

# Effect of abnormal occlusal contact on temporomandibular joint

Xin Xie<sup>1,2</sup>, Zhongcheng Gong<sup>1,2,\*</sup>

<sup>1</sup>Oncological Department of Oral and Maxillofacial Surgery, the First Affiliated Hospital of Xinjiang Medical University, School/Hospital of Stomatology, Xinjiang Medical University, Urumqi, 830054, Xinjiang Uygur Autonomous Region, China

<sup>2</sup>Stomatological Research Institute of Xinjiang Uygur Autonomous Region, Urumqi, 830054, Xinjiang Uygur Autonomous Region, China

\*Corresponding author: 565249755@qq.com

**Abstract:** Occlusion, temporomandibular joint and masticatory muscle are in a functional system, which cooperate and influence each other. When any one of these elements is abnormal, it will affect the function of other elements. The normal occlusal relationship is the convex-concave relationship of apical fossa contact, and the masticatory movement trajectory is teardrop-like, which is helpful to promote the normal mandibular functional movement. The abnormal occlusal contact relationship changes the convex-concave relationship of apical fossa contact into convex relationship, which will form abnormal masticatory movement trajectory, and may even cause abnormal movement and stress of temporomandibular joint and abnormal contractile activity of masticatory muscle. The longer the duration of this abnormal occlusal relationship, the greater the damage to bone and soft tissue. scissors bite, openbite and crossbite are common occlusal abnormalities in clinic, so this article will focus on the effects of these three abnormal occlusal contacts on the temporomandibular joint.

**Keywords:** abnormal occlusal contact; Temporomandibular joint; scissors bite; openbite; crossbite; Masticatory muscles

## 1. Introduction

Temporomandibular joint and its related anatomical structures are considered to be one of the most unique and important components of the masticatory system, and its function is very important for maintaining proper occlusion and stable oral jaw system. There is growing evidence that different occlusal conditions lead to functional adaptation of the neuromuscular system, which is guided by proprioceptive feedback reflexes originating from teeth, and this adaptation leads to changes in structure and position due to the functional load imposed on the TMJ [1]. This adaptation in turn affects the mandibular muscle and results in changes in the structure and position of the TMJ due to the functional load imposed on it. If the bite is not coordinated, the trauma caused by mastication has a greater impact on the joint, which is easy to induce temporomandibular joint disorder. Temporomandibular joint disorder (TMD) is the product of multiple factors [2]. The causes are as follows: occlusal abnormalities and structural abnormalities of temporomandibular joint developmental defects, functional abnormalities based on masticatory muscle dysfunction and nervous tension, comprehensive factors due to occlusal trauma, functional trauma and other traumatic factors and multiple etiological factors [3]. Throughout the reports related to temporomandibular joint disorders, abnormal occlusion has long been regarded as the main cause of temporomandibular joint disorders [4]. The related abnormal occlusion include dentition defect (especially progressive occlusal disorder caused by loss of posterior teeth), malocclusion, abnormal occlusion of the third molar, interference of occlusion and the change of distance between jaws [5-7]. The purpose of this paper is to through scissors bite, openbite and crossbite to review the influence of the temporomandibular joint.

## 2. Scissors bite and temporomandibular joint

Scissors bite is a common malocclusion of posterior teeth, which is caused by abnormal position of permanent teeth, early loss and retention of deciduous molars, etc. It often occurs in the permanent period [8], which is generally divided into posterior scissors bite and reverse scissors bite, which can

occur on both sides. posterior scissors bite refers to the upper posterior tongue tip of the tongue bite on the lower posterior buccal tip of the buccal oblique surface, there is no contact, there are individual scissors bite, most scissors bite, clinical common second molar lock. Xu Yingjie et al. [9] the results showed that the incidence of temporomandibular joint osteoarthritis in posterior scissors bite, especially one or more molars, is high. In the process of posterior scissors bite, the axial arrangement of upper and lower posterior teeth is abnormal. The tongue tip of the upper posterior tooth and the buccal tip of the lower posterior tooth first contact and bear the force, thus establishing a large area contact relationship under the action of attrition. The early contact point will be eliminated, resulting in wear facets and release highs. Early contact scissors bite under force of posterior teeth is too big, abnormal occlusion of masticatory muscle regulation can make the load of muscle function, make to load of the temporomandibular joint, so for a long time or short there were other factors may be different degrees of decompensated symptoms [10].

Some studies have shown that [11] unilateral posterior scissors bite can significantly affect the lateral motion trajectory of the condyle: the trajectory is not smooth and varies greatly, mostly showing zigzag reciprocating movement, and the condylar track is poorly coincident. When the lateral movement returns to ICP, the starting and ending points are not completely consistent. Both qualitative and quantitative analysis showed that compared with the normal subjects, the lateral movement of the condyle was limited and the vertical displacement of the condyle increased during the lateral mandibular movement of the unilateral posterior teeth, which was related to the locking state of the posterior teeth. For the patients with unilateral posterior scissors bite, there is bilateral asymmetry in condylar displacement and inclination during the lateral mandibular movement, indicating that the temporomandibular joint is in a state of incomplete functional balance, which may lead to temporomandibular joint disease. Tomonari H et al. [12] the results showed that there were significant differences in masticatory patterns among the scissors bite side, the no scissors bite side and the normal occlusion. The mandibular movement on the scissors bite side showed poor lateral movement and slower masticatory mode, and the abnormal masticatory mode on the scissors bite side resulted in a decrease in masticatory efficiency. Patients with the same kind of food needed a longer period of chewing to swallow after grinding. Nakanoh et al. [13] have shown that the posterior scissors bite is bilateral asymmetric malocclusion, the occlusal relationship lasts for a long time under pathological conditions, and the lateral movement of the temporomandibular joint is maladjusted, which can lead to changes in the shape and position of the joint, imbalance of bilateral muscle function in the stomatognathic system and other symptoms, and then lead to TMD. Jia Mengying et al. [14] found that there was a correlation between unilateral posterior scissors bite and masticatory muscle electromyography, and concluded that the occlusal contact area and stability of the scissors bite side decreased due to the loss of masticatory force caused by the apical oblique, and the masticatory balance ability of both sides decreased, so the EMG value of the scissors bite side was significantly lower than that of the no scissors bite side during apical malocclusion. Some scholars have also found that patients with lock-up have unilateral masticatory habits, and long-term unilateral mastication will cause great changes and destruction of the masticatory muscles of the oral and maxillofacial system [12].

### 3. Openbite and temporomandibular joint

Open openbite is a common vertical malocclusion in clinic. The causes of this malocclusion are very complex, mainly environmental factors and genetic factors, in which genetic factors play a key role [15,16]. In addition to affecting the appearance of the patient, it will also bring harm to the masticatory, respiratory and articulation functions and the health of the temporomandibular joint. Therefore, it is of great significance to study the effect of orthodontic treatment of temporomandibular joint. Clinically, it is mainly bony and dental. In general, dental opening and mild to moderate bony opening can be solved by orthodontic methods [17].

CHENY et al. [18] observed that the position of the condyle was relatively posterior and had a steeper condylar path during the opening of the condyle. In the subjects with anterior teeth opening, the vertical non-contact of the upper and lower teeth may also affect the movement track of the mandible, so the position of the condyle is relatively backward. To sum up, in the process of oral function, the position of TMJ is affected by various functional and mechanical stresses, which depends on the occlusal characteristics of the subjects. In addition, the sagittal position of the condyle is associated with TMJ dysfunction, as the posterior position of the condyle may exert pressure on the retrodisc tissue and sensory nerves, resulting in TMD [19]. Wu Chunlan et al. [20] results showed that the alveolar bone of patients with openbite is thin and low in height, and the reason for the different morphology of alveolar bone may be related to their low occlusal function. Because of the low occlusal function, the

periodontal tissue is easy to degenerate and lead to the loss of teeth. Correlation analysis shows that there is a significant correlation between the thickness of alveolar bone and the thickness of alveolar bone and the height of alveolar bone. Imamura et al. [21] proposed that the activity characteristics of masticatory muscles are related to the contact area of masticatory muscles. The more extensive the contact area is, the more the contact area of posterior teeth is, the stronger the muscle activity of maxillary muscles is, and the less the total contact area of dentition is, which results in the weakening of masseter myoelectric activity and muscle function.

#### 4. Crossbite and temporomandibular joint

Posterior crossbite is a relatively common occlusal problem, which is called transverse arch difference. The global prevalence of posterior regurgitation in permanent teeth and mixed teeth is about 9.4% and 11.7%, respectively [22]. The prevalence ranges from 7.1% of the population in the United States to 13.1% in Europe. Posterior tooth regurgitation may be caused by the transverse loss of the maxilla relative to the mandible, which may or may not be related to the functional mandibular displacement in order to maintain normal occlusal function. This impaired maxillary-mandibular relationship may have a long-term effect on the growth and development of teeth and their supporting bone bases [23]. Anterior tooth regurgitation affects facial appearance, bone development, oral function, and even affects the physical and mental health of children. It has been reported that there are more patients with reflexive disease in Asia than in Europe [22]. As an occlusal feature of anterior reflexion, the position of the lower incisor is located on the labial side of the upper tooth, which affects the mandibular movement guided by neuromuscular reflex, which may change the position of the condyle for functional adaptation. CHENY et al. [19] found that the position of the condyle was mainly anterior and central in the anterior regurgitation. It is known that bone tissue has stronger remodeling force than dental tissue, and the temporomandibular joint area is composed of hard tissue condyle, articular fossa and soft tissue articular disc. Therefore, during occlusal movement, the force is transferred from muscle contraction and traction to condyle-articular disc-articular fossa, and these tissues are constantly reconstructed to adapt to the change of occlusal force. Therefore, with the growth and development, the shape of the condyle and the relationship between the condyle and the fossa will also have some changes in the continuous functional remodeling [13,24]. Yu Jianhan et al. [25] showed that the position of bilateral temporomandibular joint was asymmetric, the adaptive remodeling of temporomandibular joint fossa and the shape of mandible were also asymmetrical in adults with unilateral posterior crossbite. Some scholars [26,27] found that in the study of the craniofacial structural characteristics of patients with unilateral posterior crossbite, mandibular displacement occurred during the mixed dentition period due to the interference of bite, but the bone structure did not show obvious deformation. In the permanent dentition period, there was a bone structure asymmetry in the mandibular morphology, that is, the length of the mandibular ascending branch and the comprehensive length of the mandible on the contralateral crossbite were smaller than those on the non-contralateral crossbite, and the degree of this bone asymmetry gradually increased with age. Some studies have also found that there is significant asymmetry in the EMG values of the masticatory muscles on both sides of the patients with unilateral posterior crossbite. Asymmetrical contraction of the masticatory muscles on both sides can cause asymmetry in the development of the mandible, resulting in skeletal mandibular deviation. Asymmetrical contraction of bilateral masticatory muscles causes differences in the load exerted by the masticatory muscles on the temporomandibular joint, and the position of the condyle changes accordingly. If the functional state of bilateral muscles and the load of the temporomandibular joint do not coordinate to a certain level and continue for a period of time, exceeding the compensatory capacity of muscles and joints, it will cause changes in the structure and function of the temporomandibular joint, which is likely to cause temporomandibular joint disorder [28].

#### 5. Conclusion

To sum up, abnormal occlusal contact is an independent pathogenic factor of temporomandibular joint degeneration and can cause TMD. There are a variety of causes of abnormal occlusion, of which the most common are environmental factors and genetic factors, environmental factors are mainly bad oral habits, and genetic factors are the main factors. The long-term existence of abnormal occlusion leads to the imbalance of bilateral occlusal force, which will lead to mandibular movement dysfunction, differences in bilateral condyle morphology, and eventually lead to temporomandibular joint remodeling; cause masticatory dysfunction, facial asymmetry and even affect mental health. Therefore, early treatment of abnormal occlusion and restoration of normal apical fossa contact relationship will

effectively correct the vertical and lateral dissonance of the patients, improve the oral and maxillofacial function and facial appearance, reduce the treatment pressure during the permanent dentition period, and effectively reduce the incidence of joint symptoms. it is of positive significance to promote the development of stomatognathic system.

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