Class II, Division 2 Subdivision Malocclusion: Diagnosis, Treatment and Retention

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T he patient presented as a healthy almost 13-year-old female of mixed Tunisian & German heritage with a history of no significant medical problems. Her oral hygiene was good and her dental health excellent. Her chief concerns were for the irregularity of the maxillary incisors and the deep bite.

Diagnostic summary

Extraoral evaluation revealed a well-balanced face with competent lips, prominent nose and chin, and slightly increased mento-labial fold. The lips were nicely curved and well-related to each other (Fig. 1.B). A slight gingival display was evident on the maxillary right central incisor on full smile (Fig. 1.C) due to uneven gingival margins on the central incisors (Fig. 1.G) with upper midline coinciding with the facial midline (Fig. 1.A).

Model analysis showed almost full Class II molar and canine relationships on the right side (Fig. 1.E) and almost perfect Class I relationships on the left side (Fig. 1.G), with the lower midline deviated 2.0 mm to the right of the upper midline (Fig. 1.L). The overbite was 8.0 mm without signs of palatal impingement, while overjet was only 3.0 mm due to the retroclined maxillary central incisors (Fig. 1.E&G). No space deficiency was observed in either arch (Fig. 1.H&I).

Cephalometric evaluation indicated a slightly increased ANB angle, a low mandibular plane angle, retroclined maxillary incisors (relative to SN), and retracted (relative to the A-P line) but normally inclined (relative to MP) mandibular incisors and increased interincisal angle (Fig. 1.D).

Radiographic examination revealed normal morphology without signs of pathology and presence of all 3rd molar buds (Fig. 1.F).

Occlusal classification

Edward H. Angle played a major role in developing a concept of occlusion in the natural dentition. He postulated that the mesio-buccal cusps of the maxillary molars should occlude in the bucal groove of the mandibular molars. Given that molar relationship, and that the teeth in each arch are arranged on a smoothly curving line – defined by Angle as the "line of occlusion" – the occlusion would be normal. That brilliant simplification made more than a 100 years ago has been proven correct, provided no aberrations in size and shape of the teeth, and his definitions of Class I, II and III malocclusions established the basis for orthodontic terminology. He further delineated his classifications by dividing them into divisions (according to maxillary incisor inclination) and subdivisions (according to specific types of asymmetric molar relationship). I have since the turn of the 20th century been customary for orthodontists to follow Angle's teaching when classifying malocclusions. He states on page 40 of his original publication that "In the subdivision of the First Division one of the lateral halves only is in distal occlusion, the relation of the other half of the lower arch being normal". Although he clearly states that a subdivision is the occurrence of a unilateral malocclusion, with one normal and one abnormal side, he neglects to specify whether the subdivision is the normal or the abnormal side. Despite this, 34 surveys returned from a total of 54 submitted to orthodontic department chairs in the US showed that 22 taught their residents that subdivisions refer to the Class II side while eight taught that it refers to the Class I side, and that three taught neither meaning.2 One chair responded that despite supporting the Class II side definition, several faculty members in the department disagreed.2 Before the controversy is resolved, Angle's original definition should be followed, classifying the present malocclusion as Angle Class II, Division 2 subdivision.I not as Class II, Division 2 subdivision right, and not as Class II, Division 2 subdivision left.

Treatment objectives

Our objectives were to level and align the dental arches, to establish bilateral Class I canine relationships with ideal intercuspation and normal overjet and overbite, and to place the dentition in positions conducive to optimal esthetics and minimal need for long-term retention.

Treatment alternatives

In Class I and Class II malocclusions the extraction decision is typically based on the mandibular dentition, and made according to a combined evaluation of arch length deficiency and incisor position. One reason is that the option of perimeter gain through distal molar movement is very limited in the mandible. Another is that lateral expansion in the absence of transverse discrepancies is likely to represent a significant relapse liability, as clearly demonstrated already in 1944 by Tweed when conducting a follow-up examination of non-extraction patients treated according to the expansion philosophy of the time.3 The relatively recent introduction of self-ligating brackets, incorrectly referred to by some as friction free despite the fact that they generate the same friction as any conventional bracket,4 combined with super-elastic arch wires with broad arch forms, has had the unfortunate effect of revitalizing the un-biologic concept of bimaxillary expansion for correction of arch length deficiency.

Subdivision cases with midline discrepancy expressed as a deviation of the mandibular molar relative to the facial midline is typically treated with extraction of one mandibular premolar on the Class I side, allowing molar midline correction concomitant with canine retraction to a Class II relationship. Extraction of two maxillary premolars will allow finishing to bilateral Class I canine relationships with coinciding facial and dental midlines.

In this patient the relative mandibular discrepancy was considerably smaller (Fig. 1.I) than the molar and canine asymmetry (Fig. 1.E&G) due to the expression of the 1.I) than the molar and canine asymmetry. One reason is that the option of perimeter gain through distal molar movement is very limited in the mandible. Another is that lateral expansion in the absence of transverse discrepancies is likely to represent a significant relapse liability, as clearly demonstrated already in 1944 by Tweed when conducting a follow-up examination of non-extraction patients treated according to the expansion philosophy of the time.3 The relatively recent introduction of self-ligating brackets, incorrectly referred to by some as friction free despite the fact that they generate the same friction as any conventional bracket,4 combined with super-elastic arch wires with broad arch forms, has had the unfortunate effect of revitalizing the un-biologic concept of bimaxillary expansion for correction of arch length deficiency.

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Excellent occlusal results were established with coinciding midlines, perfect intercuspation, slightly overcorrected overbite, and even gingival margins on the central incisors (Fig. 3E-G). Only a slight increase in intercanine distance was observed, while the interproximal distance remained unchanged.

Retention
Follow-up evaluations demonstrate that the average orthodontic patient demonstrates relapse of alignment in the mandibular anterior segment long-term post-retention, with extreme responses ranging from 0 to almost 10 mm, regardless of initial irregularity and extraction approach, and despite excellent occlusal results with aims at avoiding undue expansion.7 About 50% of this variation can be explained by post-retention reduction in the intercanine distance.7 A proven approach to maintain the mandibular incisor alignment is to adapt a thick wire of size about 0.032" passively to the lingual surfaces of the mandibular anterior teeth, and to bond it only to the canines.9 Follow-up examinations demonstrate no risk of caries and periodontal disease associated with such retainers, despite a tendency for calculus build-up along the wire, and hardly any risk of distortion of the bonded segment. Another commonly used approach is to bond a flexible spiral wire of size about 0.019" to all six mandibular anterior teeth.9,10 However, although the reason is not fully understood, distortion of the bonded segment may be uncommon following long-term use of such retainers.10 In addition, individual bond failures may go unnoticed. Malalignment of the mandibular posterior teeth is rarely observed provided the pretreatment arch form is maintained. For this reason, the need for mandibular retention was limited to the anterior segment in this patient, and the strategy selected was to bond a thick spiral wire only to the canines (Fig. 4J).

Long-term follow-up examinations have demonstrated that the intercuspation is maintained in the average orthodontic patient following successful Class II correction.11 However, maintenance of overbite correction has been shown to represent a challenge.12 It may be speculated that the key to stability of deep bite correction is establishment of perfect Class I canine relationships, an acceptable interincisal angle, and maintenance of incisor contact through long-term use of a bonded canine-to-canine retainer in the mandible (Fig. 5). For those reasons, particular retention strategies in the maxilla, such as use of an anterior bite plate, were not advised for the present patient. Instead, a routine retention strategy with a vacuum formed retainer for full time wear the first six months and a gradual reduction in wear during the following year and a half was elected.

Conclusions
Adolescent patients with Angle Class II, division 2 subdivision malocclusions associated with minimal arch length deficiency in the mandible can be treated successfully with a non-extraction approach using a unilateral cervical headgear followed by multi-bonded fixed appliances. The class II correction is likely to be stable provided an ideal intercuspation is established, and maintenance of a fixed mandibular canine-to-canine retainer made of thick spiral wire bonded only to the canines is likely to maintain the intercanine distance and the mandibular incisor position and indirectly prevent relapse of the deep bite. This retainer can be worn for a long period of time without risk of iatrogenic effects.

References

Figure legends
Fig. 1: Pretreatment records demonstrating Class II, division 2 subdivision malocclusion associated with slightly increased ANB angle, a low mandibular plane angle, retroclined maxillary incisors, and retruded but normally inclined mandibular incisors (D).
Fig. 2: Intraoral initial and progress photos demonstrating effect of unilateral HG for Class II correction (A,C). Use of anterior bite plate during initial leveling of deep bite (E,F), and use of full size rectangular wires following successful leveling (G,H).
Fig. 3: Intraoral initial and progress photos in occlusal view demonstrating design of anterior bite plate used during initial leveling (C), and bonding of mandibular second molars (F).
Fig. 4: Posttreatment records demonstrating excellent occlusal results with perfect intercuspation (E-G), slightly overcorrected overbite (I), well-squared facial proportions (A-D), ideal incisor positions and inclinations with appropriate interincisal angle (H), and adequate root parallelism (R).
Fig. 5: Lateral cephalograms and study models in lateral and occlusal view made before (A,E,I) and after (B,F,J) treatment as well as at six months (C,G), five years (D,H,K) follow-up of patient with stable correction of severe Class II subdivision malocclusion relationships, probably due to excellent, slightly overcorrected occlusal results at end of active treatment and use of fixed, mandibular canine-to-canine retainer to facilitate maintenance of mandibular incisor expansion and position.
Note spontaneous alignment of blocked out maxillary second molars after maxillary first molar distalization during active treatment.