

Case Report

The Influence of Biologic Width on Altered Passive Eruption Treatment

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ABSTRACT

Introduction: Altered passive eruption (APE) is a condition in which the relationship between teeth, alveolar bone, and soft tissues creates an excessive display of gingiva, generally known as a gummy smile. Coslet classified APE into four case types, based on the gingival and osseous relationships. The treatment options can be determined based on its classification and considering the concept of biologic width.

Case: This case report presents two cases of APE type 1A. The first case is a 36-year-old, systemically healthy, non-smoking female with a complaint of gummy smile after orthodontic treatment five years ago. The second case is a 19-year-old, systemically healthy, non-smoking female with a complaint of short teeth and uneven gingival margins.

Case Treatment: The first case was treated with a combination of soft and hard tissue crown lengthening, while the second case was treated with only soft tissue crown lengthening.

Discussion: Various crown lengthening techniques must be carried out without disturbing the biologic width. In the first case, although based on the examination it was classified as APE type 1A with gingivectomy treatment, there was a change in the gingival margin position so the distance to the crest of the alveolar bone was < 3 mm. Therefore, flap elevation and ostectomy were performed.

Conclusion: In treating APE, biologic width is one of the most important factors to be considered, along with the amount of attached gingiva and the distance of the alveolar crest to the CEJ. Maintaining biologic width is crucial for gingival health and stable treatment outcomes.

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INTRODUCTION

According to the American Academy of Periodontology's Glossary of Periodontal Terms, passive eruption is defined as tooth exposure caused by the gingival margin migrating apically to a site near the cemento-enamel junction (CEJ). Any interference with this process prevents the gingival margin from migrating apically, which is referred to as altered passive eruption (APE).¹ Clinically, APE is characterized by the gingival margin position, which is located more coronal to the tooth crown; as a result, the teeth appear short and boxy, and the gingival display becomes excessive when smiling, also known as the gummy smile. In addition to causing aesthetic problems, this condition can also promote plaque accumulation and hinder oral cleaning procedures, so treatment is necessary.²

Altered passive eruption is morphologically classified by Coslet et al. into two types based on the location of the mucogingival junction to the alveolar bone crest, and two subtypes based on the position of the alveolar bone crest to the CEJ.³ In type 1, in addition to the gingival margin, which is located more coronal than the CEJ, there is a sufficient amount of keratinized gingiva (≥ 2 mm), but in type 2, the amount of keratinized gingiva is less than normal (< 2 mm). While in subtype A, the distance of the alveolar bone crest to the CEJ is normal (1-2 mm), whereas in subtype B, the alveolar bone crest is at the CEJ.⁴

Treatment of gummy smile associated with APE can be done with crown lengthening, which is a surgical procedure that aims to reduce the excessive gingival display, increase in clinical crown height, and reshape the biologic width precisely. Crown lengthening techniques consist of gingivectomy and apically positioned flap, with or without bone resection.⁵ The crown lengthening technique options can

be determined based on its classification and considering the concept of biologic width.⁶

Gargiulo et al.⁸ described the biologic width as the physiological dimension of the dentogingival junction, namely the junctional epithelium and connective tissue attachment over the crest of the alveolar bone, which is approximately 2.04 mm.⁷ Recently, biologic width is also called supracrestal tissue attachment.⁸ The presence of a biological width is important for adhesion of the junctional epithelium and tissue insertion into the tooth structure. It also acts as a barrier to microbial entry into the periodontal tissues. Therefore, in restorative procedures, including crown lengthening, biologic width needs to be considered to maintain healthy periodontal tissue.⁹ This case report presents the management of two cases of APE type 1A with crown lengthening based on biologic width.

CASE

Case 1

A 36-year-old woman complained that her front teeth looked small and short when she smiles. (Figure 1a). Based on the anamnesis, it is known that the patient had worn braces more than 10 years ago to fix her protrusive teeth. The patient has never worn a retainer currently. The patient's oral hygiene was good; there was no history of systemic disease or bad habits.

On intraoral examination, it was found that teeth 14, 24, 34, and 46 had been extracted for orthodontic treatment. The crowns of teeth 15 - 25 appeared short, and the dimensions of the attached gingiva were adequate (Figure 1b). Panoramic radiograph showed the crest of the alveolar bone was apical to the CEJ. (Figure 1c). According to Coslet et al., this condition is classified as APE type 1A.³

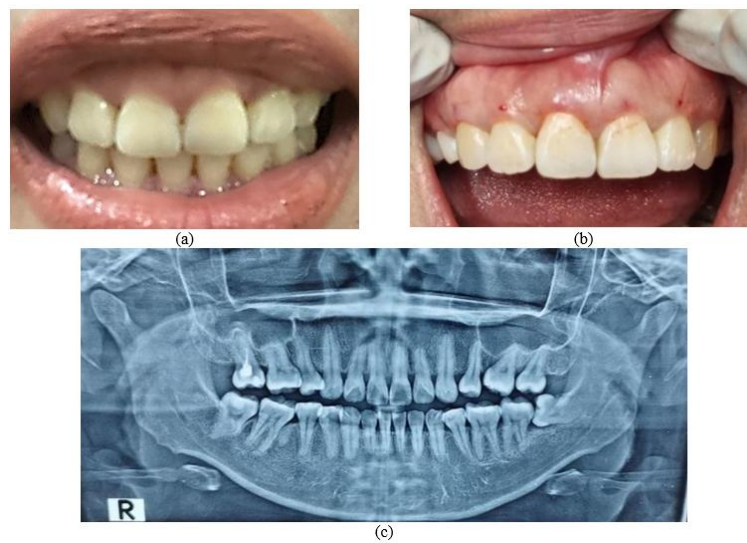


Figure 1.(a). Patient's gummy smile (b). Adequate attached gingiva (c). Panoramic radiograph

Periodontal examinations, including bone sounding, were also performed on the labial aspect of the teeth at 3 sites (Figure 2a). A study model was made to create a design of the new gingival margin (Figure 2b) with the Chu Aesthetic Gauge

tool (Hu-Friedy) and to create a surgical template (Figure 2c). From the examinations (Table 1), gingivectomy and ostectomy are the treatment options to improve the patient's condition.

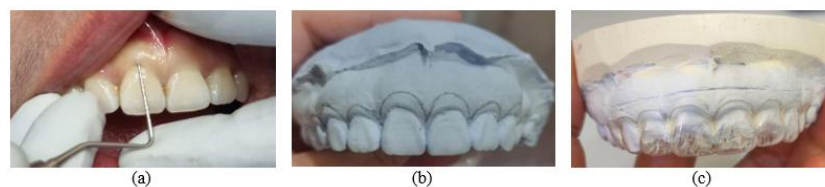


Figure 2. (a). Bone sounding (b). Gingivectomy design (c). Surgical template for gingivectomy

Table 1. Periodontal examination results (mm)

Tooth	Site	PD	Ggv	BS-b	BS-a	Ost
14	D/B/M	2/2/2	3/3/3	4/4/4	1/1/1	1/1/1
13	D/B/M	2/2/2	3/3/3	4/4/5	1/1/1	1/1/1
12	D/B/M	3/3/3	4/4/4	5/5/5	1/1/1	1/1/1
11	D/B/M	4/4/4	4/4/4	6/6/6	2/2/2	0/0/0
21	D/B/M	4/4/4	4/4/4	6/6/6	2/2/2	0/0/0
22	D/B/M	4/4/4	2/2/2	6/6/6	2/2/2	0/0/0
23	D/B/M	3/3/3	4/4/4	5/5/5	1/1/1	1/1/1
24	D/B/M	3/3/3	4/4/4	5/5/5	1/1/1	1/1/1

*M (mesial), B (buccal), D (distal), PD (probing depth), Ggv (gingivectomy), BS-b (bone sounding before gingivectomy), BS-a (bone sounding after gingivectomy), Ost (ostectomy)

Case 2

A 20-year-old woman came with complaints of visible gums when smiling/gummy smile (Figure 3a). The patient showed good oral hygiene and no history of systemic disease or bad habits. Upon intra-oral examination, the crowns of teeth 13-23 were found to be short, and the dimensions of the attached gingiva were adequate (Figure 3b). The patient has a high superior labialis frenulum

attachment and deepbite, but no orthodontic treatment was planned. Panoramic radiograph showed the crest of the alveolar bone was apical to the CEJ (Figure 3c); therefore, her condition is classified as APE type 1A.³ The results of periodontal and bone sounding examinations can be seen in Table 2. Based on the examinations, gingivectomy is the treatment of choice for the patient's condition.



Figure 3.(a). Patient's gummy smile (b). Adequate attached gingiva (c). Panoramic radiograph

Table 2. Periodontal examination results (mm)

Tooth	Site	PD	Ggv	BS-b	BS-a
13	D / B / M	5 / 5 / 5	5 / 5 / 5	7 / 7 / 7	2 / 2 / 2
12	D / B / M	4 / 4 / 4	3 / 3 / 3	7 / 7 / 7	3 / 3 / 3
11	D / B / M	5 / 5 / 5	5 / 5 / 5	7 / 7 / 7	2 / 2 / 2
21	D / B / M	5 / 5 / 5	5 / 5 / 5	7 / 7 / 7	2 / 2 / 2
22	D / B / M	4 / 4 / 4	3 / 3 / 3	7 / 7 / 7	3 / 3 / 3
23	D / B / M	4 / 4 / 4	3 / 3 / 3	7 / 7 / 7	3 / 3 / 3

*M (mesial), B (buccal), D (distal), PD (probing depth), Ggv (gingivectomy), BS-b (bone sounding before gingivectomy), BS-a (bone sounding after gingivectomy)

CASE MANAGEMENT

Case 1

The surgical procedure was initiated with informed consent followed by asepsis and anesthesia. The surgical template was then placed, and an external bevel incision was made with a No. 15

blade following the template. After the gingivectomy, gingivoplasty was performed using a flame-shaped high-speed diamond bur to contour the gingival margin (Figure 4).



Figure 4. (a). Gingivectomy using template (b). After gingivectomy and gingivoplasty

Next step, a sulcular incision was made, and a full-thickness mucoperiosteal flap was elevated. Ostectomy was performed with a round diamond high-speed bur (diameter 1 mm) to create normal biologic width (Figure 5a). After irrigation, the flap

was repositioned and sutured with 4-0 nylon suture using an interrupted suture technique (Figure 5b). The patient returned to remove the sutures after 2 weeks (Figure 5c). Clinical appearance before and after treatment can be seen in Figure 6.

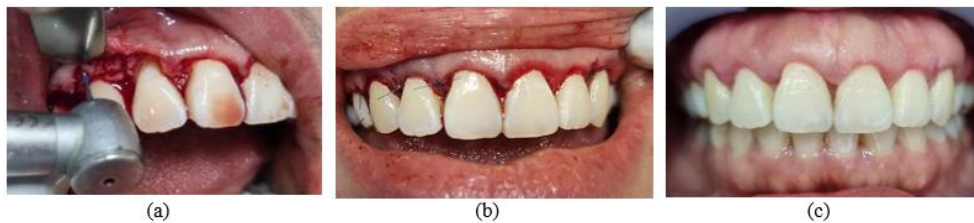


Figure 5. (a). Flap elevation and ostectomy (b). Interrupted suture (c). 2 weeks post surgery



Figure 6. (a). Before and (b). After treatment

Case 2

Following informed consent, asepsis and anesthesia were performed at the mucobuccal fold. After that, bleeding points were made on the labial gingiva of teeth 13-23 according to the measurement. The external bevel incision was made 1 mm apically to the bleeding point with a No. 15 blade (Figure 7a). Subsequently, gingivoplasty was performed with a flame-shaped high-speed diamond bur to restore the contour of the gingival margin. In addition,

frenectomy was performed to remove the high frenulum attachment and was sutured with 4-0 silk thread using an interrupted suture technique (Figure 7b). The patient was instructed to return 1 week after the surgery to remove the sutures (Figure 7c). The treatment result (3 weeks post-surgery) can be seen in Figure 8.

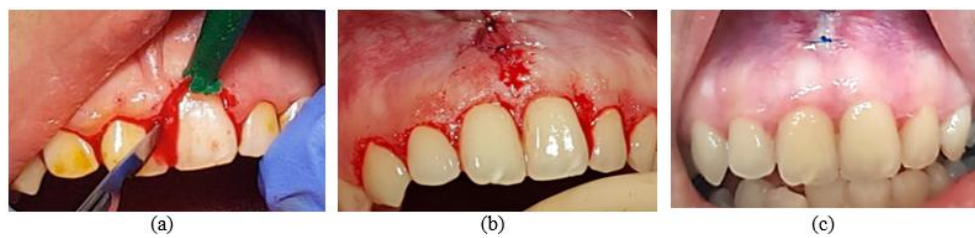


Figure 7. (a). Gingivectomy with external bevel incision (b). Gingivoplasty and frenectomy (c). 1 week post-surgery



Figure 8. (a). Before and (b). After treatment

DISCUSSION

Altered passive eruption is considered a normal variation and is not always pathological. However, since this condition is often associated with gummy smile, which interferes with esthetics and may contribute to the development of periodontal disease, treatment is necessary.¹ Garber and Salama suggested two treatment options for APE, which are gingivectomy for APE type 1A and apically positioned full-thickness flap with or without bone resection for other types of APE.¹⁰ The distance between the alveolar bone crest and the CEJ determines whether or not bone resection is necessary to establish the biologic width.¹¹

Biologic width can be determined by probing into the sulcus, under anesthesia, until it reaches the bone (a technique known as “bone sounding”) then the result is reduced by the depth of the sulcus. To ensure accurate results, measurements must be made on healthy gingival tissue and repeated on multiple teeth. The information obtained can be used to diagnose violation in the biologic width and how much correction is needed.¹² Any violation of the biologic width can

cause chronic inflammation of the soft tissue around the tooth or restoration, bleeding on probing, gingival hyperplasia, gingival recession, periodontal pocket, followed by progressive attachment loss and alveolar bone destruction.⁹

This case report describes the crown lengthening procedure of two cases of APE type 1A, with different approaches. In the first case, crown lengthening was performed by gingivectomy accompanied by ostectomy. Based on the results of the bone sounding, the distance from the gingival margin to the crest of the alveolar bone is 4-5 mm. If 3-4 mm gingivectomy is needed, there will be a change in the position of the gingival margin to be very close to the bone crest (1 mm). As a result, the biologic width will be compromised, and usually the gingival margin will return to its original position. Therefore, it is necessary to perform sufficient ostectomy to recreate the appropriate biologic width, especially in the esthetic zone^{1,5,13}. In the second case, bone sounding results of 7 mm were obtained. A gingivectomy of about 3-5 mm will leave a 2-3 mm distance between the gingival

margin and the alveolar crest. Therefore, no osteotomy is needed.

Various crown lengthening techniques must be carried out without disturbing the biologic width, so there are no effects that can interfere with the health of the periodontal tissue.¹⁴ One of the parameters to consider is whether it is necessary or not to reduce bone. If the alveolar bone crest is less than 3 mm from the gingival margin, elevation of the flap may be considered for osteotomy access. Simple gingival excision will likely result in gingival regrowth if the bony crest is less than 3 mm apical to the new gingival margin.¹⁵ A study by Dominguez et al. also showed that a stable gingival margin position at 1 to 6 months post surgery can be seen if the position of the gingival margin was maintained at ≥ 3 mm coronal to the alveolar bone crest after the crown lengthening procedure.¹⁶ In the first case, although based on the examination it was classified as APE type 1A with gingivectomy treatment, the change in the gingival margin position to the alveolar bone was < 3 mm. Thus, flap elevation and osteotomy were performed to maintain the distance of ≥ 3 mm from the gingival margin, and to provide space to accommodate the appropriate biologic width dimension.

CONCLUSION

From these two cases presented, the same type of APE could have different treatment choices because of the biologic width influence. Preserving the biologic width is one of the essential factors for maintaining healthy gingiva and achieving durable treatment outcomes, along with ensuring an adequate amount of attached gingiva as well as maintaining the proper distance of the alveolar bone crest relative to the CEJ. By taking into account these three factors, clinicians are expected to be

able to carry out appropriate APE treatment with stable results.

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