



Management of Class II Malocclusion with Extraction of the Maxillary First Premolars

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Abstract

Orthodontic treatment of Class II division 1 malocclusion represents a clinical challenge due to its esthetic and functional implications, as well as the potential risk of relapse. This case report describes the orthodontic management of a 12-year-old patient presenting with a Class II division 1 malocclusion characterized by maxillary incisor protrusion and increased overjet. The treatment plan was based on Class II mechanics combined with the extraction of the maxillary first premolars, aiming to correct the sagittal discrepancy, achieve proper dental alignment, and improve smile esthetics. Management involving extraction of two premolars required careful control of anchorage and sagittal mechanics as well as specific occlusal features. This approach allowed effective anterior retraction and resulted in a stable therapeutic Class II relationship, compatible with a balanced and durable occlusal function.

Subject Areas

Dentistry

Keywords

Class II Division 1, Maxillary First Premolars, Orthodontic, Treatment, Therapeutic Class II

1. Introduction

Class II malocclusion is defined by the distal positioning of the mandibular first molar relative to the maxillary first molar. In the Class II division 1 subtype, the maxillary incisors typically present with marked proclination, contributing to an excessive overjet and frequently a deep overbite [1].

This malocclusion reflects not only an anteroposterior dental discrepancy but may also be associated with underlying skeletal disharmony, often resulting in a retrognathic profile. The combination of increased overjet, deep bite, and altered soft tissue balance is frequently accompanied by abnormal functional patterns of the perioral musculature and tongue. Moreover, the associated unfavorable facial aesthetics can have significant psychosocial repercussions [2].

The etiology of Class II division 1 malocclusion is multifactorial, encompassing genetic, environmental, and functional components. Evolutionary modifications in craniofacial growth patterns, dietary and lifestyle habits, as well as ethnic variability, have all been implicated in its development [3]. Consequently, orthodontic treatment planning must be individualized and based on a thorough assessment of skeletal, dental, and soft tissue characteristics, in addition to the patient's age, growth potential, and family history [4].

Various therapeutic modalities have been described for the management of Class II division 1 malocclusions, including growth modification with functional appliances, extraoral traction with headgear, extraction-based protocols, and combined orthodontic-surgical approaches [5].

The aim of this article is to describe, through a clinical case, the specific therapeutic considerations in the management of a Class II malocclusion treated by single-arch extraction of the maxillary first premolars (14 and 24).

2. Case Description

2.1. Diagnosis and Etiology

A 12 years old male patient presented to the dentofacial orthopedics department of the Ibn Rochd university hospital in Casablanca for an aesthetic complaint related to the upper incisors projection causing problems with school integration. No medical or family histories were reported. He had a symmetrical oval face, a convex profile with an increased nasolabial angle, labial inoclusion at rest and an increased lower facial height. Smile analysis showed an unaesthetic smile with the presence of buccal corridors (**Figure 1(A)**).

Intraorally, the hygiene was adequate. The maxillary and mandibular dental midlines did not coincide with the mandibular midline deviated to the right side. He had an important overjet (10 mm). Moreover, he presented proclined maxillary central incisors, a linguo-version of the maxillary lateral incisors. He had a class II canine and molar relationships on both left side and right side. The mandibular arch presented a moderate crowding (**Figure 1(B)**).

The initial panoramic radiograph revealed the absence of morphological changes in the condyles, a complete dentition, and maxillary anterior dental crowding (**Figure 2(a)**).

The lateral cephalogram showed compressed upper airway, increased anterior overjet and maxillary incisors protrusion (**Figure 2(b)**). The cephalometric analysis indicated that the maxilla and the mandible were in a retrusive position relative to the cranial base (SNA = 76°; SNB = 71°). The patient presented a skeletal Class II

hyperdivergent pattern (ANB = 5°, GoGn/SN = 39°, FMA = 33°) (Table 1).

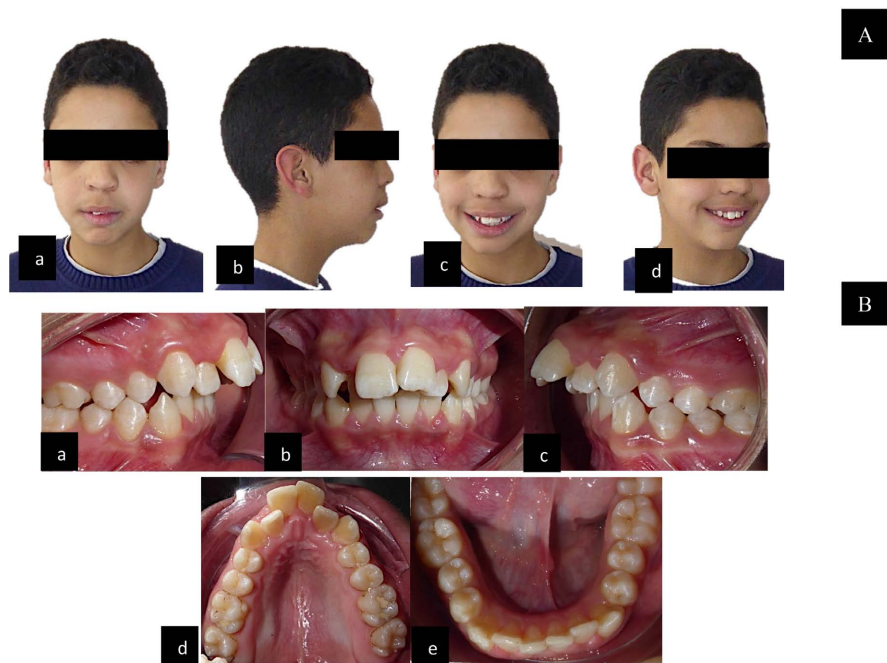


Figure 1. (A) Pretreatment extraoral photographs. (a) Frontal at rest; (b) Profile; (c) Frontal smiling; (d) Lateral smiling. (B) Pretreatment intraoral photographs. (a) Right lateral; (b) Frontal; (c) Left lateral; (d) Maxillary occlusal; (e) Mandibular occlusal.



Figure 2. Pretreatment radiographs. (a) Panoramic radiograph; (b) Lateral cephalogram.

Table 1. Cephalometric analyses before and after treatment.

Cephalometry	Norme	Pre TRT	Post TRT
SNA	82°	76°	76°
SNB	80°	71°	72°
ANB	2°	5°	4°
SND	76°	69°	70°
I/NA	22°	34°	22°
I/NA mm	4 mm	8 mm	4 mm
i/NB	25°	26°	29°

Continued

i/NB mm	4 mm	4 mm	6 mm
I/i	131°	114°	129°
Pog/NB	-	2 mm	1 mm
Occ/SN	14°	12°	16°
GoGn/SN	32°	39°	41°
FMA	25° ± 3	31°	33°
FMIA	67° ± 3	56°	51°
IMPA	88° ± 3	93°	96°
SNA	82°	76°	76°
SNB	80°	71°	72°
ANB	2° ± 2	5°	4°
AoBo	-2 mm ± 2	+6 mm	+2 mm
Occl to PF	10°	11°	11°
Angle Z	75° ± 5	60°	65°
Upper Lip	-	10 mm	8 mm
Total Chin	-	8 mm	9 mm
Ht faciale post	45 mm	49 mm	45 mm
Ht faciale ant	65 mm	74 mm	72 mm
Index Post/ant	0.69	0.66	0.62

Concerning the dental diagnosis, the patient had an important overjet (10 mm), proclined maxillary incisors (I/NA = 34°, I/NA = 8 mm), normal position of mandibular incisors (i/NB = 26°, i/NB = 4 mm) and class II canine and molar relationships on both the left and right sides.

2.2. Treatment Objectives

The treatment objectives were to improve the facial aesthetics, correct the maxillary dental protrusion and crowding, reduce the overjet and correct occlusal relationships.

The treatment also aimed to address functional problems by ensuring airway clearance (referral to an ENT specialist) and improving respiratory and lip functions.

2.3. Treatment Alternatives

The therapeutic options for this case were as follows:

- **Ortho-surgical treatment** for sagittal and vertical correction through bimaxillary advancement and genioplasty.

- **Orthodontic treatment** with extraction of either 14, 24 or both 14, 24 and 35, 45.

Although the patient was in an active growth phase, the decision to extract the maxillary first premolars (14 and 24) was motivated by the presence of significant maxillary incisor protrusion and excessive overjet associated with a skeletal hyperdivergent pattern. Extractions were not indicated in the mandibular arch, as the crowding was moderate and the incisor inclination was acceptable.

This approach would allow effective retraction of the maxillary anterior teeth and improvement of the facial profile while preserving the integrity of the mandibular dentition and avoiding unnecessary extractions.

2.4. Treatment Progress

Treatment was initiated with 0.022" × 0.028" edgewise appliance. After extraction of 14 and 24, the alignment and leveling were accomplished with sequential nickel-titanium archwires (014", 016", 016 × 022" and 017 × 025"). We progressively took the 12 after having opened its space by means of an open spring. The extraction spaces of teeth 14 and 24 closed progressively during the alignment and leveling phase.

The mandibular arch presented moderate crowding associated with a deviation of the mandibular midline to the right. Alignment was achieved progressively during the leveling phase using sequential nickel-titanium archwires, which allowed resolution of the crowding while preserving the mandibular arch form and arch perimeter (**Figure 3**).



Figure 3. Maxillary and mandibular alignment and closing of extraction spaces.

Correction of the dentition was carried out using Class II mechanics supported by rigid stainless-steel archwires. A protocol of intermaxillary elastics was used to correct the Class II relationship. The elastics were attached to an omega loop positioned between the maxillary lateral incisor and canine, then extended downward to the mandibular first premolar, and finally upward to the maxillary first molar. This configuration allowed the elastics to exert a vertical effect in addition to the Class II mechanics (**Figure 4**).

The finishing phase involved introducing first- and second-order adjustments on stainless steel archwires.

The decision to extract two upper premolars resulted in the achievement of a Class I canine occlusion and a Class II molar relationship, referred to as "therapeutic Class II" (**Figure 3**). This outcome required precise occlusal adjustments to prevent interferences on the non-working side during lateral excursions. To ad-

dress this, third-order buccal root torque was applied to the maxillary first molar in order to reduce the prominence of the mesio-palatal cusp. The maxillary first molar was positioned perpendicular to the occlusal plane to improve buccal intercuspatation (**Figure 5**).



Figure 4. Use of class II elastics to set up the occlusion.



Figure 5. Set of photographs showing finishing stage.

3. Treatment Results

After 24 months of active treatment, all brackets were removed, and fixed retainers were bonded to both the maxillary and mandibular anterior segments to maintain long-term stability. At the completion of treatment, the main therapeutic objectives were achieved. Noticeable improvements were observed in the soft tissue profile, with a reduction in facial convexity and improved lip competence. The retraction of the maxillary incisors resulted in a more harmonious facial profile and improved smile esthetics (**Figure 6(A)**). The excessive overjet was reduced from 10 mm to approximately 2 - 3 mm, allowing the establishment of proper incisal guidance and improved anterior function. A Class I canine relationship was obtained bilaterally through the extraction of the maxillary first premolars and controlled retraction of the maxillary anterior teeth, while a therapeutic Class II molar relationship was established (**Figure 6(B)**). Overall, the treatment produced both functional and esthetic improvements, with well-coordinated dental arches and stable occlusal relationships.

In the panoramic radiograph, dental and periodontal health were maintained (**Figure 7**). When comparing pre- and post-treatment cephalometric data, it was

observed that the sagittal discrepancy was corrected ($SNA = 76^\circ$; $SNB = 72^\circ$; $ANB = 4^\circ$), the mandibular plane has almost not changed ($GoGn/SN = 41^\circ$, $FMA = 33^\circ$) with a mild proclination of the mandibular incisors ($i/NB = 29^\circ$ and $i/NB = 6\text{ mm}$) and maxillary incisors proclination was corrected ($I/NA = 22^\circ$ and $I/NA = 4\text{ mm}$) (**Table 1**). Cephalometric superimposition demonstrated the maintenance of the lower facial height, the improvement of the upper incisors position and the correction of the excessive overjet (**Figure 8**).

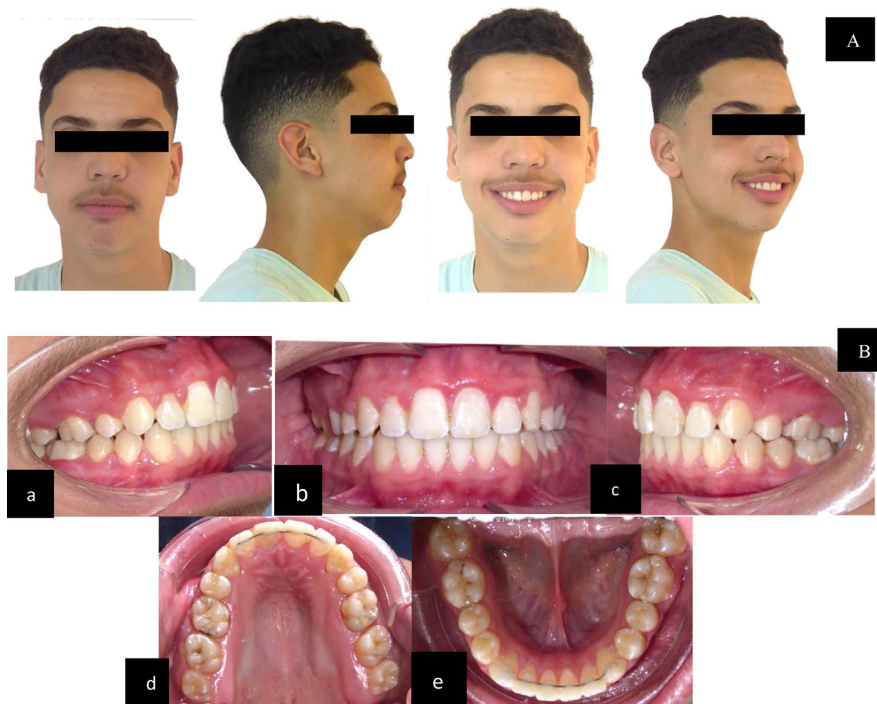


Figure 6. (A) Final extraoral photographs. (a) Frontal at rest; (b) Profile; (c) Frontal smiling; (d) Lateral smiling. (B) Final intraoral photographs. (a) Right lateral; (b) Frontal; (c) Left lateral; (d) Maxillary occlusal; (e) Mandibular occlusal.



Figure 7. Posttreatment radiographs. (a) Panoramic radiograph; (b) Lateral cephalogram.

4. Discussion

Orthodontic treatment of Class II malocclusion with extraction of upper first premolars is a well-established therapeutic approach supported by scientific litera-

ture. Extraction of premolars is often indicated to address crowding issues and achieve proper dental alignment. The treatment aims to correct the anteroposterior discrepancy between the maxilla and mandible, typical of Class II malocclusion, by retracting the upper anterior teeth and protracting the lower anterior teeth. This approach helps to improve facial aesthetics, dental function, and stability of the occlusion [5].



Figure 8. Total superimposition (A), maxillary and mandibular superimpositions (B) of initial (black) and final (red) cephalometric tracing.

Houb-Dine *et al.* identified maxillary crowding as an important factor in the decision to extract maxillary first premolars. In fact, patients with maxillary arch crowding greater or equal to 3.5 mm should be treated with extractions of two upper premolars [4]. This therapeutic approach is generally indicated in the absence of mandibular arch discrepancy.

In the current case, we chose to extract 14 and 24 primarily due to the considerable skeletal discrepancy and maxillary arch crowding.

The choice between two-premolar and four-premolar extraction protocols in Class II cases is primarily guided by the severity of the malocclusion, the amount of dental crowding, anchorage requirements, and the patient's skeletal and facial characteristics [3].

Janson G *et al.* [6] compared the occlusal outcomes of Class II orthodontic treatment using two-premolar and four-premolar extraction protocols. Initial and final occlusal conditions, as well as changes in key clinical variables, were evaluated and compared between the two treatment approaches. The results demonstrated significantly more favorable dental relationships and greater overall occlusal improvement in patients treated with two premolar extractions.

Guilherme J. *et al.* [7] also found that the 2-maxillary premolar extraction protocol produced better occlusal success rates than the 4-premolar and the non-ex-

traction protocols. However, the 2-maxillary premolar extraction protocol might cause greater palatal inclination of the maxillary incisors than the 4-premolar and the non-extraction protocols and this may negatively influence the soft tissue profile.

The management of Class II malocclusion involving 2-maxillary premolar extraction presents particular challenges with regard to occlusal control during treatment. Interproximal enamel reduction can be performed between the mandibular premolars in cases of persistent residual diastema in the maxillary arch [8].

Many studies Bolla, E. *et al.* [9] assessed the impact of first premolar extraction on facial aesthetics in patients with Class II malocclusion. They found that this protocol can lead to significant improvements in facial profile and lip position, enhancing overall facial harmony. However, the decision to extract should be carefully considered based on individual patient characteristics and treatment goals.

Considering the facial aspect, in the present clinical case, the profile improved considerably. Improved vertical dimension control resulted in a more harmonious vertical proportion of the lower facial third. The smile became more pleasant and wider with the correction of buccal corridors.

Regarding post-orthodontic stability, the extraction of two maxillary premolars in the treatment of Class II malocclusion did not affect the stability of the occlusal outcomes, as no significant difference was observed between treatment protocols with and without premolar extraction. Therefore, similar stability is achieved by finishing treatment with either a Class II or a Class I molar relationship [10]. This finding was confirmed by the study of Janson *et al.* [11], which found that extraction-based treatment achieved stable outcomes over a 10-year follow-up period, with favorable aesthetic and functional results.

Another study by Gianelly and Goldman [12] evaluated the long-term stability of Class II malocclusion treatment with extraction of maxillary first premolars. The results demonstrated that extraction treatment resulted in stable occlusal outcomes over a 20-year period, with minimal relapse.

In the current case, stability was optimized by engaging the Class II molar occlusion. The finishing of a therapeutic Class II molar relationship requires specific orthodontic adjustments to ensure a non-traumatogenic static and dynamic occlusal balance. At the maxillary molar level, increased buccal root torque is required to reduce the Curve of Wilson and to limit functional interferences. Reduction of archwire toe-in in the molar region is essential to prevent premature contacts during lateral excursions and to increase maxillary arch length, thereby compensating for Bolton tooth-size discrepancies associated with unilateral premolar extractions. In selected cases, selective grinding of the mesiopalatal cusp of the maxillary molar may be indicated to improve functional occlusal contacts. These combined adjustments aim to achieve a stable, functional, and aesthetically satisfactory occlusion despite the absence of a Class I molar relationship [13].

Precision is essential in completing the finishing and end-of-treatment equilibration to avoid any occlusal obstacles and optimize the stability of results over time. For instance, enamel reduction at the level of the marginal groove/mesial embrasure of the second upper premolar may be necessary in certain cases to achieve proper cusp-embrasure relationship in occlusion [14].

Janson [7] compared the occlusal success rate of Class II malocclusion treatments: completed in therapeutic molar Class II (extraction of two maxillary premolars) versus Class I molar (bimaxillary extractions of 4 premolars). The authors showed a significantly better occlusal success rate in the group finished in therapeutic Class II molar (in terms of overlap, anteroposterior canine relationships, and transverse molar relationship) at the end of orthodontic treatment.

5. Conclusions

In conclusion, the scientific literature supports the use of extraction of upper first premolars in the treatment of Class II malocclusion. Extraction treatment has been shown to be effective in reducing overjet, achieving a stable therapeutic Class II molar relationship associated with Class I canine occlusion, improving occlusal outcomes, and enhancing facial esthetics, with stable long-term results.

In short, this case demonstrates that the overjet and molar occlusion were effectively improved and the protruded upper lip and facial profile were enhanced.

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Conflicts of Interest

The authors declare no conflicts of interest.

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