Article published online: 2024-11-18



# Lingual Orthodontic Retreatment of an Adult Patient with Protruded Lips and a Missing Lower Incisor: A Case Report

Viet Anh Nguyen[1] Thi Hanh Pham[2] Thuy Anh Nguyen[2]

[1] Faculty of Dentistry, Phenikaa University, Yen Nghia, Ha Dong, Hanoi, Vietnam
[2] Private Practice, Viet Anh Orthodontic Clinic, Nam Tu Liem, Hanoi, Vietnam

**Address for correspondence** Viet Anh Nguyen, DDS, MS, Faculty of Dentistry, Phenikaa University, Yen Nghia, Ha Dong, Hanoi 12116, Vietnam (e-mail: anh.nguyenviet1@phenikaa-uni.edu.vn).

Eur J Gen Dent

## Abstract

Orthodontic retreatment in adult patients presents unique challenges and considerations. Previous dental intervention or even missing teeth may influence treatment planning and pose challenges for bracket bonding.

A 23-year-old female patient sought orthodontic retreatment to address her chief complaint of upper lip protrusion. She had previously completed fixed labial orthodontic treatment involving the extraction of a lower central incisor.

The diagnosis was a skeletal maxillary protrusion and mandibular dentoalveolar protrusion on dental class I and skeletal class II relationships.

A nonsurgical camouflage treatment option was chosen, which involved the removal of the upper first premolars and lower right first premolar. The lower left canine, lateral, and central incisor were substituted with the lower left first premolar, canine, and lateral incisor, respectively. Lingual self-ligating brackets, straight archwires, and temporary anchorage devices were utilized. The treatment was completed after 32 months with an improved facial profile and a stable occlusion.

This case report demonstrates the successful retreatment of an adult patient with lip protrusion and relapse of lower arch crowding using straight-wire lingual appliances and premolar extractions. This approach achieved optimal aesthetics and a stable occlusion, highlighting the effectiveness of lingual appliances in complex adult retreatment cases.

**Keywords**

- case report
- lingual brackets
- tooth agenesis
- lingual straight archwire
- protrusion

## Introduction

Many adults are seeking orthodontic treatment, whether for the first time or to address concerns from previous interventions.[1] Some are pursuing the smiles they missed out on in their youth, while others are returning to correct relapse or further refine their results. This highlights the evolving needs and expectations of patients, who are increasingly informed and discerning about their treatment options. Relapse, often due to inadequate retention following earlier treatment, is a common reason for retreatment.[2] Others seek to address aesthetic concerns like overjet or other bite discrepancies that may have persisted from their initial treatment, possibly stemming from limitations in the initial treatment plan or the patient's growth and development at the time.

Retreatment presents unique challenges and considerations.[3] For instance, adults often present with more

**DOI** https://doi.org/10.1055/s-0044-1793912.
**ISSN** 2320-4753.



Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

complex dental conditions, including previous dental interventions such as endodontically treated teeth, ceramic restorations, or even missing teeth, which may influence treatment planning and pose challenges for bracket bonding. Moreover, adult patients tend to have a heightened awareness of their desired outcomes and prioritize aesthetics, comfort, and efficiency.[4] This often leads to a preference for discreet treatment modalities, such as lingual orthodontics or clear aligners, which offer minimal disruption to their daily lives and professional appearances. These preferences underscore the importance of patient-centered care and shared decision-making in developing a comprehensive retreatment plan that addresses both functional and aesthetic goals.

This case report details the orthodontic retreatment of an adult patient missing a lower incisor presenting who sought to correct unresolved lip protrusion following previous nonextraction treatment. To achieve optimal treatment outcomes, the retreatment plan incorporated a comprehensive approach, including asymmetric premolar extractions to facilitate anteroposterior and midline correction, lingual appliance therapy to address the patient's aesthetic concerns, and the utilization of temporary anchorage devices (TADs) for enhanced biomechanics and control of tooth movement.

## Case Report

### Diagnosis and Etiology

A 23-year-old female patient sought orthodontic retreatment to address her chief complaint of upper lip protrusion. She had previously completed fixed labial orthodontic treatment involving the extraction of a lower central incisor to relieve lower arch crowding 6 years ago. After fixed appliance removal, the patient was instructed to wear removable retainers without fixed retainers placed. However, the patient had discontinued wearing retainers for 3 years. At present, the patient noted the relapse of crowding in the lower arch, while her lip protrusion remained significant. The patient had a dental history of third molar pericoronitis and had all third molars extracted 2 years ago.

A lateral extraoral examination reveal a convex profile and protruded maxilla. A frontal extraoral examination indicated a balanced vertical proportion of the face with a right-deviated chin (►**Fig. 1**). Her smile arc was consonant. An examination of the temporomandibular joint revealed no click, pain, or mouth-opening limitation.

An intraoral examination showed class I canine and molar relationships on both sides with normal overjet and overbite. The lower dental midline deviated 3.5 mm to the right. There was mild crowding in the lower arch with an arch length discrepancy of 2.2 mm. The upper second premolars and first molars exhibited mesial inclination. The position of the lingual frenum indicated that the lower right central incisor was missing.

On lateral cephalometric evaluation, the patient had a class II skeletal relationship (point A-nasion-point B [ANB], 5.2 degrees) with a slightly protruded maxilla (sella-nasion-point A [SNA], 84.7 degrees) and a mesofacial pattern (Frankfort mandibular angle [FMA], 22.9 degrees). The cephalometric analysis revealed that the upper incisors were normally inclined (upper incisor/sella-nasion [SN], 102.6 degrees), while the lower incisors were proclined (incisor mandibular plane angle [IMPA], 99.7 degrees). Both the upper and lower

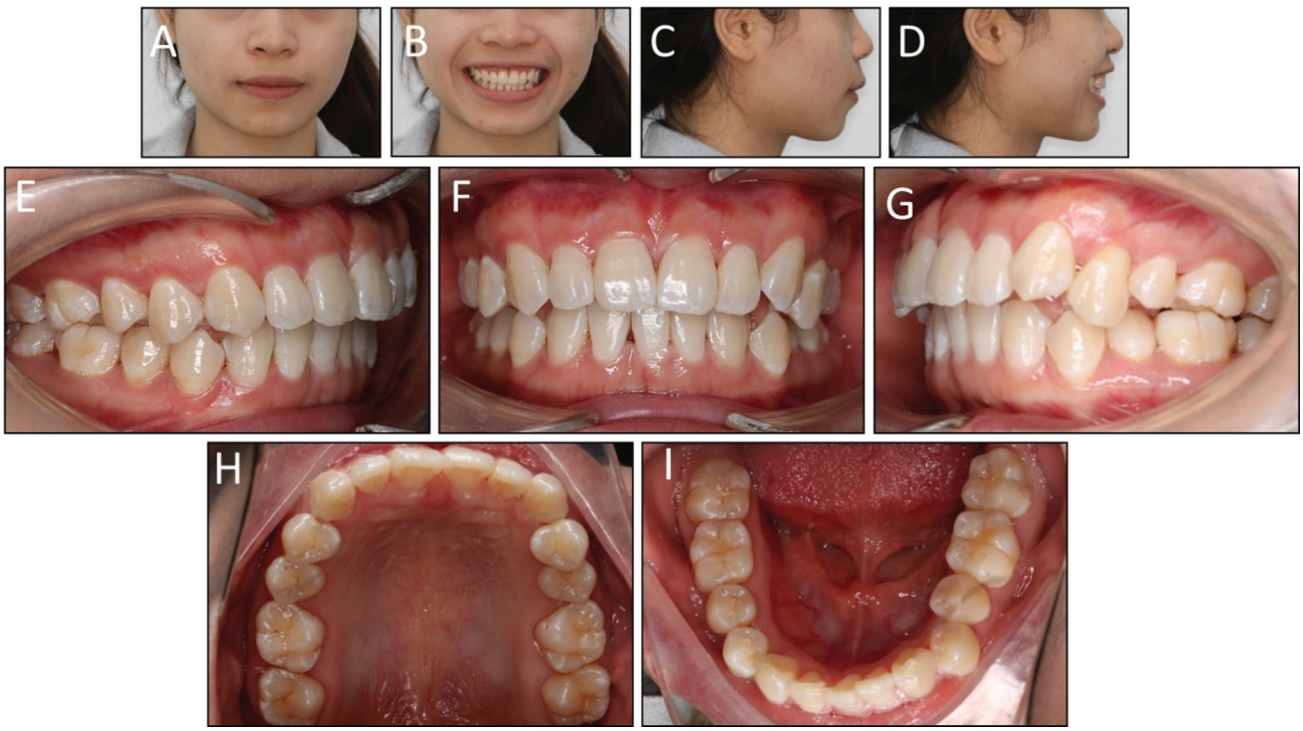


**Fig. 1** Pretreatment extraoral and intraoral photographs: (**A**) frontal, (**B**) frontal smiling, (**C**) lateral, (**D**) lateral smiling, (**E**) right occlusion, (**F**) anterior occlusion, (**G**) left occlusion, (**H**) upper arch, and (**I**) lower arch.

**Table 1** Lateral cephalometric measurements

| Measurements | Pretreatment | Posttreatment | Norm |
|---|---|---|---|
| **Skeletal** | | | |
| SNA (degrees) | 84.7 | 83.8 | 81.1 ± 3.7 |
| SNB (degrees) | 79.6 | 79.7 | 79.2 ± 3.8 |
| ANB (degrees) | 5.2 | 4.1 | 2.5 ± 1.8 |
| FMA (degrees) | 22.9 | 22.1 | 25.0 ± 4.0 |
| A to N perpendicular (mm) | 1.8 | 1.2 | 0.4 ± 2.3 |
| **Dental** | | | |
| Upper incisor/SN (degrees) | 102.6 | 96.5 | 105.3 ± 6.6 |
| Upper incisor/NA (degrees) | 17.8 | 12.7 | 22.0 ± 5.0 |
| Upper incisor/NA (mm) | 4.6 | 1.9 | 4.0 ± 3.0 |
| IMPA (degrees) | 99.7 | 95.2 | 90.0 ± 3.5 |
| Lower incisor/NB (degrees) | 29.3 | 23.2 | 25.0 ± 5.0 |
| Lower incisor/NB (mm) | 8.7 | 5.1 | 4.0 ± 2.0 |
| Interincisal angle (degrees) | 127.8 | 137.0 | 128.0 ± 5.3 |
| Upper incisal display (mm) | 1.5 | 1.0 | 2.5 ± 1.5 |
| Overjet (mm) | 3.3 | 2.4 | 2.0 ± 2.0 |
| Overbite (mm) | 2.4 | 1.7 | 2.0 ± 2.0 |
| **Soft tissue** | | | |
| E-line/upper lip (mm) | 4.0 | 2.7 | 0.0 ± 2.0 |
| E-line/lower lip (mm) | 3.4 | 2.0 | 0.0 ± 2.0 |

Abbreviations: ANB, point A-nasion-point B; FMA, Frankfort mandibular angle; IMPA, incisor mandibular plane angle; NA, nasion-point A; NB, nasion-point B; SN, sella-nasion; SN-MP, sella-nasion to mandibular plane; SNA, sella-nasion-point A; SNB, sella-nasion-point B.

lips were protruded relative to the E-line (E-line/upper lip, 4.0 mm; E-line/lower lip, 3.4 mm; ►**Table 1**). The panoramic radiograph confirmed the missing third molars and lower right central incisor (►**Fig. 2**). The diagnosis was a skeletal maxillary protrusion and mandibular dentoalveolar protrusion on dental class I and skeletal class II relationships.

## Treatment Plan

The main treatment objective was to move the upper and lower front teeth backward to reduce the prominence of the lips and improve the patient's facial profile. Other treatment objectives were to retract the upper and lower incisors to reduce lip protrusion, to eliminate crowding in the lower arch, to correct the mesial inclination of the upper second premolars and first molars, to preserve class I canine and molar relationships, to establish normal overbite and overjet, and to correct the lower dental midline deviation.

The first treatment option was an orthodontic-orthognathic comprehensive treatment in which the orthodontic phase aimed to reduce the labial inclination of lower incisors, while orthognathic surgery's objectives were to address the skeletal class II relationship and bodily retract upper incisors

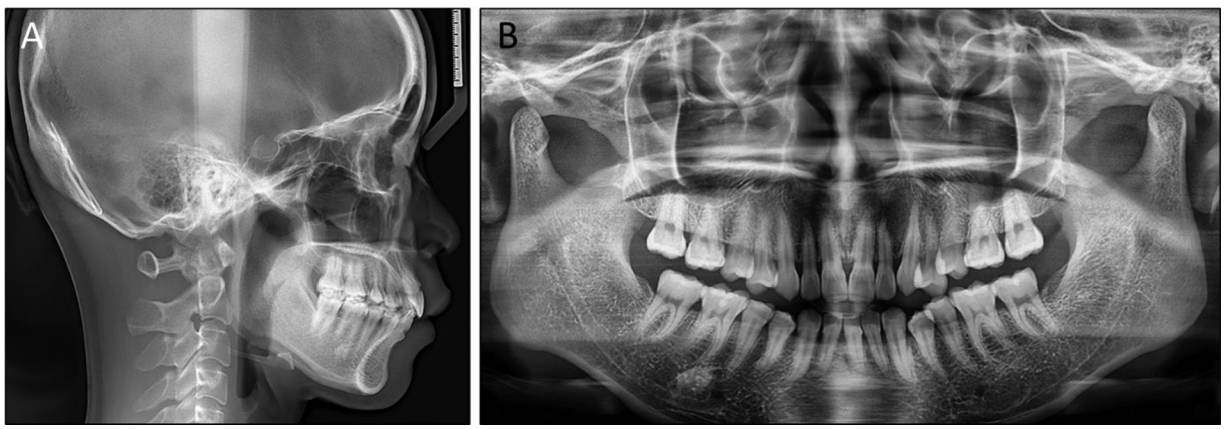


**Fig. 2** Pretreatment radiographs: (**A**) lateral cephalometric radiograph and (**B**) panoramic radiograph.

 

through a maxillary anterior segmental osteotomy. The second treatment option was a nonsurgical orthodontic treatment with removals of two upper first premolars and a lower first premolar to camouflage the skeletal class II relationship and reduce lip protrusion. The upper incisors would be more lingually inclined with the second treatment option compared with the first one because bodily retraction in a limited buccolingual alveolar bone thickness was not feasible. However, the patient did not want any general anesthesia and massive surgical intervention; therefore, the second treatment alternative was selected. The patient elected to extract the lower right first premolar because it had a shorter root compared with the left one. Due to the missing lower right central incisor, the lower left canine and lateral and central incisors would be substituted with the lower left first premolar, canine, and lateral incisor, respectively.

## Treatment Progress

After confirming the treatment plan, a digital impression was taken with an intraoral scanner (i500, Medit, Korea). An orthodontic setup was created and virtual lingual bracket placement was performed utilizing the lingual straight wire concept.[5] Indirect bonding trays were designed and printed based on the method of Nguyen.[6] The treatment commenced by bonding all teeth with 0.018 inch $\times$ 0.025 inch lingual passive self-ligating brackets (Linpass SL, ADB, Korea). Lingual straight archwires were used in the initial leveling and alignment stage with a sequence of 0.012, 0.014, 0.016, and 0.016 inch $\times$ 0.022 inch nickel-titanium wires.

After 6 months of initial leveling and alignment, the patient was sent to an oral surgeon to remove the upper first premolars and lower right first premolar. The space closure stage was initiated by inserting stiff 0.016 inch $\times$ 0.022 inch stainless steel archwires into both arches. To counteract the potential for the incisors to extrude and create a lateral open bite during retraction, the lower archwire was given a reverse curve of Spee, while the upper archwire was shaped with an accentuated curve of Spee. The upper archwire was pre-torqued with 15 degrees in the buccolingual direction to avoid lingual tipping of the upper incisors, which were already uprighted pretreatment, during retraction. Power chains were used to retract the upper and lower incisors. To prevent unwanted mesial movement of the upper posterior teeth during retraction, which hindered the correction of the class II tendency, TADs were placed in the palatal alveolar bone between the upper second premolars and first molars. Retraction force from TADs to crimpable hooks on the archwire provided extra anchorage and control (►**Fig. 3**). These careful biomechanical preparations helped maintain proper vertical control of the teeth throughout the space closure process.

After closing extraction spaces, interproximal reduction was performed on the lower left first premolar and canine to reduce their mesiodistal width as they were wider than the substituted lower canine and lateral incisor. Approximately 0.3 mm of enamel was reduced from each side of the teeth, ensuring that no more than half of the enamel thickness was removed. The space closure stage was completed in 18 months, followed by a 10-month finishing stage, resulting in a total active treatment time of 32 months. After lingual appliance removal, fixed permanent retainers were boned in both arches combined with nighttime-wear clear vacuum-formed retainers to ensure long-term stability.

## Treatment Results

A posttreatment extraoral and intraoral evaluation indicated excellent results with improved facial aesthetics and functional occlusion (►**Fig. 4**). Lip protrusion was significantly reduced, creating a more harmonious profile with a balanced chin projection. The final occlusion exhibited class I canine and molar relationships with ideal overjet, overbite, and solid interdigitation of the teeth. Lower arch crowding was eliminated and mesial inclination of the upper second premolars and first molars was corrected. The lower left canine and lateral incisor were well substituted. All the extraction

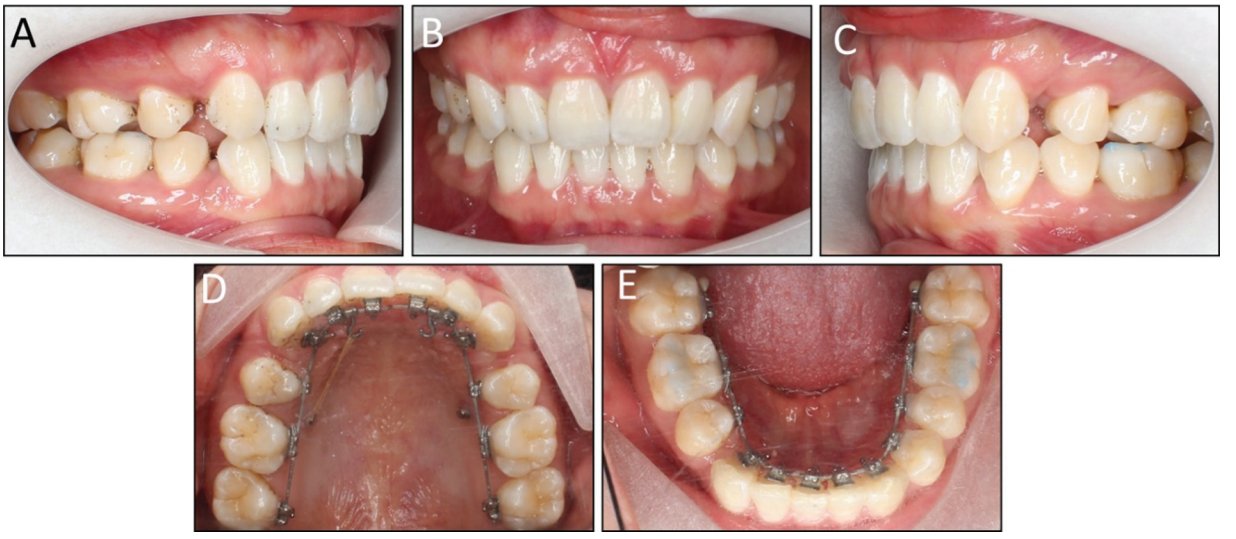


**Fig. 3** Space closure: (**A**) right occlusion, (**B**) anterior occlusion, (**C**) left occlusion, (**D**) upper arch, and (**E**) lower arch.

 

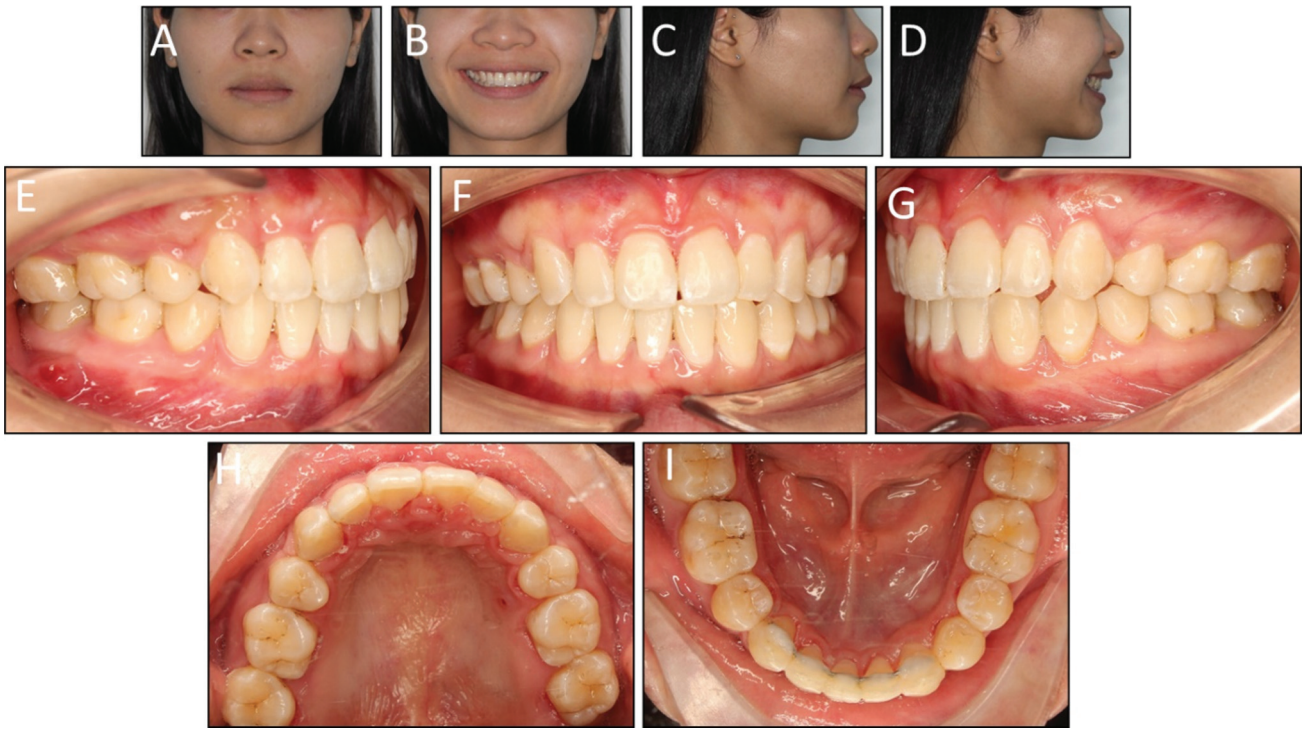


**Fig. 4** Posttreatment extraoral and intraoral photographs: (**A**) frontal, (**B**) frontal smiling, (**C**) lateral, (**D**) lateral smiling, (**E**) right occlusion, (**F**) anterior occlusion, (**G**) left occlusion, (**H**) upper arch, and (**I**) lower arch.

spaces were completely closed. The right-deviated lower dental midline was significantly improved.

A lateral cephalometric evaluation indicated a slight improvement in the skeletal class II relationship (ANB, 4.1 degrees) and protruded maxilla (SNA, 83.8 degrees). The mandibular plane angle was slightly reduced (FMA, 22.1 degrees), suggesting a counterclockwise rotation of the lower jaw. This change likely contributed to the improved chin projection. The lower incisor proclination was reduced (lower incisor/MP, 99.3 degrees) and lip projections significantly improved (E-line/upper lip, 2.7 mm; E-line/lower lip, 2.0 mm). Despite lingual tipping occurring on the upper incisors (upper incisor/SN, 96.5 degrees), torque control of these teeth was acceptable, as their roots approximated the lingual cortical bone (►**Fig. 5**). A panoramic radiograph evaluation demonstrated adequate root parallelism without orthodontic external apical root resorption.

### Follow-Up Results

The patient was reevaluated 1 year after fixed appliance removal. An intraoral evaluation demonstrated the stability of the treatment results (►**Fig. 6**). Tooth alignment was well maintained without recurrence of crowding in the lower arch, thanks to the fixed retainers. Additionally, there was no sign of extraction space reopening.

## Discussion

Although this patient had undergone previous orthodontic treatment, her upper lip protrusion persisted because the

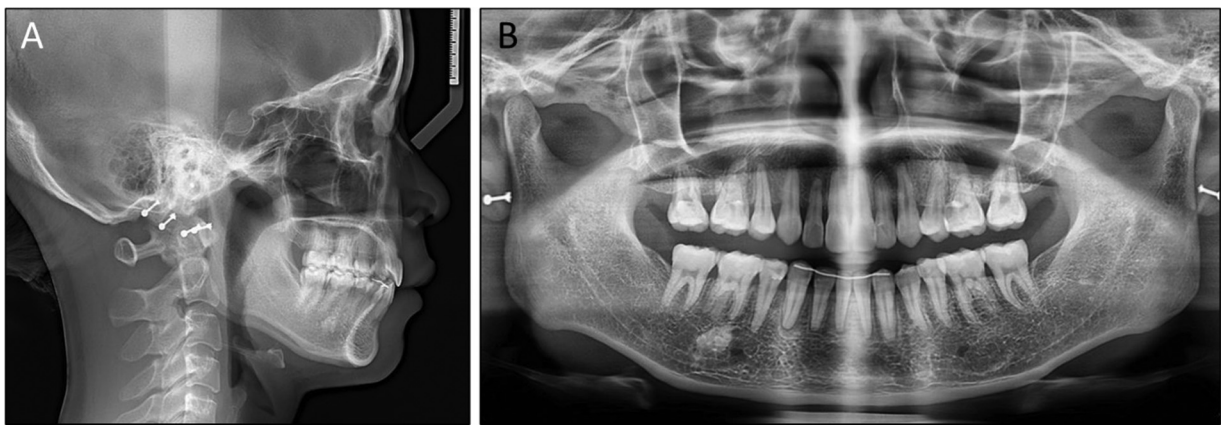


**Fig. 5** Posttreatment radiographs: (**A**) lateral cephalometric radiograph and (**B**) panoramic radiograph.

 

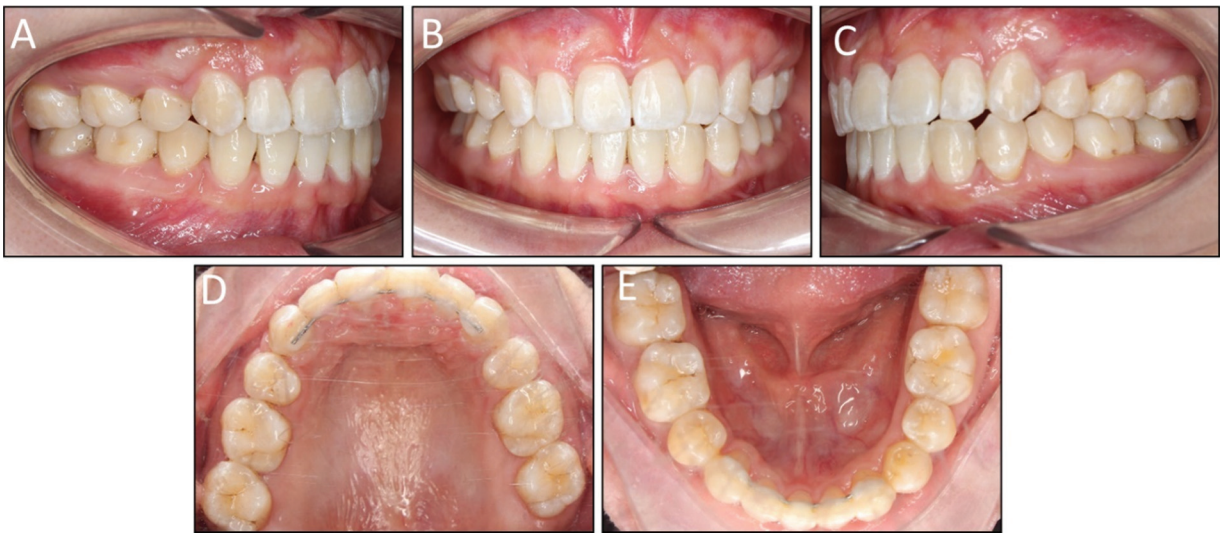


**Fig. 6** One-year postretention intraoral photographs: (**A**) right occlusion, (**B**) anterior occlusion, (**C**) left occlusion, (**D**) upper arch, and (**E**) lower arch.

initial treatment plan did not include premolar extractions in the upper arch, relying solely on the extraction of a lower incisor. The relapse of crowding in the lower arch may be attributed to the lack of a permanent fixed retainer.[7] Additionally, the extraction of a lower incisor in the previous treatment created a significant Bolton discrepancy, where the upper anterior teeth outnumbered the lower anterior teeth.[8] This mismatch in tooth number likely contributed to occlusal instability and a tendency for relapse.[9] The new treatment plan, involving asymmetric extraction of a lower first premolar, reestablished a balanced number of teeth between two arches and improved the Bolton index. This approach aimed to achieve a more stable occlusion with good interdigitation.

While adult patients seeking retreatment often express a preference for clear aligners or lingual appliances, fixed appliances remain the preferred choice for cases involving premolar extractions. This is because fixed appliances offer greater control and predictability of tooth movement, especially in complex space closure, compared with clear aligners, which may have limitations in achieving optimal results.[10] Additionally, for East Asian patients seeking retreatment, protruding teeth are a frequent concern, often stemming from a previous nonextraction treatment approach. Many East Asian women, in particular, desire a less convex profile with teeth that are less prominent. While minor crowding can be resolved without extractions, more complex cases require careful consideration to avoid an unsuitable nonextraction plan. Therefore, an extraction treatment plan is often necessary for adult patients seeking retreatment to correct persistent protrusion. This need for extractions further highlights the advantages of fixed lingual appliances, which offer precise control of tooth movement and address aesthetic concerns.

Lingual brackets, while offering cosmetic advantages, can present unique challenges in cases involving premolar extractions. One of the main difficulties is the tendency for the incisors to tip lingually during the process of retracting them. This occurs because of the difference in how force is applied to the teeth with lingual brackets compared with traditional brackets attached to the labial side. With lingual brackets, the retraction force applied to the incisors is directed in a way that can cause them to tip inward. This is due to the mechanics of lingual orthodontics and how the force interacts with the center of resistance of the teeth. In contrast, traditional labial brackets apply force in a way that generally avoids this tipping effect.

In this particular case, controlling the buccolingual inclination of the upper incisors became significant as they were initially in a more upright position. To overcome this, a combination of strategies was utilized, including special archwires with built-in curves and overcorrection of buccolingual inclination to counteract the tipping tendency and control tooth movement. Through this careful approach, a satisfactory outcome was achieved, with the roots of the upper front teeth positioned correctly within the supporting bone.

Traditional lingual appliances often utilize “mushroom” archwires with offset in-out bends to accommodate the varying widths of anterior teeth, premolars, and molars. However, these bends can impede space closure in cases with premolar extractions because they prevent the archwire from sliding freely. Additionally, the bends in these archwires can compromise their stiffness, potentially leading to distortion during treatment.[11] In contrast, newer lingual straight archwires simplify space closure and eliminate the need for archwire replacement, as they prevent the bends from contacting the posterior lingual brackets during tooth movement.[12]

## Conclusions

This case report highlights the successful retreatment of an adult patient with lip protrusion and relapse of lower arch crowding. The initial treatment, which involved extraction of a lower incisor, failed to address the patient’s primary

concern. Through careful planning and the use of straight-wire lingual appliances, combined with premolar extractions, optimal aesthetics and a stable occlusion were achieved. This case demonstrates the effectiveness of lingual appliances in complex retreatment cases, particularly in adults seeking discreet orthodontic solutions. Further research is needed to validate these findings in a larger patient population.

### Ethical Approval

Informed consent was obtained from the patient, and the patient consented to the publishing of all images and clinical data included in the manuscript.

### Data Availability Statement

All data generated or analyzed during this study are included in this manuscript.

### Funding

None.

### Conflict of Interest

None declared.

## References

1 Ben Gassem AA, Aldweesh AH, Alsagob EI, et al. Psychosocial impact of malocclusion and self-perceived orthodontic treatment need among young adult dental patients. Eur J Dent 2023;17(03): 713–719
2 Alhasyimi AA, Suparwitri S, Christnawati C. Effect of carbonate apatite hydrogel-advanced platelet-rich fibrin injection on osteoblastogenesis during orthodontic relapse in rabbits. Eur J Dent 2021;15(03):412–419
3 Santiago RC, da Silva Campos MJ, Vitral RWF, Vieira RA, Nojima LI, Sant'Anna EF. Characteristics of patients seeking orthodontic retreatment. J World Fed Orthod 2022;11(01):36–40
4 Ben Gassem AA. Does clear aligner treatment result in different patient perceptions of treatment process and outcomes compared to conventional/traditional fixed appliance treatment: a literature review. Eur J Dent 2022;16(02):274–285
5 Scisciola F, Palone M, Scuzzo G, Scuzzo G, Huanca Ghislanzoni LT, Lombardo L. Accuracy of lingual straight-wire orthodontic treatment with passive self-ligating brackets and square slot: a retrospective study. Prog Orthod 2023;24(01):30
6 Nguyen VA. 3D-printed indirect bonding trays and transfer jigs for lingual brackets: digital workflows and two case reports. Heliyon 2024;10(11):e32035
7 Quinzi V, Carli E, Mummolo A, De Benedictis F, Salvati SE, Mampieri G. Fixed and removable orthodontic retainers, effects on periodontal health compared: a systematic review. J Oral Biol Craniofac Res 2023;13(02):337–346
8 Shahid F, Alam MK, Khamis MF. Intermaxillary tooth size discrepancy in a Pakistani population: a stereomicroscope versus digital caliper. Eur J Dent 2016;10(02):176–182
9 Berbert M, Cotrin P, Oliveira RCG, et al. The influence of $3 \times 3$ bonded retainer on anterior crowding relapse in mandibular incisor extraction cases. Dental Press J Orthod 2021;26(06): e212081
10 Song JH, Lee JH, Joo BH, Choi YJ, Chung CJ, Kim KH. Treatment outcome comparison of Invisalign vs fixed appliance treatment in first premolar extraction patients. Am J Orthod Dentofacial Orthop 2024;165(04):399–413
11 Lombardo L, Carlucci A, Palone M, Mollica F, Siciliani G. Stiffness comparison of mushroom and straight SS and TMA lingual archwires. Prog Orthod 2016;17(01):27
12 Fillion D. The lingual liberty system: advantages of a digital lingual straight wire system. Semin Orthod 2018;24(03):286–296

 