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To review the research progress of temporomandibu-lar joint disc displacement in patients with malocclusion

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Abstract: *With the continuous improvement of living standards, people pay more and more attention to facial appearance and oral health. Dentists found that patients with malocclusion had temporomandibular disorders (TMJ), in which disc displacement was the most common. Because it affects the growth and reconstruction of condyle, which affects joint function, facial appearance, growth and development, etc. This article summarizes the etiology, imaging examination, manifestations and related treatment of articular disc displacement, in order to provide clinical guidance for the treatment of Anterior Disc Displacement patients, improve clinicians' understanding of the disease, and reduce the occurrence of Anterior Disc Displacement or relieve the symptoms of Anterior Disc Displacement.*

Keywords: *Anterior Disc Displacement; Malocclusion; Magnetic resonance imaging*

Temporomandibular joint anterior disc displacement (Anterior Disc Displacement, ADD) is a common Temporomandibular disorders (TMD), and the reported prevalence of ADD reaches 18-35% [1] in the asymptomatic population, and the incidence may be higher in the orthodontic population. In addition to the common clinical manifestations such as joint ringing, limited mouth opening, abnormal jaw movement and preear pain, it will further involve the bone and joint disc with the duration of disease, resulting in secondary jaw deformity and malocclusion. At present, MRI, curved tomography panoramic photography X and cone beam computed tomography have been widely used in various fields of stomatology. Through imaging examination supplemented by specialized clinical examination, in order to obtain rich diagnostic information, so as to lay a foundation for the early diagnosis and treatment of ADD. The etiology, auxiliary examination, imaging signs, and treatment of ADD are reviewed.

1. The etiology of the TMJ disc displacement

In the 1970s and 1980s, the displacement of the temporomandibular joint disc was recognized by the development of arthroscopy and arthrography. ADD is generally considered to be the main cause of joint firing, limited mouth opening, abnormal jaw movement and pain in the anterior ear, which can be classified into anterior displacement (Anterior Disc Displacement with Reduction, ADDR) and anterior displacement (Anterior Disc Displacement without Reduction, ADDWR) [2]. Under the normal anatomical position, the posterior band of the articular disc is located at the top of the condyle. After the anterior displacement of the articular disc, the posterior double plate area composed of loose connective tissue is forced to move forward into the joint load area, and a series of bone reconstruction [3] can occur under the stress. The temporomandibular joint disc can show pathological and morphological changes, and some studies have reported that pathological changes in the disc vascularization can occur in the posterior zone of the articular disc, leading to morphological changes in the articular disc, such as articular disc perforation and other [4].Besides,P. Shen [5] et al found that increased serum testosterone level in men and increased serum prolactin level in women promoted the anabolism of the condylar bone, and the rapid condyle growth led to disc-condyle relationship imbalance and disc displacement of the temporomandibular joint.

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2. Imaging of the anterior displacement of the temporomandibular joint disc

2.1 Curved fault panoramic photography X film

As a preliminary examination before CT and MRI, the curved fault film is the most commonly used, simple and cost-effective method for the temporomandibular joint in imaging examination. It not only shows the images of the whole dentition, upper mandible and bilateral temporomandibular joint, but also can judge whether the bilateral condyles are symmetrical and [6]. However, the deficiency of curved tomography is the partial overlap between the top of the condyle and the joint nodules, which affects the early diagnosis of the bone changes in the condyle and its surrounding area.

2.2 CBCT

CBCT [7,8] (Cone beam computer tomography) has the advantages of high spatial resolution, high diagnostic accuracy of bony changes on the condyle and temporal bone surface, low radiation dose and low cost. It can pass through the three-dimensional reconstruction to reflect the bony changes of the temporomandibular joint (flattening, vegetation, erosion, hypoplasia, sclerosis, etc.); However, because the articular disc cartilage is mainly composed of collagen fibers, when the soft tissue lesion of the temporomandibular joint is suspected, the deformation resolution of the displacement of the articular disc is low and the imaging ability is poor.

2.3 Nuclear magnetic resonance imaging (Magnetic resonance imaging, MRI)

MRI is a kind of noninvasive, no radiation damage of multidimensional, multi-angle imaging technology, with high soft tissue resolution, it can not only clearly, comprehensive show the temporomandibular joint structure and accessories, nonbony structure and the relationship between soft tissue, can also diagnose the joint disc before, after, inside, outside and rotational shift, the joint disc before displacement is the most common, diagnostic accuracy of up to 80%~90% [9-11].

3. Imaging findings of anterior displacement of the temporomandibular joint disc

The MRI of the normal joint disc in the closed sagittal position shows double concave shape and normal shape; the Angle between the disc boundary between the double plate zone and the vertical line of the condyle is within 10°; The ADD if the anterior direction of the opening is defined as ADDR; and the ADDWR [12] when the sagittal image disc-condyle relationship is not restored to normal and the joint disc is in front of the condyle. The study found that the widening of the posterior articular disc and the thickening of the articular disc can be seen in the early stage of ADD, with the development of the articular disc; in addition, the displacement of the joint disc stimulates the joint exudincreased, and the MRI of the joint disc morphology and the assessment of ADD lesions [13].

4. Treatment for anterior displacement of the temporomandibular joint disc

ADD is a common oral and maxillofacial surgical disease with high morbidity. With the development of temporomandibular joint disc displacement, not only condylar bone absorption, but also joint disc degenerative changes, which further affects the growth and development of the mandible [3]. It have shown that articular disc deformation is more prevalent in ADDWR compared to ADD patients, including [14] such as articular disc folding and shortening or even perforation. Therefore, without appropriate clinical intervention, the morphological changes of the joint disc will continue to deteriorate, with a great negative impact on the patient's quality of life.

4.1 Conservative treatment

4.1.1 Dental pad treatment

The dental pad is one of the most commonly used non-surgical treatments [15] by adjusting the vertical distance between the upper and lower jaw and changing the position of the condyle in the joint socket. The dental pad improves the three-dimensional spatial relationship between the joint disc and the condyle by changing sensory transmission and reducing pressure within the TMJ joint [16]. Qi Dongyuan [17] et al. found that although the dental pad does not improve the joint function by

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restoring the position of the joint and disc, it can still promote the adaptive reconstruction of the double plate area of the temporomandibular joint, which can significantly reduce pain and improve the mandibular movement function.

4.1.2 Orthodontic treatment

Herbst the appliance and Twin-Block appliance and [18] are the most commonly used functional appliance to promote mandible growth. Hu [19] et al suggested that obtaining a stable occlusal relationship after orthodontic correction helps to maintain a stable joint disc position after treatment, In 85% of ADDWR patients, corrected with a modified Twin-Block appliance, The articular disc morphology was significantly improved. However, the use of this appliance for patients with severe articular disc deformation or perforation still needs to be careful; Zhu Huimin [20] et al showed that adolescent patients with ADD and malocclusion during maxillofacial development were first surgical joint disc reduction and anchored by orthodontic functional correction can effectively promote the growth and development of the mandible. To reduce the development of maxillofacial deformities; Foreign scholars have shown that adolescent patients with ADDR can use the Hebst appliance, Twin-Block appliance and other functional appliances to push the jaw forward, Reposition of the normal disc-condylar relationship. Coordinate the position of the upper and lower mandible to achieve the correct occlusal relationship and promote condylar growth and mandibular development with orthodontic force [21, 22].

4.2 Surgical treatment

In the past few decades, the treatment of anterior displacement, the treatment of conservative therapy [23], which can effectively improve the clinical symptoms of patients, but the disc-condyle relationship cannot return to the normal position. As surgical procedures develop and mature, arthroscopic surgery and temporomandibular joint disc anchorage are widely used in the treatment of ADDWR patients.

4.2.1 Arthroscopic surgery

Arthroscopic surgery is a less invasive and more acceptable endoscopic joint surgery performed under local anesthesia. It is suitable for various cases of intra-joint dislocation where the symptoms are not significantly relieved after conservative treatment. Moses [24] And other studies found that arthroscopic surgery can completely remove the joint cavity and joint fluid, the postoperative pain is significantly reduced, the mouth opening is significantly improved, and the long-term effect is good. Team [25] and other studies showed that arthroscopic reduction of the articular disc can significantly increase the posterior space and upper space, making the condyle move downward, thus conducive to the formation of new bone of the condyle. However, this technique requires high technical level for doctors, certain understanding of anatomical structure and surgical technique; in addition, ADDWR is accompanied by joint disc perforation, severe joint disc distortion, condyle tissue injury, and open surgery is still required after arthroscopy.

4.2.2 Joint disc reduction and anchorage surgery

Articular disc reduction was performed by Professor Annandale, [26]In 1887First proposed. In 2001, the Mehra [27]class Using Mitek anchor, the condyle was implanted for the first time, and the joint disc reduction method was used. After follow-up observation, a good curative effect was achieved. Since 2011, Professor Yang Chi [28] and others have improved the original surgical method by transplanting and filling the free fat flap in the anterior ear in the anterior attachment gap after release, achieving good results after surgery. Wang Yan [29] et al. showed that the joint space significantly increased, reduced the load of the condyle, and promoted the condyle bone regeneration. Zhu Huimin [20] et al. found that the incidence of malocclusion in adolescent unilateral ADDR was 50% higher than that in normal people, and the degree of joint degenerative changes and mandible asymmetry was more serious with the extension of disease time. For patients with irreducibility anterior displacement, avoid using functional appliance, aggravating joint disc anterior displacement and condyle absorption, therefore, the first use temporomandibular joint disc anchorage reduction joint disc, MRI assessment confirmed condyle new bone formation, then wear functional appliance, this method can promote adolescent condyle reconstruction, so as to reduce the degree of malocclusion deformity.

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5. Summary

In conclusion, the preliminary examination of the temporomandibular joint should not be ignored. After specialized examination and imaging examination to obtain a clear diagnosis, each patient was analyzed and evaluated specifically, and reasonable individualized treatment plans and strategies were formulated [30]. In order to prevent adolescents, to prevent the instability of the mouth and jaw system, the morphology and function of the TMJ should be fully considered and given active diagnosis and treatment.

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