week of intra uterine life the first indication of TMJ development occurs as a condensation of mesenchymal cells, derived from neural crest cells, on the dorsal end of mandible. During the next two weeks these cells proliferate and differentiate into the condylar cartilage. This is a wedge shaped structure attached to the mandible, and is separated from the temporal component of the joint. During the tenth to twelfth week

the condylar cartilage undergoes tremendous growth in size in posterior and lateral direction to keep pace with the widening cranial base. The temporal component of the joint develops in the eighth week as a separate condensation of cells posterior and lateral to the developing condyle. Between these two blastemata a third condensation of cells occurs which is associated with the lateral pterygoid muscle and this subsequently becomes the disc.^[7]

Histology

Histologically, TMJ disc can be divided into three regions according to thickness (FIG 1b) anterior, intermediate and posterior zone. The thinnest part is the central area, called the intermediate zone which separates the articular surface of the mandibular condyle from the slope of the articular tubercle. The thickened posterior band, called the posterior zone, is situated between the condyle and the floor of the mandibular fossa. The anterior zone, is thicker than the intermediate zone and lies slightly in front of the condyle.^[8] In the posterior region, the TMJ disc is divided into two laminae: the superior retrodiscal lamina, consisting of elastic fibers, which attaches the disc to the tympanic plate; and the non-elastic inferior retrodiscal lamina, that, consists entirely of collagen which rotates in a downward direction and merges with the periosteum of the condylar neck. This region is named as bilaminar zone.^[9]

Disc displacement

The precise alignment of condyle-disc assembly is important for the proper functioning of TMJ ((FIG 1c).^[10] The exact relationship between the disc, condyle, and the articular tubercle has been defined as 12 o'clock position, in which the posterior band of the disc is located over the cranial portion of the condyle. Disc positions other than '12 o'clock' are clinically appreciable due to the presence of typical click noises, which is an indication of disc displacement.^[11,12] Disc displacement is one of the most common type of TMJ arthropathy.

According to Clark et al and Moloney et al disc displacement presents in about 15% to 25 % of patients with TMDs.^[13,14] The role of articular disc in the progression of TMJ disorders is controversial. It has been postulated that disc displacement precedes the onset of degenerative changes in the TMJ.^[15] The high association of articular degeneration with disc malposition has led some investigators to suggest that the degenerative process predisposes to disc displacement.^[16]

Disc displacement is characterized by several stages of clinical dysfunction arising from deviant relationship of articular disc to condyle.^[17] The diagnostic criteria of TMDs describes disc displacement as an intracapsular biomechanical disorder involving the condyle-disc complex.^[18]

Etiology and Types

Physiologic disc-condyle relationship has an effective intra-articular lubrication mechanism that keeps the articular friction coefficient low.^[18] An increase in the friction coefficient may be due to chronic microtrauma or acute macrotrauma directed against the TMJ.^[19] Microtrauma refers to repetitive minor injuries to the TMJ occurring over a long period. Bruxism represents the most frequent cause of microtrauma. Macrotrauma caused by an external source that provokes damage to the TMJ are often considered to be a risk factor for disc displacement. Macrotrauma includes strong blow to the mandible, a whiplash injury, or mandibular hyperextension.^[20,21]

Kirveskari et al mentioned the loss of posterior occlusal support as a cause of discal and condylar deformation and degeneration.^[22] Rubio et al and Alanen et al considered occlusal abnormalities to be a fundamental factor in the onset of TMD symptoms.^[23,24]

According to Daneile et al, under normal conditions, the strong discal ligaments and the 'self-seating' wedge shape of the disc prevent any shift movement. For the disc to shift over the condyle, a deformation of its surfaces is

needed, together with damage to the discal ligaments.^[25] Atkinson et al proposed that a steep articular eminence may be an etiologic factor for disc displacement.^[26]

Disc displacement can be anterior or posterior. It may also be displaced medially or laterally. Although the precise etiology is not known, microtrauma and macrotrauma (occlusal interferences, nocturnal bruxism, and physical overloading of the muscles) and systemic factors (psychiatric illness and emotional stress) have been identified as causative factors.^[27,28] Healthy TMJ exhibits a disc with normal configuration of biconcave shape during mastication. According to Mori et al the concept of maintenance of shape of disc even after inducing masticatory load could be due to the push back reactionary force exerted by the disc against the compressive force induced by the condyle on the disc. This property of the disc is known as viscoelasticity of the disc. This facilitates stress relaxation and maintains the configuration of the disc.^[29] But when the load on the disc increases due to microtrauma or macrotrauma, it can result in loss of viscoelastic property of the disc resulting in thinning or perforation of the disc causing the disc to displace anteriorly or posteriorly.

When the posterior most border of the disc is anterior to the 11:30 position of the condylar head it is called anterior disc displacement. Movement of the disc onto and off the condylar head may result in a clicking or popping sound. Since the disc reduces during condylar translation, range of motion is not limited. This condition is called disc displacement with reduction. When the articular disc consistently does not reduce, resulting in limited opening it is called disc displacement without reduction.^[30] Anterior disc displacement which is the most common type of disc displacement is characterized by limitation in mouth opening, pain, deviation of the mandible and clicking.

POSTERIOR DISC DISPLACEMENT

Posterior disc displacement (FIG 1d) is a rare condition seen in 0.7% to 2.2% of patients with internal derangement. Westesson et al and Okochi et al described PDD as disc tissue located posterior to the condyle between the posterior surface of the condyle and postglenoid tubercle.^[31,32] Tasaki et al described PDD as disc displaced posterior to the 12'o clock position on top of the condyle.^[33] Nagwak et al described PDD as the type of disc displacement where the most anterior part of the anterior zone is more than zero degree and the most posterior part of the posterior zone is greater than 180 degree.^[34] Huglund et al described PDD as open lock condition or mouth closing disorder.^[35]

Westesson et al. described three different presentations:

1. A thin disc spans from the superior portion of the condylar head to posterior of the condylar head
2. A centrally-perforated disc is present, with a small portion anterior to the condylar head, and a larger portion posterior to the condylar head, and
3. The entire disc is posterior to the condylar head.^[31]

The most common clinical symptoms reported by Okochi et al, is clicking followed by pain, luxation and open lock.^[36] Clinical symptoms of PDD includes lack of occlusion on the affected side, deviation of the mandible, pain on palpation, and large or nearly average mouth opening or interincisal distance.^[31] The etiopathogenesis of this condition is idiopathic. However, different authors have proposed different etiology or predisposing factors, e.g., trauma, forceful wide opening like yawning, lack of anterior prominence of the disc, disc adhesion, and perforation of the disc.^[37-40] Though PDD is considered a rare type of disc displacement,^[31,37] there are three possible mechanisms of occurrence of PDD :

1. Stretching of the structures limiting posterior displacement of the disc.
2. Widening of the posterior part of the TMJ.

3. And the impairment of forward disc movement by adhesion in the inferior joint space.

However, Chiba et al proposed that, pain is not the chief complaint of the patients with PDD as it is in cases of anterior disc displacement.^[37] Other feature associated with PDD was lack of occlusal contact on the affected side.^[31,37,41] Santos et al described the osseous changes in PDD which includes change in morphology of condyle and articular eminence and joint effusion.^[42] Pressman et al studied TMJ abnormalities associated with whiplash injuries that may be considered as the risk factor for PDD.^[43] Although, Katzberg et al suggested that the prevalence of PDD is extremely low because the normal position of the disc is slightly anterior to the condyle.^[44] Interestingly Ueki et al found a high prevalence of PDD seen in skeletal class III patients. He hypothesised that PDD reflects a form of adapted TMJ morphology to individual mandibular morphology.^[34]

Hypothetically there are two forms of PDD, that is, reducible or nonreducible. In the reducible form, the disc resumes its normal position over the condyle in open mouth position. In the nonreducible form, the disc remains turned at less than 11 o'clock with respect to the condyle in the open mouth position. In both forms, the disc is displaced backwardly when the mouth is closed.^[38]

Cone beam computed tomography (CBCT) is considered the modality of choice for imaging the osseous components of TMJ.^[45,46] CBCT exhibits a high spatial resolution at low radiation dose.^[47] TMD patients will have different soft and hard tissue abnormalities of the TMJ, which can be studied using different imaging modalities. Osseous abnormalities can be detected and confirmed precisely using CBCT.^[48,49]

Magnetic resonance imaging (MRI) is considered the gold standard imaging tool for evaluation of soft tissue components of the TMJ and has been pointed out as the best imaging modality in diagnosing disc

displacements in all the three planes, i.e., sagittal, axial and coronal.^[50,51]

MRI is an objective method for examination of disc displacement before and after treatment with no radiation hazard to the patient.^[52] MRI should precede CBCT for cases in which the diagnosis of soft tissue pathology is a concern.^[47] MRI helps to detect the early signs of TMJ dysfunction, like thickening of anterior or posterior zone, rupture of retrodiscal tissue, changes in shape of the disc, joint effusion.^[51]

Even though articular disc is unique with its ability of self healing, repair and adaptation proper treatment methods should be implicated for disc displacement, as it plays vital role in all or of acial functionings. The therapeutic approach available for the treatment of TMDs includes: Conservative approach and surgical approach. Conservative methods are non-invasive, this involves the use of occlusal splints, physical therapy, feedback, acupuncture and short-term pharmacotherapy. Surgical treatments include arthrocentesis, arthroscopy, arthroplasty, discectomy, and TMJ reconstruction.^[53,54] The most commonly applied conservative managements for TMDs are: patient education and counseling, mandibular manipulation, splint therapy, exercise therapy and pharmacotherapy. The surgical management should be considered after unsuccessful conservative therapy.^[55] Occlusal Splint therapy may be defined as the art and science of establishing neuromuscular harmony in the masticatory system and creating a mechanical constrain for parafunctional forces with removable appliance.^[56] Occlusal splint therapy is a relatively simple, reversible and non-invasive therapy advocated for TMD patients. It helps in distributing the heavy load exerted on the articular disc during parafunctional activities. Occlusal splints that increases the occlusal vertical dimension beyond the freeway space, cause an immediate adaptation of the jaw to a new freeway space allowing muscles to function

more efficiently during contact and be less active during postural functions. Hence, occlusal splint decreases muscular effort resulting in relaxation of the muscles and TMJ.^[57]

The performance of occlusal splint is based on the mechanism of neuromuscular reflex and decrease in the intra-articular pressure in TMJ.^[22,18] The purpose of occlusal splint is to provide an indirect method of altering occlusion until correctness of condylar axis position is determined. Occlusal splints can prevent the existing occlusion from controlling the jaw to jaw relationship at maximum intercuspation. Occlusal surfaces are covered, either partially or completely, so that splint material becomes an occluding surface.^[58] The effectiveness of splint in reducing the TMD symptoms are reported to vary between 70-90 %.^[59] The ultimate effect of occlusal splint is to accommodate the condylar axis into a splint dictated jaw relationship.^[58] Marta et al explained that the presence of an occlusal appliance leads to

stress reduction in the TMJ, change in the position of the mandible and decrease in muscle activity.^[55] Wolter et al proposed that the result of splint therapy is achieved not only by improving the disc position but also it is strongly related to basic decoupling of the neuromuscular reflex mechanism and reduction in TMJ stress.^[59] The effectiveness of occlusal splint in treatment of disc displacement have already been proven by many authors.^[31,37,38] Afros et al, the author noted reduction in TMD symptoms in a PDD patient after the use of occlusal splint.^[41] Chossgross et al found occlusal splint to be the best treatment option in relief of PDD symptoms. In addition Honda et al, Boering et al and Chiba et al also advocated use of occlusal splint in PDD.^[40,39,37] Sameh et al recommended occlusal splint in disc displacement for 3 months for improvement in TMD symptoms.⁶⁰ Amin et al and Yueh et al described occlusal splint therapy, as the safest and effective method in relieving TMD symptoms.^[61,62]

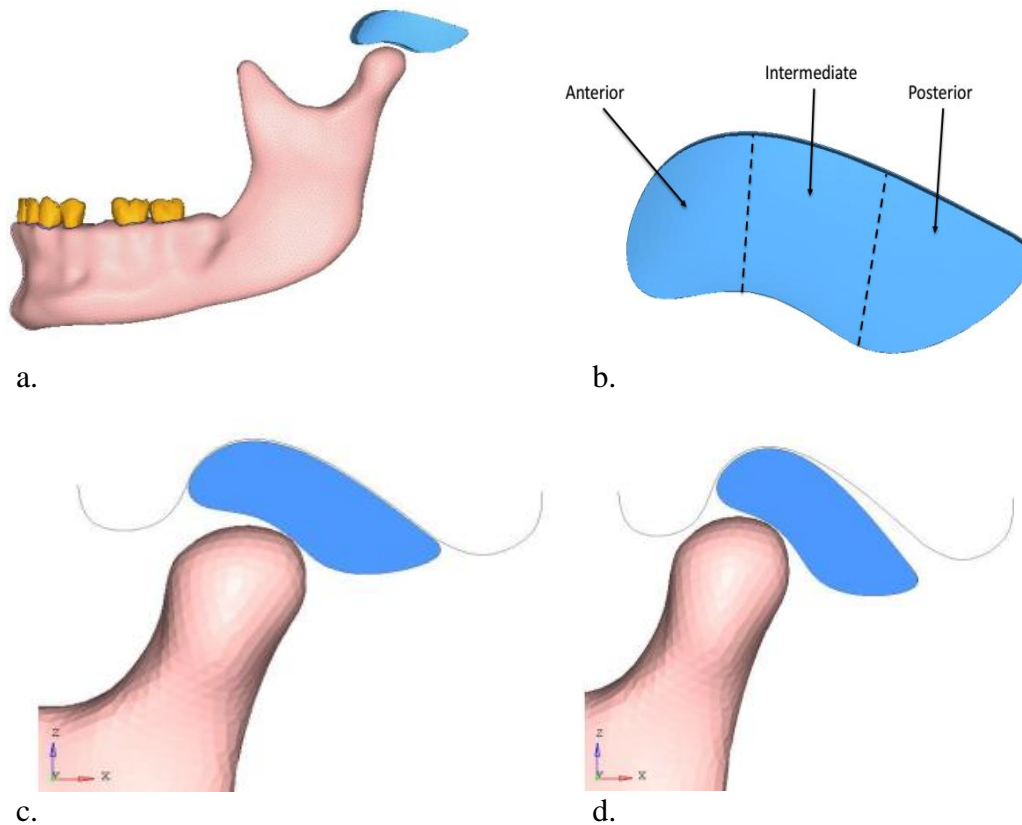


Fig 1 (ORIGINAL FIGURE) - a. Normal mandibular model, b. Zones of Articular zone
 c. Normally positioned disc in TMJ, d. Posteriorly positioned disc in TMJ

CONCLUSION

There is limited knowledge available in the literature about posterior disc displacement of TMJ, thorough understanding and diagnosis of the condition is mandatory to enforce the finest treatment protocol to the patients.

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