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Kun-Feng Lee
epartment of Orthodontics, Dental Clinics, Kaohsiung Medical University Hospital, Kaohsiung Taiwan

Yu-Chuan Tseng
Department of Orthodontics, Dental Clinics, Kaohsiung Medical University Hospital, Kaohsiung Taiwan; School of Dentistry and Graduate Program of Dental Science, College of Dental Medicine, Kaohsiung Medical University, Kaohsiung Taiwan

Hong-Po Chang
School of Dentistry and Graduate Program of Dental Science, College of Dental Medicine, Kaohsiung Medical University, Kaohsiung Taiwan; Department of Dentistry, Kaohsiung Municipal Hsiao-Kang Hospital, Kaohsiung, Taiwan

Szu-Ting Chou
Department of Orthodontics, Dental Clinics, Kaohsiung Medical University Hospital, Kaohsiung Taiwan; School of Dentistry and Graduate Program of Dental Science, College of Dental Medicine, Kaohsiung Medical University, Kaohsiung Taiwan

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Abstract

Class II division 2 malocclusion has low incidence rate of only 1% in Taiwan. The criteria of diagnosis and treatment consideration is more challenging as compared to other types of malocclusions. The consideration of orthodontic biomechanics could be sophisticated in facing the correction of the molar relationship and the angulation of the anterior teeth. This article discusses the clinical diagnosis and treatment mechanics of Class II division 2 malocclusion.

Keywords

Class II division 2 malocclusion; deep overbite.

Review Article

Orthodontic Correction of Class II Division 2 Malocclusion

Kun-Feng Lee,[1] Yu-Chuan Tseng,[1,2] Hong-Po Chang,[2,3] Szu-Ting Chou[1,2]

[1]Department of Orthodontics, Dental Clinics, Kaohsiung Medical University Hospital, Kaohsiung Taiwan

[2]School of Dentistry and Graduate Program of Dental Science, College of Dental Medicine, Kaohsiung Medical University, Kaohsiung Taiwan

[3]Department of Dentistry, Kaohsiung Municipal Hsiao-Kang Hospital, Kaohsiung, Taiwan

Class II division 2 malocclusion has low incidence rate of only 1% in Taiwan. The criteria of diagnosis and treatment consideration is more challenging as compared to other types of malocclusions. The consideration of orthodontic biomechanics could be sophisticated in facing the correction of the molar relationship and the angulation of the anterior teeth. This article discusses the clinical diagnosis and treatment mechanics of Class II division 2 malocclusion. ***(Taiwanese Journal of Orthodontics. 30(3): 142-147, 2018)***

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INTRODUCTION

In 1899, Angle[1] defined Class II division 2 malocclusion as the presence of a Class II molar relationship and retroclined maxillary central incisors. The maxillary lateral incisors may be either proclined or normally inclined. Years later, van der Linden[2] further classified the Class II division 2 malocclusion into the following three types: Type A, in which the maxillary central and lateral incisors are retroclined but the retroclination is not severe; Type B, in which maxillary lateral incisors overlap with the retroclined maxillary central incisors; and Type C, in which the maxillary central and lateral incisors are retroclined and overlap with the maxillary canines. The reported incidence rates of Class II division 2 malocclusion ranged from 5% to 12% in Europe, 3% to 4% in the United States, and 1% in Taiwan (Perng and Lin).[3] Although it was presented in a relatively small population, orthodontists should be aware of that when encountering Class II division 2 malocclusion, the Class II molar relationship is not the only treatment problem to be solved. Hitchcock[4] (1976) concluded that, although Class II division 2 malocclusion is not stereotypical, it did represent as a specific syndrome. In literatures, the authors have reported that radiographic measurements significantly differed among patients with Class II division 2 malocclusion, patients with Class II division 1 malocclusion, and a control group of patients with normal occlusion.

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Reprints and correspondence to: Dr. Szu-Ting Chou, 100 Shih-Chuan 1st Road, Kaohsiung 80708, Taiwan

Tel: +886-7-3121101 ext 7049 Fax: +886-7-3221510 Email: cherubiz@yahoo.com.tw

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CLINICAL FEATURES

Most Class II division 2 malocclusions result from a skeletal Class II jaw relationship; however, some authors suggested that many of these cases present a skeletal Class I jaw relationship. Patients usually present with a hypodivergent facial pattern, which may accompany with an anterior rotation of the mandible, an overdevelopment of the inter-incisor bone, or an under-development of the maxillary posterior alveolar process. Karlsen[5] reported that the cephalograms of Class II division 2 malocclusion indicated the vertical discrepancy between maxillary incisal and molar heights. Patients with Class II division 2 malocclusion usually exhibit upright incisors, relatively small tooth size, discrepancies in the arch and tooth size, increased Collum angle of maxillary incisors, and thin incisors with small tubercles. Soft tissues or muscle activities are believed to have a strong association with Class II division 2 malocclusion (Table 1).

ETIOLOGY

Although the etiology of Class II division 2 malocclusion remains unclear, many theories have been proposed. Some authors suggested that this type of malocclusion results from a lack of mandibular development or distal positioning of the mandible in relation to the cranial base. Others believed that the main cause is dentoalveolar rather than skeletal origin. Other studies have compared the measurements in lateral cephalometric radiographs to differentiate between Class II division 2, Class II division 1, and normal occlusion. In Pancherz et al.,[6] a cephalometric radiographic study in children revealed that dentoskeletal morphology did not significantly differ between Class II division 2 malocclusions and Class II division 1 malocclusions. One notable exception was the position of the maxillary incisor. In a comparison of patients with Class II division 2 malocclusion and patients with ideal occlusion, Karlsen[5]

Table 1. *Features of Class II division 2 on each aspects.*

Skeletal	Skeletal Class II jaw relation More often a skeletal Class I relation
Dental	Severe deep bite, “Cover-bite” Retroclination of upper incisors & lower incisors Labially flared maxillary lateral incisors Increase in interincisal angle Deep curve of Spee
Soft Tissue	Profile Brachycephalic head shape Deep mentolabial fold Intra-oral finding Gingival line malaligned Impinged bite over lower anterior gingiva

concluded that the Class II division 2 group had an abnormally short distance between gonion and B-point combined with retroclination of the symphysis. This resulted in a B-point in a retruded position in relation to the A-point, cranial base, and pogonion. In addition, maxillary incisal height and molar height significantly differed between the patients with Class II division 2 malocclusion than those with ideal occlusion. Some clinicians had suggested that the lips act as a local genetic factor in Class II division 2 malocclusion and that maxillary incisor retroclination results from excessive non-physiological pressure between the lip and teeth. Fletcher[7] found that the lower lip guided the maxillary incisors into a retroclined position if the maxillary incisors were not obstructed by the digits, tongue or the other teeth in either arch. In the study of Lapatki et al.[8], the activity shown in perioral electromyography indicated that the local epigenetic factors had an important role in the development of imbalanced vertical relationship between the lips and the maxillary anterior dentoalveolar structures.

ORTHODONTIC CORRECTION

Heide[9] inferred that occlusal interference is a possible etiology of Class II division 2 malocclusion. He suggested that the treatment should begin with correcting the centric relation position of the patients. This can accomplish by instruct the patients to open the mouth widely for an extended period of time and then slowly close the mouth until the first premature dental contact is detected. Some cases of Class I molar relation may not have a true Class II division 2 malocclusion. If the posterior bite reveals a cusp-to-cusp relationship, the standard procedure for correcting a typical Class II division 1 malocclusion can be performed. However, if the posterior bite reveals a full Class II relationship, and if a Class I molar relationship could not be expected after using the inter-maxillary elastics for a period of time, extraction of the maxillary bicuspids can be considered. Extraction in the mandibular arch is not suggested because correction of overbite has a high risk of relapse. Heide[9] has also suggested that satisfactory results may be obtained by interdental stripping and tooth contouring, i.e., grinding of the erratic incisal edges and contact areas. Uribe and Nanda[10] recommended that the treatment objectives should include the chief complaint of the patient and that the mechanics of correction should be individualized for each patient and based on specific treatment goals. Orthodontists generally have difficulty to decide whether the maxillary bicuspids should be extracted. Although tooth extraction may help to relieve anterior crowding, which is common in Class II division 2 malocclusion, it may also complicate the correction of anterior teeth retroclination during space closure of the tooth extraction. On the other hand, non-extraction therapy for correcting the Class II molar relationship, protusive lip profile and the created overjet after crowding relief. The treatment goal and the range of tooth movement in different mechanics of treatment should be clearly evaluted before treatment.

Preformed CIA nickel titanium intrusion wires are used in Class II division 2 malocclusion. A short wire is used in cases requiring extraction, and a long wire is used in non-extraction cases. These wires can deliver a force of 35-40 gm in patients with an average arch length and a full complement of teeth. An intrusion arch produces a labial tipping movement and intrusive forces while applying extrusive force on the molars. To achieve an ideal angulation in the anterior teeth, the intrusion arch wire should not be cinched back in distal end of the molar tubes initially. Thus, the incisors can be flared prior to their intrusion. The wire then could be cinched 2-3 mm distal to the molar tubes for intrusion as well as flaring of the incisors. The intrusion arch wire should first be ligated to the anterior segment between the two central incisors. This enables attachment of the wire at the most anterior point is related to the center of resistance of the incisors. Once the incisor root inclinations have been corrected,

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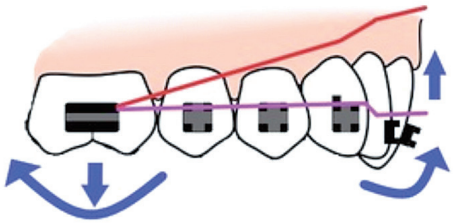

Figure 1. *Intrusive arch could perform a extrusive force on molars and intrusive force on incisors that would help improve deep overbite in Class II division 2 malocclusion. The effect of intrusion also provides the labial crown torque on the upper anterior teeth.*

the intrusion arch wire can be ligated to the anterior segment at two lateral incisors and between the central incisors. During insertion, the wire should be bent 3-5 mm mesial to the first molar auxiliary tube (Figure 1). Since one of the treatment goals is to correct deep overbite in Class II division 2 malocclusion, vertical control could be important in some of the cases. Even though molar extrusion could help for overbite reduction, large amount of molar extrusion would result in mandible clockwise rotation, increase lower facial height and make chin backward in position. In these cases, anchorage should be well designed and prepared. TADs and other devices could provide anchorage in these cases to prevent further mandible clockwise rotation.

Some authors have demonstrated combined orthodontic and surgical methods to correct Class II division 2 malocclusion in adults. Stoelinga and Leenen[11] and Arvystas[12] had presented orthodontic treatments that included maxillary anterior subapical osteotomy and/or sagittal split ramus osteotomies. Anterior subapical osteotomy may help to improve deep bite and correct anterior teeth inclination. Sagittal split ramus osteotomy could provide forward mandibular movement to correct the sagittal dental or jaw bone relation.

Another widely discussed issue is whether extraction of tooth is required. Different patterns of extraction therapy have been suggested, including extraction of the first four premolars, extraction of maxillary first premolars and mandibular second premolars, extraction of maxillary second molars for maxillary arch distalization, extraction of maxillary premolars with mandibular incisors, or even extraction of a single mandibular incisor. In Class II division 2 cases, considerations such as crowding, molar relationships, overbite depth, retroclination of maxillary incisors, and hypodivergent facial pattern contribute to the dilemma of whether and at which sites extraction therapy should be performed. In Litt and Nielson,[13] comparisons of identical twins revealed that, if one of the twins had undergone extraction of four premolars, the twin that had undergone extraction may have more mandibular forward growth rotation and more vertical molar extrusion as compared to the other twin. In adults, Tsou et al.[14] suggested that an initial non-extraction treatment plan could be revised to extraction therapy after reevlalute the lip profile when anterior tooth inclination is corrected. Therefore, constant evaluation of changes in the features on the patients is necessary; the only disadvantage is prolonged treatment duration.

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Class II division 2 malocclusion is characterized with retroclined incisors and deep overbite, some authors believed Class II division 2 malocclusion and deep incisal overbite would resulting in disk displacement and caused posterior condylar positioning. Pullinger[15] found the association between nonconcentric condyle-fossa relationships and abnormal temporomandibular joint function. Stamm[16] has found the measurement approximately 7° higher angle of the condylar path inclination (CPI) in asymptomatic Class II division 2 malocclusion cases with Computer-Aided Axiography. The Class II division 2 malocclusion group rotated to a significantly higher angle in protrusive and mediotrusive movements and showed longer condylar path lengths than the control group. Anders[17] also found increased mobility in mandibular protrusion and a somewhat steeper condylar path in young patients and concluded that the results collaborate the concept of functional TMJ adaptation to incisor inclination and speak for early uprighting of maxillary incisors.

RETENTION

Class II ddivisioni 2 malocclusion is considered to be difficult to treat and is prone to relapse. A meta-analysis of 322 studies by Millett et al[18] found that highly biased prospective and retrospective evidence apparently favored non-extraction treatment and indicate that overbite correction is reasonably stable in the short term. In growing patients, a bite-raising appliance was suggested to maintain the maxillary incisor inclination and to induce anterior mandibular growth rotation. Comparisons of various retainers indicated no effect on maxillary incisor stability at a mean of 3.5 years post treatment. However, Uribe and Nanda[10] recommended a lower bonded 3-3 retainer to ensure a stable intrusive movement. Minor overbite relapse should be expected since the correction involves some amount of posterior buccal extrusion. Therefore, some over-correction is required to achieve good long-term results in Class II division 2 cases.

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