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Case Report **Dentofacial Orthopedics**

Beyond Extraction: A Biomechanical Approach to Severe Dental Crowding Using the Damon Ultima System

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Abstract

Background: Orthodontic management of a dentoalveolar discrepancy associated with severe crowding may, in selected cases, be undertaken without premolar extraction. This approach requires careful diagnostic assessment and control of tooth movement to respect periodontal boundaries and achieve functional and aesthetic objectives. ***Case presentation:*** A 14-year-old male patient presented with ectopic canine positioning. Clinical examination and the available records revealed bilateral Class I molar and canine relationships, severe dental crowding, bimaxillary dentoalveolar protrusion, mild transverse maxillary constriction, and localized crossbites involving teeth 12 and 43. Initial cephalometric measurements included an SNA angle of 85°, an SNB angle of 80°, and an ANB angle of 5°. Treatment was carried out without premolar extraction using the Damon Ultima system, combining dentoalveolar expansion and interproximal enamel reduction. The reported overall treatment duration was 25 months. ***Results:*** The available records include initial and final photographs and radiographs, as well as a comparative cephalometric table. Between the beginning and end of treatment, SNA increased from 85° to 86°, SNB from 80° to 82°, and ANB decreased from 5° to 4°. IMPA increased from 95° to 98°, and the I/F angle from 117° to 119°. Interpretation of these changes and a detailed description of the occlusal and periodontal outcomes remain to be completed after verification of the clinical records. ***Conclusion:*** This case illustrates a non-extraction treatment approach in an adolescent presenting with severe crowding and ectopically positioned canines. The final report should document incisor inclination control, correction of the crossbites, the quality of the occlusal relationships, and stability.

Keywords: orthodontics; dental crowding; non-extraction treatment; Damon Ultima; interproximal enamel reduction; case report.

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1. INTRODUCTION

Dental crowding is a common reason for orthodontic consultation. When space deficiency is severe, treatment planning should take several factors into account, including facial profile, skeletal relationships, tooth inclinations, arch width and shape, tooth dimensions, periodontal status, and functional and aesthetic objectives. The decision to extract or not extract teeth should therefore not be based solely on the severity of crowding.

Depending on the clinical indication, non-extraction treatment may combine dentoalveolar expansion, interproximal enamel reduction, and space redistribution. However, these procedures require careful monitoring of tooth axes and root positions, particularly in the anterior segments. The Damon Ultima system was

the appliance used in the present case. This case report aims to describe the diagnostic reasoning, biomechanical treatment choices, and observed clinical and cephalometric changes.

The reference list has been supplemented with identifiable scientific publications. Specific evidence on the Damon Ultima system remains limited: a recent in vitro biomechanical study is available, but it is not sufficient on its own to establish clinical superiority of the system.

2. CASE PRESENTATION

2.1. Chief Complaint and Medical History

A 14-year-old male patient presented for consultation because of ectopically positioned canines. The general medical history was reported as unremarkable, and there was no history of previous orthodontic treatment.

2.2. Extraoral Examination

At rest, frontal facial examination showed equal facial thirds. The horizontal reference lines were parallel, and the midsagittal plane was straight. The lips were considered normal. On smiling, the smile was broad and dental, with adequate incisor display. The maxillary dental midline was deviated 1 mm to the right of the facial midsagittal plane.

Profile examination showed a convex profile, a nasolabial angle of approximately 90°, and an S-shaped mentolabial sulcus. The cervicomental distance was estimated at four fingerbreadths.

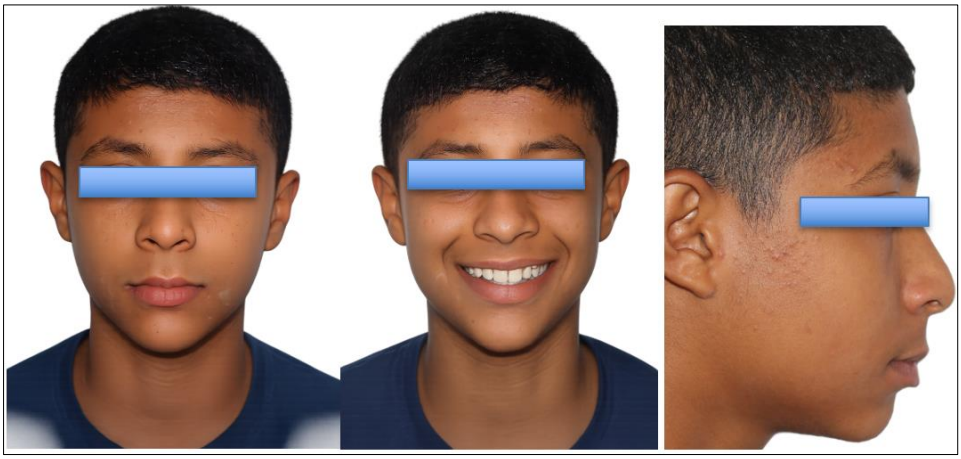


Figure 1: Pre-treatment photographs: facial photographs

2.3. Intraoral Examination

Intraoral examination revealed bilateral Class I molar and canine relationships, associated with severe dental crowding. Crossbites were reported at teeth 12 and 43.

Mild transverse constriction was also reported. The dental axes in the lateral segments appeared favorable for dentoalveolar expansion. Overjet was estimated at 3–4 mm and overbite at 4–5 mm.



Figure 2: Pre-treatment photographs: intra-oral photographs

2.4. Additional Investigations and Diagnosis

The initial radiographic assessment included the images available in the clinical records, together with cephalometric analyses according to Tweed and Steiner. The diagnostic assessment identified a skeletal Class II relationship attributed to maxillary prognathism, while the molar and canine dental relationships were bilaterally Class I. Bimaxillary dentoalveolar protrusion was also reported.

Vertically, the patient was described as normodivergent, with an FMA angle of 23° and a GoGn/SN angle of 31°. Overbite was 4–5 mm. In the transverse dimension, the records described mild constriction and a 1-mm deviation of the maxillary dental midline to the right, with a straight facial midsagittal plane.

Bolton analysis showed ratios of 78.43% for the six anterior teeth and 94.11% for the twelve teeth. These values were interpreted in the clinical records as indicating a mild tooth-size discrepancy (TSD) due to mandibular excess.

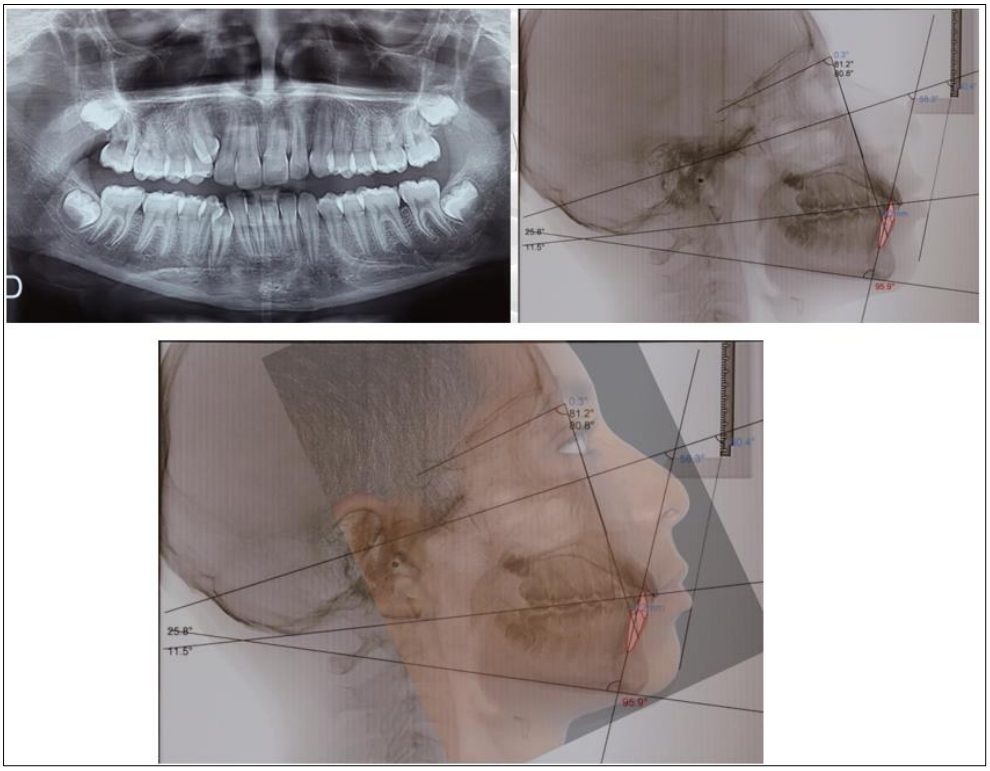


Figure 3: Pre-treatment radiographs

Table 1: Tweed's analysis

Tweed Nom de la céph	Original	Norme	Unité	Dév O
FMA (ML/FH)	25.8	16-35	°	
IMPA (ILi/ML)	95.9	80-95	°	+
FMIA (ILi/FH)	58.3	65-70	°	---
SNA	81.2	80-84	°	
SNB	80.8	78-82	°	
ANB	0.3	1-5	°	-
Wits	-8.2	0-4	mm	-----
OL/FH	11.5	8-12	°	
Z	60.4	75-78	°	----*

Table 2: Steiner's analysis

Nom	Norme	± (σ)	Valeur	Graphique
SNA	82°	2°	90,49°	
SNB	80°	2°	83,66°	
ANB	2°	2°	6,83°	
OP-SNP	14°	2°	16,74°	
MP(GoGn)-SNP	32°	3°	32,54°	
+1-NA	22°	2°	14,81°	
+1:NA	4mm	2mm	0,65mm	
-1-NB	25°	2°	34,0°	
-1:NB	4mm	5mm	11,94mm	
-1 to +1	131°	8°	124,35°	
Rapport de Holdaway	0mm	2mm	6,66mm	

2.5. Diagnostic Summary

Following clinical examination and additional investigations, the case was characterized by a dentoalveolar discrepancy with severe crowding and ectopically positioned canines, in the context of bilateral dental Class I relationships and a skeletal Class II pattern related to maxillary prognathism. Transverse findings included mild constriction and localized crossbites. The profile was convex, and bimaxillary dentoalveolar protrusion was reported.

3. Treatment Objectives

The treatment objectives were as follows:

- Relieve dental crowding while maintaining strict control of tooth axes;
- Harmonize arch form and coordinate the dental arches;
- Maintain Class I canine and molar relationships;
- Correct the deviation of the maxillary dental midline and seek coincidence of the dental midlines;
- Improve smile aesthetics and, insofar as permitted by the dentoalveolar objectives, facial profile balance.

4. Treatment Decision and Treatment Plan

The selected approach was orthodontic treatment with the Damon Ultima system, without premolar extraction, combining dentoalveolar expansion and interproximal enamel reduction (IPR). With a smile-arc protection protocol, and In order to prevent the upper and lower incisors' proclination the torque selection was: neutral torque for upper central incisors, low torque for all lower incisors and upper lateral incisors, high torque for all lower and upper canines

The treatment protocol involved delayed management of the ectopic canines.

In the maxillary arch, the appliance was initially placed while tooth 13 was excluded from the archwire. The reported archwire sequence included.014- and.018-inch CuNiTi wires, followed by.014 ×.0275-inch and.018 ×.0275-inch Damon Ultima wires, and then a.018 ×.025-inch stainless-steel wire.

Tooth 13 was subsequently bonded and managed using a so-called "piggyback" technique, after which leveling continued with.014 ×.0275-inch and.018 ×.0275-inch CuNiTi wires.

In the mandibular arch, the appliance was initially placed while tooth 43 was excluded. The sequence began with.014- and.018-inch CuNiTi wires. After space had been created for tooth 43 through expansion and IPR, the tooth was incorporated into the appliance, and the leveling sequence resumed with.018-inch CuNiTi,.014 ×.0275-inch CuNiTi,.018 ×.0275-inch CuNiTi, and finally.018 ×.025-inch stainless-steel wires.

Arch coordination was performed using two coordinated.018 ×.025-inch stainless-steel archwires, followed by finishing and stabilization. Maxillary and mandibular bonded retainers were planned after appliance removal.

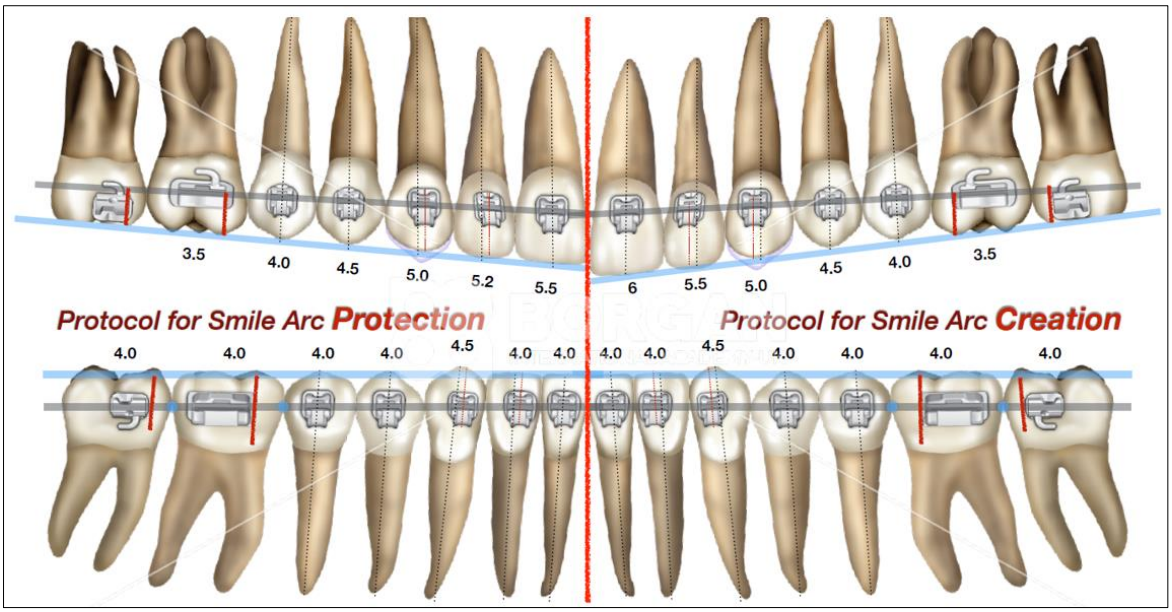


Figure 4: Bonding Protocol

5. Treatment Progress

5.1. Initial Phase: Alignment and Leveling

Treatment began with placement of the Damon Ultima appliance. The ectopic canines 13 and 43 were temporarily excluded from the archwires to allow initial alignment of the remaining teeth and preparation of the space required for their incorporation. In the maxillary arch, progression from CuNiTi to stainless-steel archwires aimed to achieve leveling and progressive control of tooth axes. Initial mandibular leveling was also performed using a sequence of CuNiTi archwires.

5.2. Space Creation and Canine Alignment

In the maxillary arch, after the initial phase, tooth 13 was incorporated into the appliance and traction/alignment was performed using the piggyback technique described in the protocol. In the mandibular arch, space for tooth 43 was prepared using a.018-inch CuNiTi archwire, expansion, and interproximal enamel reduction before the tooth was incorporated into the alignment sequence.

5.3. Arch Coordination, Finishing, and Retention

After canine incorporation and further leveling, arch coordination was performed using coordinated.018 ×.025-inch stainless-steel archwires. The final phases included occlusal finishing and stabilization of the results. The treatment duration is reported as 25 months. Maxillary and mandibular bonded retainers were planned at the end of treatment.



Figure 5: Bonding of the maxillary arch and opening the space for the 13 (Upper arch.014 CuNiTi)

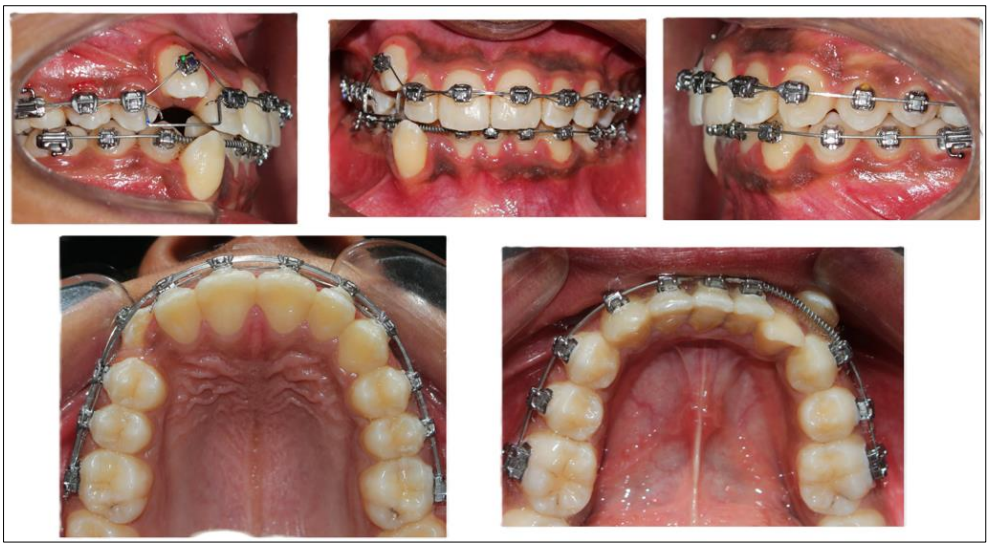


Figure 6: Traction of the 13 with a piggyback technique and bonding of the mandibular arch (Upper arch.018*0.275 SS, Lower arch.018 CuNiTi)



Figure 7: Return to leveling (upper and lower archs.014*.0275 CuNiTi)



Figure 8: Tooth axes control (upper and lower arch.018*.0275 SS)



Figure 9: Arch Coordination, Finishing (upper and lower arch.018*.0275 SS)

6. RESULTS

6.1. Clinical Outcomes

At the end of treatment, comparison of the initial and final photographs showed an improvement in dental alignment, with successful integration of the ectopically positioned canines into the dental arches. The treatment also aimed to correct the initial crossbites, maintain the bilateral Class I molar and canine relationships, and achieve better coordination of the maxillary and mandibular arches.

Particular attention was paid to smile aesthetics, with preservation and improvement of the smile arc, seeking harmonious coordination between the maxillary incisal edges and the curvature of the lower lip. The final extraoral assessment also focused on smile symmetry, incisor display, and facial profile.

Following appliance removal, bonded retainers were planned in both arches to maintain the treatment results. Follow-up examinations were reported at 3 months and 1 year.

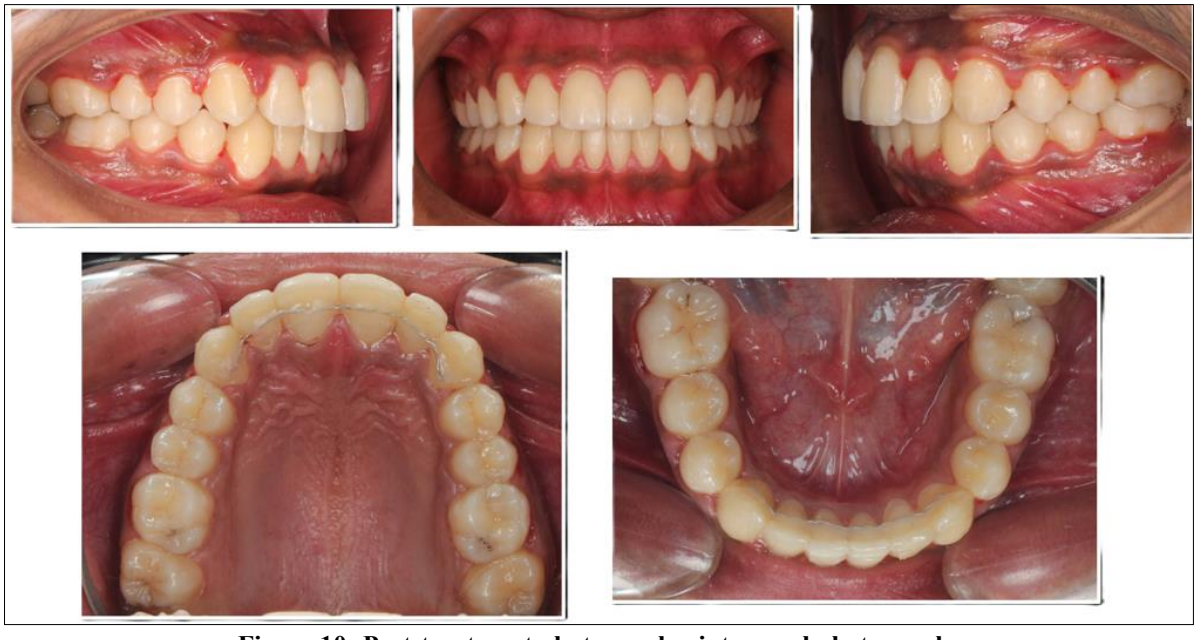


Figure 10: Post-treatment photographs: intra-oral photographs

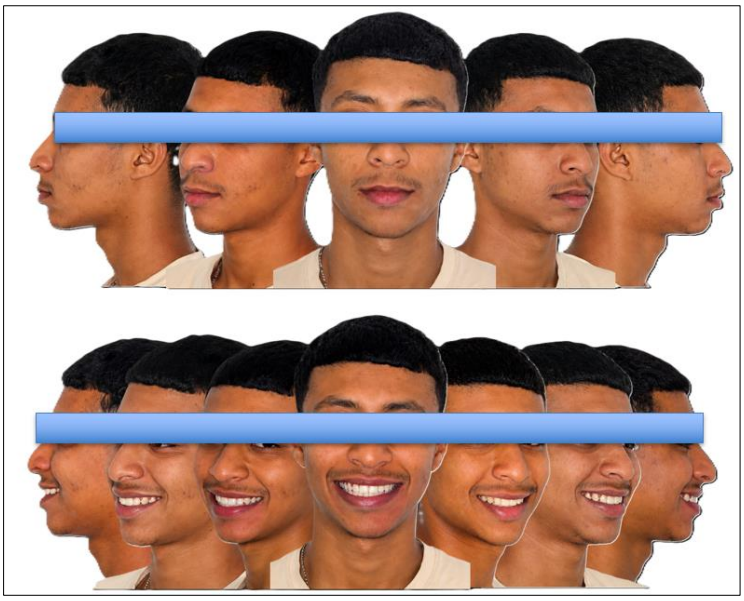


Figure 11: Post-treatment photographs: facial and smile photographs

6.2. Cephalometric Outcomes

The initial and final cephalometric values reported in the presentation are shown in Table 1.

Table 1

Measurement	Reference value	Initial	Final
SNA	82 ± 2°	85°	86°
SNB	80 ± 2°	80°	82°
ANB	2 ± 2°	5°	4°
AO–BO	0 ± 2 mm	+1 mm	+2 mm
FMA	25 ± 3°	23°	26°
GoGn/SN	32 ± 5°	31°	32°
IMPA	87°	95°	98°
I/F	107 ± 5°	117°	119°

The values show an increase in SNA of 1°, an increase in SNB of 2°, and a decrease in ANB of 1°. FMA increased from 23° to 26°, while GoGn/SN increased from 31° to 32°. Incisor measurements also increased: IMPA rose from 95° to 98°, and the I/F angle from 117° to 119°. These changes should be interpreted in light of the patient's growth, the measurement method, and tracing reproducibility. In isolation, they do not establish the nature or magnitude of the tooth movements.

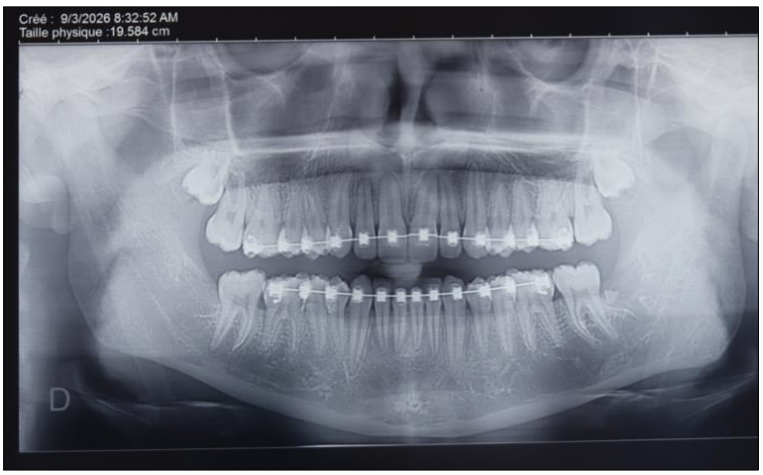


Figure 12: Post-treatment panoramic radiograph

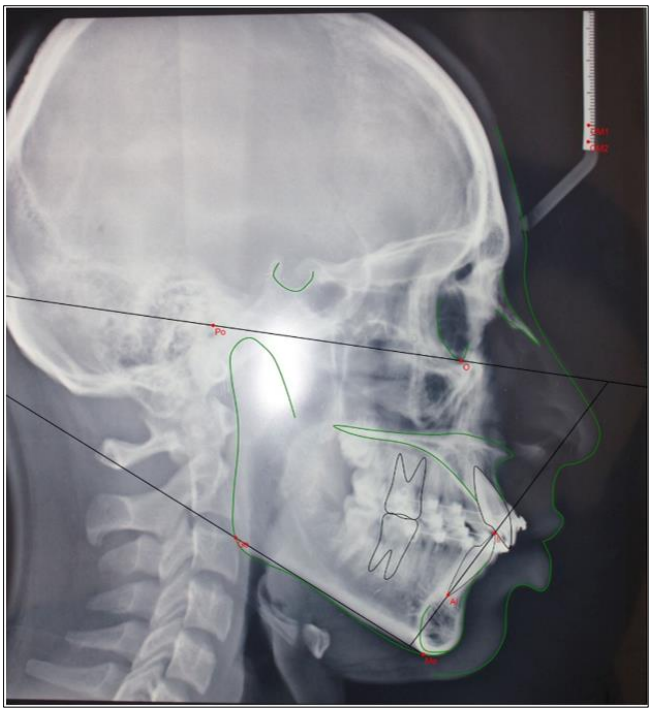


Figure 13: Post-treatment cephalometric radiograph

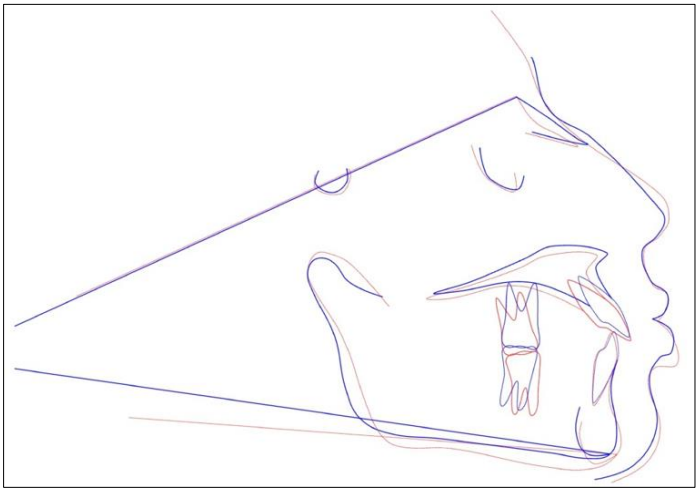


Figure 14: Post-treatment cephalometric radiograph

7. DISCUSSION

The distinctive feature of this case is the selection of a non-extraction strategy in an adolescent with severe crowding and ectopically positioned canines, while maintaining Class I molar and canine relationships. According to the treatment plan provided, this decision was based on a combination of dentoalveolar expansion and interproximal enamel reduction, with delayed incorporation of the canines.

7.1. Rationale for the Non-Extraction Approach

The decision not to extract premolars should be discussed in light of the overall assessment of the case: convex profile, bimaxillary dentoalveolar protrusion, initial incisor inclinations, degree of crowding, arch width, tooth dimensions, and periodontal envelope. Comparative literature indicates that the choice between extraction and non-extraction depends on the clinical indication, and that the level of evidence remains limited for several outcome measures [1]. In the present case, the selected treatment plan prioritized space creation through dentoalveolar expansion and IPR. However, non-extraction treatment in a patient presenting with bimaxillary protrusion requires particular caution. Excessive arch expansion or uncontrolled proclination of the incisors may compromise facial aesthetics and exceed the biological limits of the supporting alveolar bone. For this reason, careful control of tooth inclination, root positioning, and the periodontal envelope was essential throughout treatment.

7.2. Management of Ectopic Canines

Temporary exclusion of teeth 13 and 43 from the archwires at the beginning of treatment, followed by their subsequent incorporation, was a central feature of the protocol. This sequence aims to avoid applying forces prematurely to teeth for which insufficient eruption or alignment space is available.

7.3. Incisor Inclination Control and Biomechanical Limitations

Cephalometric measurements show an increase in IMPA from 95° to 98° and in the I/F angle from 117° to 119°. These changes suggest an evolution in incisor inclination that should be examined using cephalometric superimpositions and photographs. They are particularly important to discuss in a non-extraction case with initial bimaxillary dentoalveolar protrusion.

7.4. Contribution of the Damon Ultima System

The Damon Ultima system differs from earlier generations of Damon self-ligating brackets through a slot and archwire design intended to reduce play between the archwire and bracket and to improve the expression of rotation, angulation, and torque. An in vitro experimental study compared a conventional bracket, Damon Q2, and Damon Ultima; it found significantly greater torque expression with Damon Ultima than with Damon Q2 in certain archwire configurations, with performance comparable or superior to the conventional bracket depending on archwire geometry [2]. These findings should nevertheless be interpreted cautiously: they were obtained in an experimental model and do not, by themselves, demonstrate improved clinical outcomes, shorter treatment duration, or greater stability. Independent clinical evidence specifically addressing Damon Ultima remains limited. Furthermore, systematic reviews examining self-ligating brackets as a whole have not demonstrated consistent clinical superiority over conventional brackets [3, 4]. In the present case, outcomes should therefore be attributed to the overall treatment plan, archwire sequence, auxiliaries, IPR, and patient cooperation, rather than to the bracket system alone.

7.5. Limitations

This is a single clinical case. The absence, in the currently available records, of detailed quantitative measurements of initial and final crowding, periodontal data, precise IPR amounts, and complete information on long-term stability limits comprehensive evaluation of the outcome. Post-retention follow-up should be documented if available.

8. CONCLUSION

This case illustrates the management of severe dental crowding and ectopically positioned canines in an adolescent patient using a non-extraction approach with the Damon Ultima system. By combining controlled dentoalveolar expansion, interproximal enamel reduction, and progressive canine alignment, the treatment aimed to resolve the space deficiency while maintaining the existing Class I molar and canine relationships.

The observed clinical and cephalometric changes should be interpreted in relation to the initial treatment objectives, particularly regarding dental alignment, incisor inclination, facial aesthetics, and periodontal health. Although this case demonstrates the clinical feasibility of a carefully planned non-extraction strategy in a selected patient, long-term follow-up remains essential to assess the stability of the results. Further clinical studies are also needed to establish the specific contribution of the Damon Ultima system to treatment outcomes.

Conflicts of Interest: The authors declare that they have no conflicts of interest.

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