

## Case Report

# Buccal corridor and gummy smile treatment with MARPE and gingivoplasty: A 2-year follow-up case report

Viet Hoang<sup>1</sup> , Phuoc Hong Tran<sup>2</sup>, Thao Thi Nhu Dang<sup>1</sup>

<sup>1</sup>Department of Orthodontics and Pedodontics, Faculty of Dentistry, Van Lang University, Ho Chi Minh City, <sup>2</sup>Department of Oral Surgery, SaiGon Dental Private Hospital, Ho Chi Minh City, Vietnam.



### \*Corresponding author:

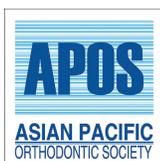
Viet Hoang,  
Department of Orthodontics  
and Pedodontics, Faculty of  
Dentistry, Van Lang University,  
Ho Chi Minh City, Vietnam.

[viet.h@vlu.edu.vn](mailto:viet.h@vlu.edu.vn)

Received: 29 September 2023  
Accepted: 15 January 2024  
Epub Ahead of Print: 22 February 2024  
Published:

DOI  
[10.25259/APOS\\_216\\_2023](https://doi.org/10.25259/APOS_216_2023)

### Quick Response Code:



## ABSTRACT

The advent of Mini-screws assisted rapid palatal expansion (MARPE) has introduced a simpler in-office procedure that enables the translation of the alveolar process in adults. This case report showed the combination of MARPE, orthodontic treatment, and gingivoplasty to correct malocclusion and enhance smile aesthetics. A 20-year-old woman expressed concerns about excessive buccal corridors and a gummy smile. She exhibited skeletal class I malocclusion, with buccal corridors exceeding 4 mm, a gummy smile, and lingual tipping of the lower posterior segments. The treatment plan involved utilizing the MARPE appliance, a Nitinol wire, gingivoplasty to address the gummy smile. Retention evaluations demonstrated the stability of MARPE in transversal skeletal discrepancies. There was notable improvement in incisor inclination and soft tissue profile, particularly evident in the E-line and nasolabial angle. Cephalometric analysis confirmed these changes, showing a decrease of 5.9 degrees in the inclination of the maxillary incisors. After a 2-year follow-up, the results remain stable, and the patient expresses satisfaction with the outcome. MARPE can be considered as an effective tool for managing buccal corridors, complemented by fixed orthodontic treatment employing labial appliances and gingivoplasty to correct malocclusion and enhance smile aesthetics. The treatment showed positive long-term outcomes.

**Keywords:** MARPE, gummy smile, gingivoplasty, expansion, mini-screws, miniscrew-assisted rapid palatal expansion

## INTRODUCTION

Smiling has a significant impact on the satisfaction of individuals, it is related to skeletal, dental, and soft-tissue problems.<sup>[1]</sup> Common factors have negative impacts on the beauty of a smile, such as buccal corridor, maxillary central incisor crown width to height ratio, maxillary lateral to central incisor ratio, maxillary midline to face, maxillary to mandibular midlines, the teeth alignment, canine and posterior crown torque, incisal edge discrepancy, and maxillary gingival display.<sup>[2]</sup>

Buccal corridors as the spaces between the anterior surfaces of the posterior teeth and the corners of the lips when the patient is smiling. Having small buccal corridors is considered an attractive characteristic for both males and females. Significant buccal corridors should be identified as an issue during the diagnosis and planning stages of orthodontic treatment.<sup>[3,4]</sup> Significant

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, transform, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

©2024 Published by Scientific Scholar on behalf of APOS Trends in Orthodontics

buccal corridors in adult patients were commonly addressed through orthognathic surgery or surgically assisted rapid palatal expansion.<sup>[5-7]</sup> However, the inherent surgery risks, high costs, long-term hospitalization, and attendant morbidity are huge concerns for patients to undergo these procedures.<sup>[8]</sup>

To overcome those drawbacks, miniscrew-assisted rapid palatal expansion (MARPE) was developed.<sup>[9,10]</sup> MARPE has two variants, a tooth-bone borne or a solely bone-borne device with a rigid component linking to mini-screws implanted into the palate, enabling the direct expansion force to the basal bone of the maxilla. It was designed to maximize skeletal effects because the incomplete ossification of the mid-palatal suture in humans, even among older individuals, is demonstrated through recent histological research.<sup>[10]</sup> Therefore, MARPE is considered a non-surgical treatment for maxillary transverse deficiency.

Expression, symmetry, and appearance of the teeth and gingival display also have significant impacts on smile attractiveness. Many patients who require orthodontic treatment are motivated by dental esthetics.<sup>[11]</sup> The gummy smile is related to the visibility of an excessive amount of gingiva during smiling. The major etiological factors consist of a short upper lip, hyperactive upper lip, skeletal conditions, or altered passive eruption.<sup>[12]</sup> This study aimed to describe a successful case report regarding the treatment of buccal corridor and gummy smile by MARPE appliance, Niti wire bending, and gingivoplasty.

## CASE REPORT

The 20-year-old female patient presented with a chief complaint of protruding lips, maxillary and mandibular incisors that were proclined, a gummy smile, and an excessive buccal corridor [Figure 1].

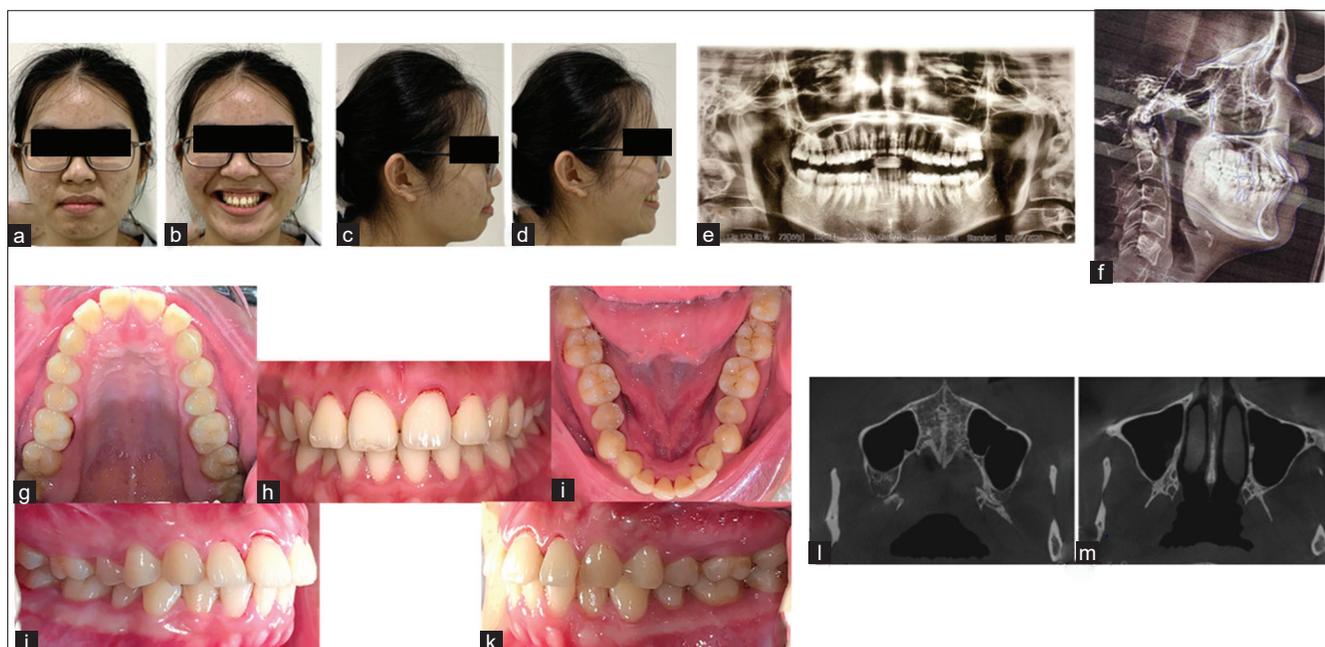
### Clinical findings

#### Soft tissue

- Convex profile
- Acute nasolabial angle
- Strain on circumoral muscle when closing the mouth (no temporomandibular joint symptoms).

#### Dental

- Molar relationship: Class I
- Canine relationship: Class II (both sides)
- Archform:
  - Upper: Severely narrow
  - Lower: Severely narrow, especially due to lingually inclined molars
- Lower arch:
  - 6 mm crowding
  - Flat curve of Spee
- Bolton discrepancy:
  - Anterior: 3-3:82.7% (reduced)
  - Posterior: 91.8% (normal)
- Midline: Upper and lower coincident with facial midline.



**Figure 1:** (a-d) initial extraoral, (g-k) intraoral photographs, (e and f) panoramic and lateral cephalometric X-rays, (l and m) cone beam computed tomography (CBCT) scans.

**Skeletal**

- Skeletal jaw relationship: Class I
- Maxilla and mandible: Relatively normal position (SNA 82.4°, SNB 79°, and ANB 3.4°)
- Lower facial height: Reduced (FMA 21.4°).
- Incisor angulation
  - Upper: Proclined (U1-SN 121.7°)
  - Lower: Proclined (L1-MP 100.8°).

**Diagnostic assessment****Lip position assessment**

- Upper and lower lips protrusive
- Both lips anterior to E-line
- Smile: Gummy smile
- Buccal corridors: Present.

**Dental assessment**

- Molar relation: Class I
- Canine relation: Class II (both sides)
- Arch form:
  - Upper: Transverse deficiency with severe narrowing
  - Lower: Severe narrowing with mild crowding
- Dental discrepancy: Bolton tooth size discrepancies
- Incisor angulation:
  - Upper and mandibular incisors proclined.

**Skeletal**

- Class I jaw relationship
- Reduced lower facial height.

**Treatment objectives**

The objectives were to fix skeletal Class I malocclusion, with buccal corridors exceeding 4 mm, a gummy smile, and lingual tipping of the lower posterior segments.

**Potential alternative treatments**

In discussions with the patient regarding this case, we presented several treatment options, including the choice between the current treatment plan and extraction/distalization combined with the intrusion of the entire upper arch. However, the patient expressed concerns about the buccal corridor and preferred not to pursue the option involving the intrusion of the whole upper arch. Consequently, she opted for the treatment involving MARPE and gingivoplasty following the treatment process.

In the case of vertical maxillary excess, intrusion using temporary anchorage devices can be employed. Severe instances may require orthognathic surgery as part of the treatment.

**Treatment timeline**

- First stage: MARPE appliance (three weeks)
- Second stage: Fixed appliance with metal brackets (18 months)
- Third stage: Gingivoplasty after one month of debonding

**Treatment progress**

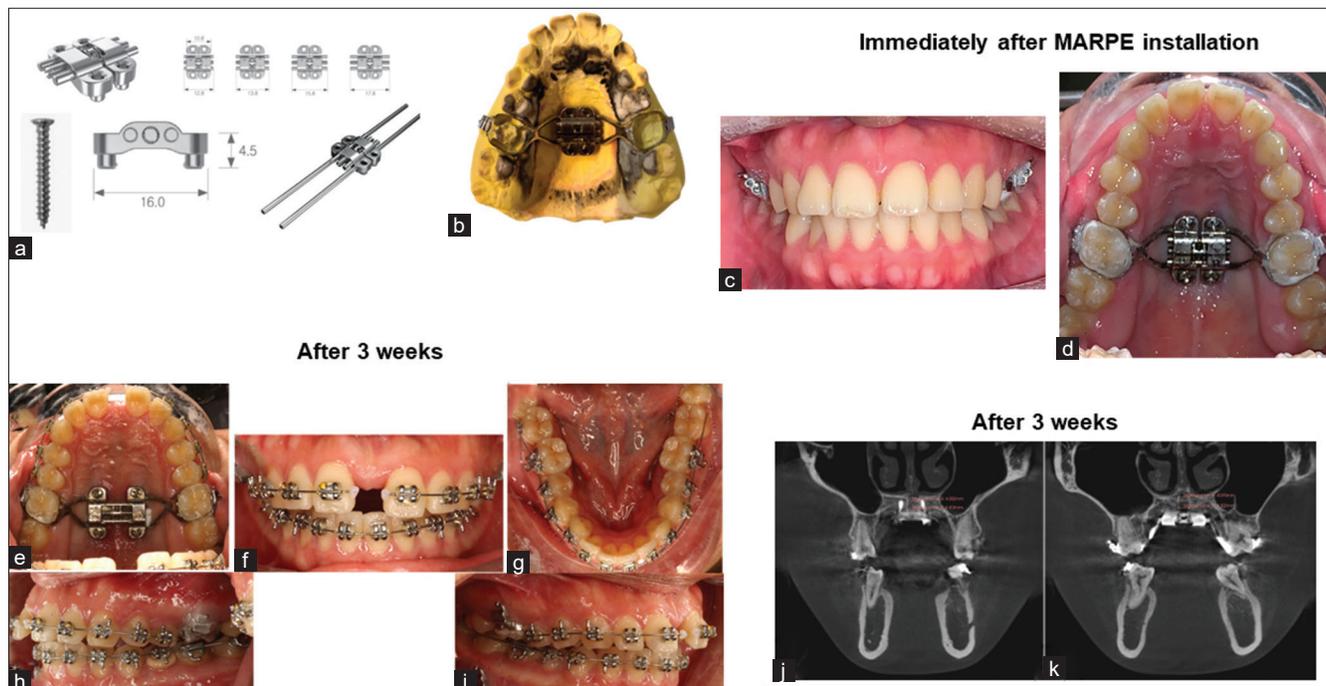
The initial step involved the installation of the MARPE appliance, using a tooth-bone-born design. Teeth separators were placed mesiodistally of the U6s. One week later, the bands were fitted, and an impression was made to create the MARPE with an 8 mm body. The appliance was cemented in place a week later, and 4 mini-screws (1.8 × 12 mm) were inserted through the body of the MARPE. These screws were guided by four holes in the MARPE body, positioned between the second premolar and first molar, with two mini-screws installed at the back with bicortical support.

The braces were bonded on the same day, and a 0.014 Nitinol wire was inserted in both the upper and lower arches. During treatment, upper archwires were utilized for both upper and lower arches. The lower archwire was expanded in the posterior sector to aid the uprighting process, along with lingual buttons and a ¼ 3.5 oz cross elastic for facilitation.

The MARPE was expanded at a rate of 0.25 mm/turn, with an activation pattern of six turns on the first day, followed by two turns in the morning and evening until spacing occurred between 11 and 21 (on the fifth day). Subsequently, one turn was applied in the morning and evening until 4 mm of palatal expansion was achieved. Post-expansion, the MARPE was retained in place for eight months to allow for retention and palatal suture bone remodeling. Moreover, on the first day of bracket bonding, the upper wire was cut between 11 and 21.

In the second stage, after three weeks of MARPE, a continuous archwire and thread elastic were introduced to initiate the closure of the space. The upper cutting remained separated into two segments during the entire MARPE phase, and continuous wires were employed thereafter. When reaching the Nitinol 0.016 × 0.022 stage, a V bend was added between 11 and 21 to facilitate a translation movement while closing the space. For the finishing stage and addressing Bolton discrepancies, interproximal reduction (IPR) was performed on the lower anterior from distal 33 to distal 43 using IPR blades of 0.1 mm, 0.2 mm, and 0.3 mm, followed by fluor polishing. Post this, a 0.017 × 0.025 SS wire on the upper and 0.020 SS wire on the lower, along with Class II elastics (1/8 3.5), were utilized from L6s to U3s to correct the dental Class II relationship [Figures 2 and 3].

In the last stage, gingivoplasty was conducted, involving smile design before treatment presentation to the patient and guidelines for the gingivoplasty procedure. The



**Figure 2:** (a) MARPE appliance, and (b) MARPE design, (c and d) immediately after MARPE installation, (e-i) three weeks after MARPE installation, and (j and k) cone beam computed tomography (CBCT) scans three weeks after MARPE installation; MARPE: miniscrew-assisted rapid palatal expansion.



**Figure 3:** MARPE: miniscrew-assisted rapid palatal expansion.

process involved 2 mm gum cutting, flap opening for gum recontouring, alveolar bone trimming, and closure using medical sutures [Figure 4]. Finally, the Essix appliance was used for the retention protocol, with full-time wear in the first year and in the evenings from the second year onward.

### Treatment results

All treatment objectives were successfully met, resulting in a well-aligned dentition and improved facial esthetics. The expansion of the mid-palatal suture reached 4 mm with minimal buccal crown tipping of the upper posterior teeth. Retraction of both upper and lower incisors effectively corrected severe overjet, utilizing the space created from the MARPE expansion.

The achieved outcomes include the maintenance of a Class I molar relationship and a slight Class II relationship on the canines, attributed to tooth size discrepancies; however, the occlusion is considered acceptable. The maxilla was expanded through MARPE, whereas the mandibular intra-arch width experienced slight expansion due to molar uprighting, as evidenced in cone-beam computed tomography (CBCT) scans [Figure 2].

Throughout the treatment, the retraction of both upper and lower lips facilitated a passive lip seal, contributing to a notably straight profile post-treatment. Minimal root resorption was observed, with good root parallelism achieved across most teeth, aside from tooth 44. There was a notable improvement in incisor inclination and soft-tissue profile, particularly evident in the E-line and nasolabial angle. Cephalometric analysis confirmed these changes, showing a decrease of 5.9° in the inclination of the maxillary incisors [Figures 4-7 and Table 1].

After a 2-year follow-up, the results remain stable, and the patient expresses satisfaction with the outcome [Figure 8].

### DISCUSSION

This case report demonstrates a successful compensatory treatment of the buccal corridor and gummy smile with MARPE, Nickel-titanium (Niti) wire bending, and gingivoplasty.

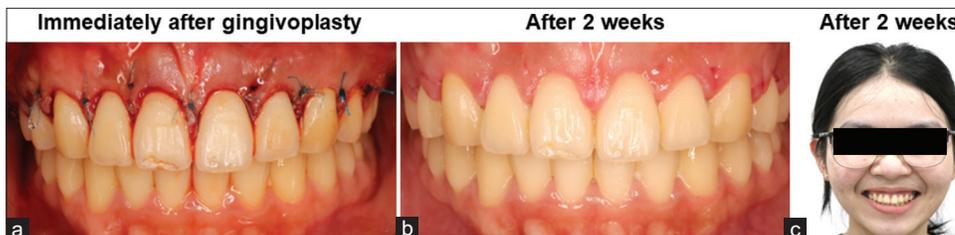


Figure 4: (a) Immediately after gingivoplasty, and (b,c) two weeks after gingivoplasty.



Figure 5: Niti bending (V bend on 16 22 Niti between 11 21 and elastic thread for closing diastema), Niti: Nickel-titanium.

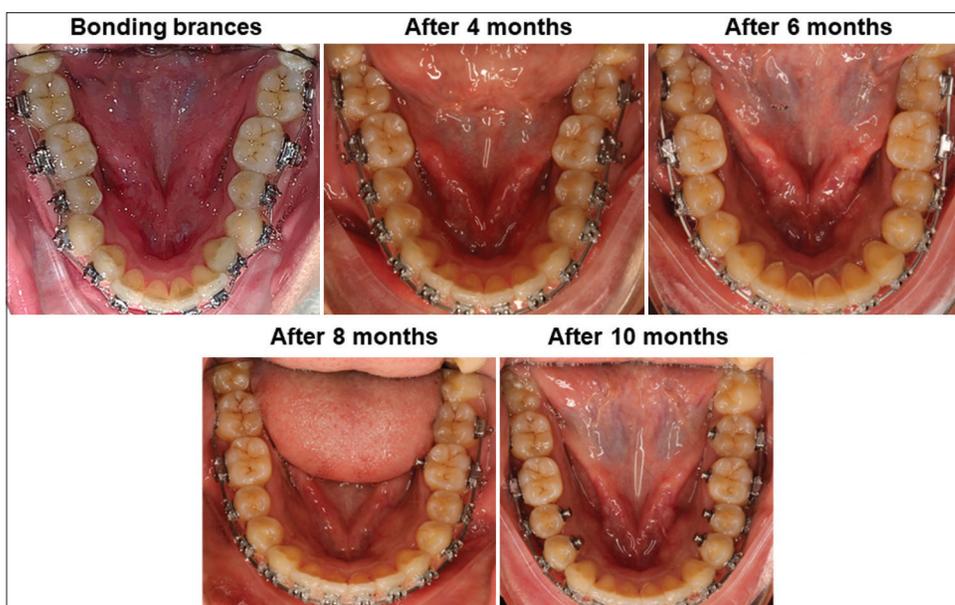
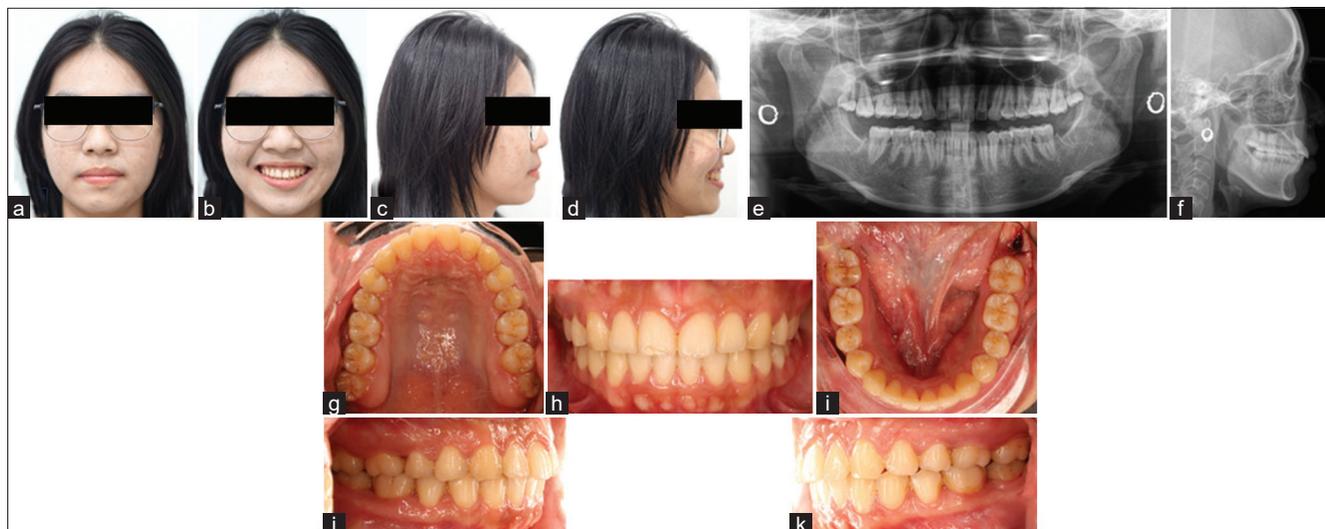


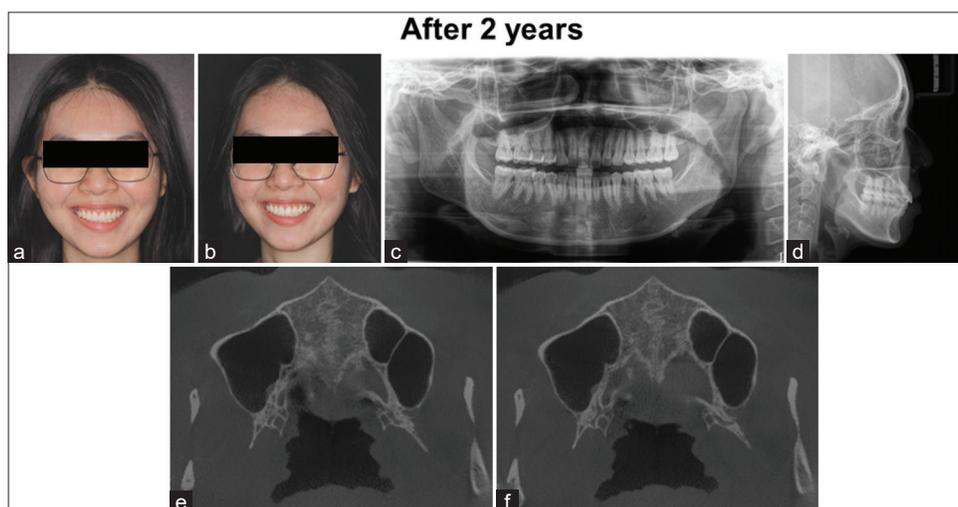
Figure 6: Nickel-titanium (Niti) bending for buccal tipping posterior lower teeth.

The purpose was to expand the mid-palatal suture and address the buccal crown tipping of the lower posterior, aiming to reduce the issue of excessive buccal corridor and enhance the esthetic appearance of the smile. MARPE was considered a suitable choice for this case due to the normal crown torque of the upper posterior teeth, the need for an

interproximal reduction on the lower anterior teeth, and the implementation of Class II elastics to reduce the proclination of the upper incisors, ultimately aiming to achieve a favorable occlusion. As the gummy smile originated from a gingival-based cause, surgery was selected as the treatment method. The CBCT revealed that the intermaxillary suture was at a



**Figure 7:** (a-d) post-treatment extraoral, (e, f) panoramic and lateral cephalometric X-rays, (g-k) intraoral photographs.



**Figure 8:** (a-b) two years after treatment: extraoral, (c-d) panoramic and lateral cephalometric X-rays, and (e-f) cone-beam computed tomography (CBCT) scans.

stage B maturation level (the scalloped appearance of the high-density sutural line),<sup>[13]</sup> which has been linked to a high success rate with MARPE. However, some molar tipping occurred due to the appliance being tooth-bone-borne rather than bone-borne. Utilizing a MARPE appliance, a degree of buccal tipping is anticipated, despite significantly less compared to rapid palatal expansion (RPE), as teeth continue to serve as anchor units alongside mini-screws. The tendency for buccal tipping is directly linked to the resistance exerted by the mid-palatal suture.

Finally, to optimize the cosmetic outcome, an adjunctive procedure involving gingivoplasty was recommended post-

treatment. Gingivoplasty was selected as the treatment choice due to the presence of altered passive eruption as the etiology, coupled with a favorable positioning of the incisal edge concerning the lower lip.

Research conducted by Gurgel *et al.*<sup>[14]</sup> and Christie *et al.*<sup>[15]</sup> has similarly highlighted a certain level of buccal tipping. Previous studies have suggested more pronounced alterations in molar inclination compared to premolars.<sup>[16]</sup> This greater buccal inclination observed in the first molar, as opposed to the first premolar, could potentially be attributed to the increased density of the buccal cortical bone in the maxillary canine and premolar areas.<sup>[17-19]</sup>

**Table 1:** Comparison of cephalometric measurement between pre-and post-treatment

Measurement	Normal	Pre-treatment	Post-treatment	
SNA (°)	78–82	82.4	82.4	Skeletal
SNB (°)	76–82	79	78.2	
ANB (°)	0–4	3.4	4.1	
A-N Perp FH (mm)	–1.9–2.7	2.8	3.1	
B-N Perp FH (mm)	–5.5––1.5	–0.6	–1.7	
FMA (°)	25	24.4	23.7	
Y-Axis (°)	59 (53–63)	60.4	60.2	
U1-SN (°)	104	121.7	114.8	Dental
U1-NA (mm/°)	4/22	8/39	4.5/32.4	
U1-MaxP (°)	110–116	127.9	122	
U1-L1 (°)	131	102.6	112.5	
L1-NB (mm/°)	4/25	8.7/34.8	6.4/31	
L1-MP: IMPA (°)	90	100.8	98.2	
UL-E line (mm)	–4––1	–1.3	–2	Soft tissue
LL-E line (mm)	–2–0	0.7	0.4	

ANB: A point, nasion, B point, FMA: Frankfort mandibular plane angle, IMPA: Incisor mandibular plane angle, L1: Lower central incisor, LL: Lower lip, MP: Mandibular plane, MaxP: Maxillary plane, NA: Nasion point A, NB: Nasion point B, SN: Sella nasion, SNA: Sella nasion point A, SNB: Sella nasion point B, U1: Upper central incisor, UL: Upper lip, E-line: A line connects the nose tip to the chin, A to N Perp FH: Distance between point A to Nasion perpendicular Frankfort plane (FH), B to N Perp FH: Distance between point B to Nasion perpendicular Frankfort plane.

## CONCLUSION

Utilizing bicortical mini-screws in MARPE has been shown to be an effective method in addressing buccal corridors. In addition, combining fixed orthodontic treatment with labial appliances and gingivoplasty has proven to be successful in correcting malocclusion and improving smile esthetics, demonstrating lasting and stable outcomes.

## Ethical approval

The Institutional Review Board has waived the ethical approval for this study.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the

writing or editing of the manuscript and no images were manipulated using AI.

## REFERENCES

- De Oliveira AT, Paes-Souza SA, Garcia MA, Mattos CT, Nojima MC. Therapeutic effects of botulinum toxin type A in subjects with gummy smile: A longitudinal sEMG approach. *Int Orthod* 2021;19:652-8.
- Kaya B, Uyar R. Influence on smile attractiveness of the smile arc in conjunction with gingival display. *Am J Orthod Dentofacial Orthop* 2013;144:541-7.
- Moore T, Southard KA, Casco JS, Qian F, Southard TE. Buccal corridors and smile esthetics. *Am J Orthod Dentofacial Orthop* 2005;127:208-13.
- Gracco A, Cozzani M, D'Elia L, Manfrini M, Peverada C, Siciliani G. The smile buccal corridors: Aesthetic value for dentists and laypersons. *Prog Orthod* 2006;7:56-65.
- Shetty SK, Neeraj NS, Kumar YM, Madhur VK. Surgically assisted rapid palatal expansion (SARPE): A literature review. *Sch J Dent Sci* 2021;8:25-40.
- Gauthier C, Voyer R, Paquette M, Rompré P, Papadakis A. Periodontal effects of surgically assisted rapid palatal expansion evaluated clinically and with cone-beam computerized tomography: 6-month preliminary results. *Am J Orthod Dentofacial Orthop* 2011;139:S117-28.
- Suri L, Taneja P. Surgically assisted rapid palatal expansion: A literature review. *Am J Orthod Dentofacial Orthop* 2008;133:290-302.
- Carvalho PH, Moura LB, Trento GS, Holzinger D, Gabrielli MA, Gabrielli MF, et al. Surgically assisted rapid maxillary expansion: A systematic review of complications. *Int J Oral Maxillofac Surg* 2020;49:325-32.

9. Machado AW, Briss B, Huang G, Kulbersh R, Caldas SR. An interview with Won Moon. *Dental Press J Orthod* 2013;18:12-28.
10. Lee KJ, Park YC, Park JY, Hwang WS. Miniscrew-assisted nonsurgical palatal expansion before orthognathic surgery for a patient with severe mandibular prognathism. *Am J Orthod Dentofacial Orthop* 2010;137:830-9.
11. Pithon MM, Nascimento CC, Barbosa GC, Coqueiro RS. Do dental esthetics have any influence on finding a job? *Am J Orthod Dentofacial Orthop* 2014;146:423-9.
12. Ramesh A, Vellayappan R, Ravi S, Gurumoorthy K. Esthetic lip repositioning: A cosmetic approach for correction of gummy smile - a case series. *J Indian Soc Periodontol* 2019;23:290-4.
13. Angelieri F, Cevidanes LH, Franchi L, Gonçalves JR, Benavides E, McNamara JA Jr. Midpalatal suture maturation: Classification method for individual assessment before rapid maxillary expansion. *Am J Orthod Dentofacial Orthop* 2013;144:759-69.
14. Gurgel JA, Tiago CM, Normando D. Transverse changes after surgically assisted rapid palatal expansion. *Int J Oral Maxillofac Surg* 2014;43:316-22.
15. Christie KF, Boucher N, Chung CH. Effects of bonded rapid palatal expansion on the transverse dimensions of the maxilla: A cone-beam computed tomography study. *Am J Orthod Dentofacial Orthop* 2010;137:S79-85.
16. Moon SH, Park SH, Lim WH, Chun YS. Palatal bone density in adult subjects: Implications for mini-implant placement. *Angle Orthod* 2010;80:137-44.
17. Corbridge JK, Campbell PM, Taylor R, Ceen RF, Buschang PH. Transverse dentoalveolar changes after slow maxillary expansion. *Am J Orthod Dentofacial Orthop* 2011;140:317-25.
18. Rungcharassaeng K, Caruso JM, Kan JY, Kim J, Taylor G. Factors affecting buccal bone changes of maxillary posterior teeth after rapid maxillary expansion. *Am J Orthod Dentofacial Orthop* 2007;132:428.e1-8.
19. Garib DG, Henriques JF, Janson G, de Freitas MR, Fernandes AY. Periodontal effects of rapid maxillary expansion with tooth-tissue-borne and tooth-borne expanders: A computed tomography evaluation. *Am J Orthod Dentofacial Orthop* 2006;129:749-58.

**How to cite this article:** Hoang V, Tran PH, Dang TT. Buccal corridor and gummy smile treatment with MARPE and gingivoplasty: A 2-year follow-up case report. *APOS Trends Orthod*. doi: 10.25259/APOS\_216\_2023