

Orthodontic Management of Impacted Mandibular Second Premolar (Tooth 45) Using the Edgewise Technique – A Case Report

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Abstract

Introduction: Impacted teeth represent a common clinical challenge in orthodontic practice due to their potential to disrupt normal occlusion and oral function. Objective: This case report aims to present the orthodontic management of an impacted mandibular second premolar (tooth 45) using the Edgewise technique to restore proper alignment and functional occlusion.

Case Report: A 14-year-old female presented with Class I dentoskeletal malocclusion, severe crowding in the mandibular arch, midline shift, and an impacted tooth 45. Extraoral examination revealed a convex facial profile with slight asymmetry. Treatment was conducted using the 0.022-inch Standard Edgewise system. Leveling and aligning were initiated using multiple loop stainless steel archwires. Space creation for tooth 45 was achieved using an open-coil spring combined with molar distalization and anterior flaring, followed by uprighting and traction of tooth 45 into the dental arch. **Conclusion:** Comprehensive orthodontic treatment using the Edgewise technique with open-coil mechanics successfully uprighted and aligned the impacted tooth 45, establishing a stable Class I canine and molar relationship with improved smile aesthetics.

Keywords: dental impaction, fixed orthodontic, edgewise technique

INTRODUCTION

Tooth impaction is defined as a pathological condition in which a tooth fails to erupt into its functional position within the dental arch. Premolar impactions, although less frequent than third molar or canine impactions, represent a significant clinical concern due to potential esthetic and functional complications. The etiology is multifactorial, involving local factors such as space deficiency, retained primary teeth, abnormal tooth angulation, and premature loss of primary molars.

Management of impacted mandibular premolar requires careful biomechanical planning to create sufficient space, upright the tooth, and guide it into the arch without compromising adjacent structures. The Edgewise technique with auxiliary appliances (such as open-coil springs and multiple loops) provides effective three-dimensional control for space creation and tooth uprighting. This report illustrates the successful management of an impacted tooth 45 in a 14-year-old patient.

DIAGNOSIS AND ETIOLOGY

A 14-year-old female presented to the Orthodontic Clinic at Hasanuddin University Dental Hospital with chief complaints of misaligned and crowded lower front teeth. Extraoral examination showed a convex profile, competent lips, and slight facial asymmetry. Intraoral examination revealed a bilateral Class I molar and canine relationship, severe crowding in the lower arch, mild crowding in the upper arch, a deep palate, positive curve of Spee (4 mm), an overjet of 4 mm, an overbite of 3 mm, and a 2 mm lower midline shift to the right. Crossbite was observed involving teeth 15/45. Panoramic radiograph confirmed impaction of tooth 45, along with impacted third molars (18, 28, 38, and 48). Cephalometric analysis indicated a Class I skeletal pattern (SNA 80°, SNB 78°, ANB 2°) with a counter-clockwise growth pattern (FMPA 29°) and proclined mandibular incisors (IMPA 101°).

TREATMENT OBJECTIVES

The main objectives of treatment were: Create space and upright the impacted tooth 45 into proper alignment. Resolve maxillary and mandibular crowding. Correct the lower midline shift and close the diastema. Reduce overjet and overbite to achieve functional occlusion. Enhance facial aesthetics and ensure post-treatment stability.

TREATMENT ALTERNATIVES

Two main treatment alternatives were considered: The first treatment are extraction of impacted tooth 45: This would simplify orthodontic mechanics and shorten treatment duration. However, it could compromise arch integrity and lead to unnecessary space loss in a Class I occlusion. The second treatment are non-extraction space creation and orthodontic traction of tooth 45: Preserves natural

dentition and alveolar bone while maintaining arch continuity.

The second option was selected to preserve natural dentition and achieve optimal functional results.

TREATMENT PROGRESS

The treatment was executed using 0.022-inch Standard Edgewise brackets. Mandibular third molars (38 and 48) were extracted prior to active mechanics. Leveling and Alignment: Initiated with 0.014-inch, 0.016-inch, and 0.018-inch Stainless Steel (SS) archwires with multiple loops for flexible force delivery and rotation control. Space Opening Mechanics: An open-coil spring was inserted between teeth 44 and 46 to create adequate space for tooth 45 by distalizing tooth 46 and flaring the anterior segment. Uprighting and Alignment of Tooth 45: Once adequate space was opened, a bracket was bonded to tooth 45. Uprighting and leveling were performed using light SS wires while preserving space with the open-coil spring. Finishing and Detailing: Rectangular SS archwires (00.016 x 0.016) were utilized for artistic positioning and occlusal refinement.

TREATMENT RESULT

After active orthodontic treatment, tooth 45 was successfully uprighted and integrated into the lower arch with normal axial inclination. Upper and lower dental midlines were coordinated, crowding was fully resolved, and normal overjet (3 mm) and overbite (2 mm) were established. A bilateral Class I canine and molar relationship was maintained. Post-treatment facial photos demonstrated improved smile aesthetics and facial symmetry. Post-treatment cephalometric analysis showed stable skeletal parameters (SNA 80°, SNB 78°, ANB 2°) and controlled incisor inclination. The soft tissue profile was well preserved.

DISCUSSION

Tooth impaction represents a significant orthodontic challenge, with the global prevalence of premolar impaction reported to range between 0.5% and 17.5% across various populations.^{1,5} In this case, local space deficiency in the mandibular arch was identified as the primary factor preventing the natural eruption of tooth 45.^{1,6} Mandibular premolars are particularly susceptible to impaction due to their chronological eruption sequence, as they typically erupt after the lower first molars and canines.¹ The application of an open-coil spring between teeth 44 and 46 created sufficient space through controlled distalization of tooth 46 and minor anterior flaring.¹ This conservative mechanics successfully avoided the extraction of tooth 45, maintaining arch continuity and long-term functional stability.^{1,7} The Edgewise technique, utilizing a multiple loop archwire configuration, provided optimal force distribution during the initial alignment phase.¹ The sequential wire

progression from 0.014-inch to 0.018-inch stainless steel archwires facilitated controlled uprighting and traction of tooth 45 while minimizing stress on adjacent periodontal tissues.¹ Cephalometric evaluation confirmed that the skeletal Class I relationship remained stable post-treatment, with SNA and SNB values maintained at 80° and 78°, respectively, resulting in a constant ANB angle of 2°.^{1,2} Dental corrections were effectively achieved, including the leveling of a 4 mm curve of Spee, resolution of a 2 mm lower midline shift, and establishment of a 3 mm overjet and 2 mm overbite.^{1,2} Furthermore, facial profile aesthetics were enhanced, with soft tissue positions adjusting to 1.5 mm for the upper lip and 3.5 mm for the lower lip relative to the E-line.^{1,2} Overall, controlled biomechanical application combined with targeted space creation proved highly effective in guiding the impacted mandibular second premolar into functional occlusion without compromising periodontal health.¹



Fig 1. Pretreatment Extraoral photograph.



Fig 2. Pretreatment Intraoral photograph.

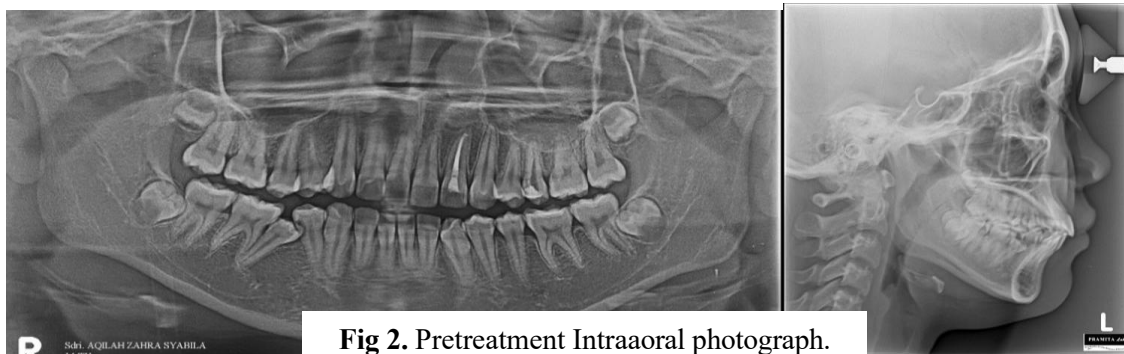


Fig 2. Pretreatment Intraoral photograph.

Fig 3. Pretreatment panoramic and cephalometric photograph.

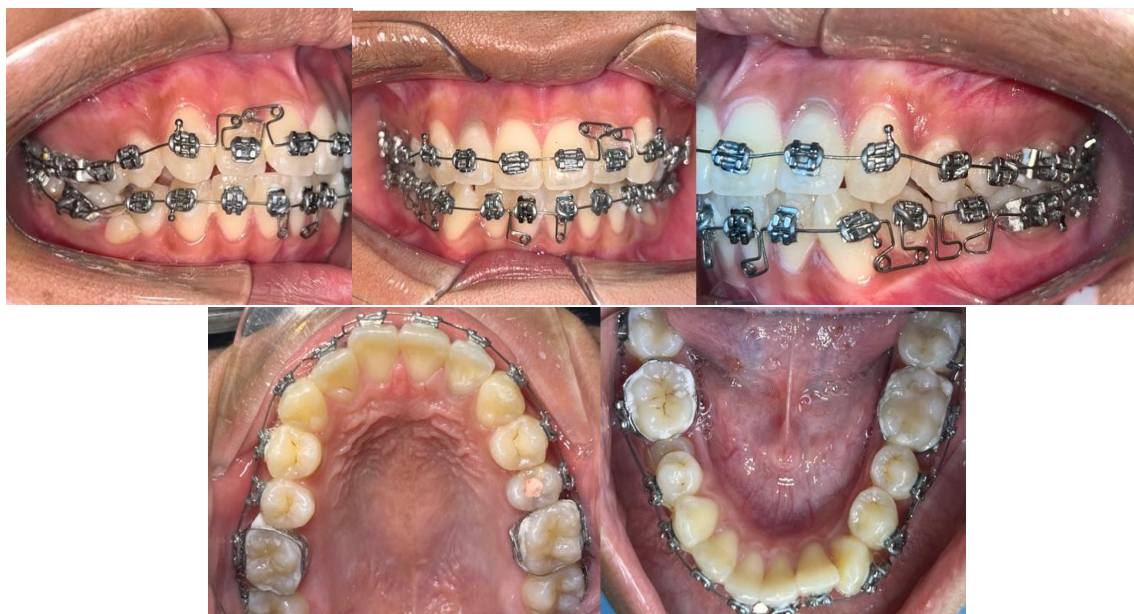


Fig 4. Bracket placement (standard edgewise brackets with multiple loop), leveling and alignment.

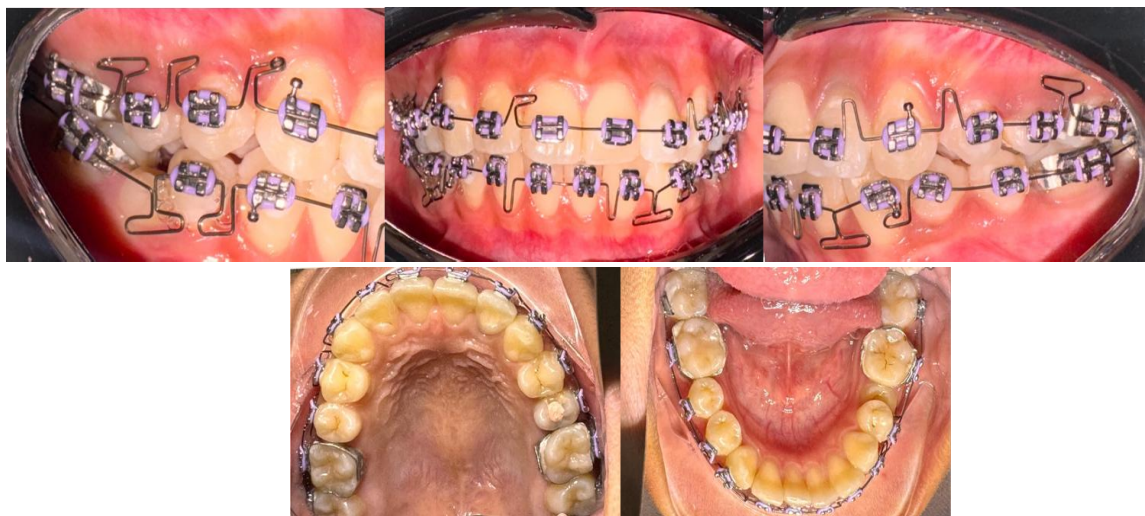


Fig 5. Space opening for tooth 45 in the maxillary arch and leveling alignment in the mandibular arch using multiple loop stainless steel archwires.



Fig 6. Open-coil spring used to create space for alignment of impacted tooth 45.



Fig 7. Open-coil spring maintained to preserve space during alignment.



Fig 8. Artistic positioning and occlusal adjustment.



Fig 9. Posttreatment photographs.

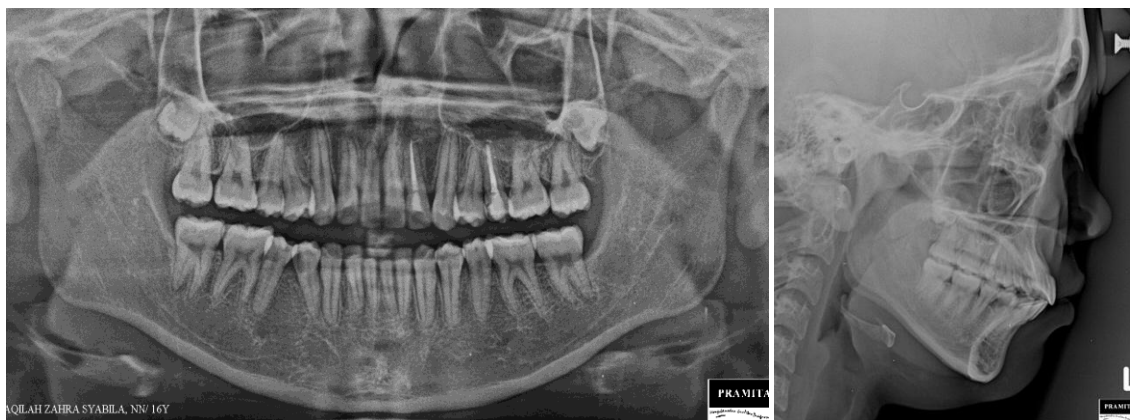


Fig 10. Panoramic and cephalometric radiograph posttreatment.

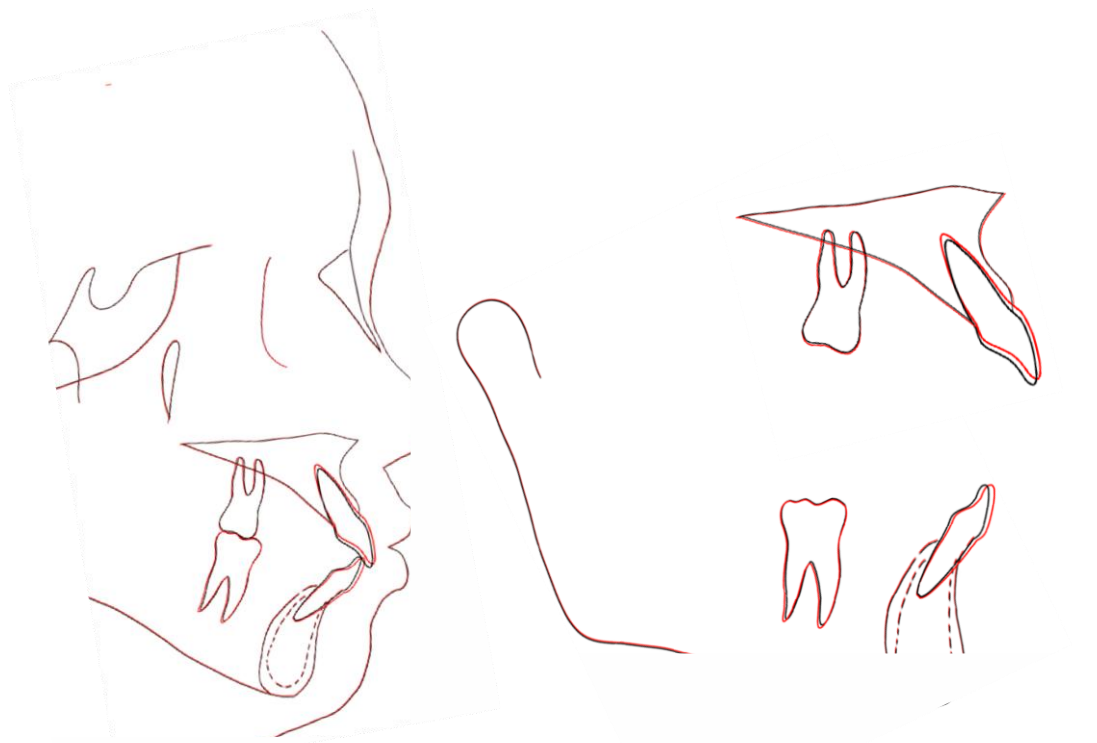


Fig 11. Superimposition of cephalometric tracings: black, pretreatment; red, posttreatment.

Table 1. Cephalometric summary

<i>Parameter</i>	<i>Norm (mean ± SD)</i>	<i>Pre- treatment</i>	<i>Post- treatment</i>
Cephalometric			
SNA (°)	82 ± 2	80	80
SNB (°)	80 ± 2	78	78
ANB (°)	2 ± 2	2	2
Wits appraisal (mm)	1 ± 3	2	2
Y axis (°)	54,9 ± 6	62	62
SN-mandibular plane (°)	32 ± 8	27	27
FMPA (°)	25 ± 3	29	30
N-ANS: ANS-Me	45% : 55%	44,8% : 55,2%	44,8%;55,2%
U1-NA (°)	20 ± 4	31	32
L1-NB (°)	25 ± 4	32	33
IMPA (°)	90 ± 5	101	102
Interincisal (°)	135 ± 10	112	116
E-Line to upper lip (mm)	1 ± 2	0	1,5
E-Line to lower lip (mm)	0 ± 2	0	3,5

CONCLUSIONS

Orthodontic management using the Edgewise technique with open-coil mechanics successfully uprighted and aligned the impacted tooth 45. A stable Class I occlusion, coordinated midlines, and enhanced smile aesthetics were achieved, demonstrating the efficacy of conservative orthodontic traction for impacted premolars.

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