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(CASE REPORT)

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Aetiology-driven multidisciplinary management of excessive gingival display following clear aligner therapy: A two-year case report

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Abstract

Introduction: Achieving an Aesthetic smile requires more than orthodontic tooth movement; it depends on harmony among dental, gingival, labial, and facial components. Residual smile disharmony may persist after successful clear aligner therapy when the underlying aetiology is not fully identified.

Case Report: A female patient remained dissatisfied with her smile after successful closure of a maxillary midline diastema using clear aligners. Although the orthodontic outcome was satisfactory, the smile was still perceived as unaesthetic. Comprehensive facial analysis, dynamic smile assessment, upper lip evaluation, and digital smile design were used to determine the contributing factors. Because orthodontic correction alone was insufficient, a multidisciplinary treatment plan was performed, consisting of digitally guided aesthetic crown lengthening with osteotomy and osteoplasty, followed by lip repositioning surgery. Clinical and photographic evaluations were conducted throughout treatment and during a two-year follow-up.

Discussion: This case demonstrates the value of an aetiology-driven diagnostic approach in managing residual smile disharmony after orthodontic treatment. The integration of facial analysis, digital smile design, and periodontal plastic surgery allowed individualized treatment of both hard- and soft-tissue deficiencies. The combined approach improved smile harmony and maintained clinical stability during follow-up.

Conclusion: Successful orthodontic treatment does not always produce optimal smile aesthetics. Comprehensive etiologic evaluation and multidisciplinary management may provide predictable, stable, and patient-centered outcomes in patients with residual smile disharmony following clear aligner therapy.

Keywords: Clear aligner therapy; Digital smile design; Aesthetic crown lengthening; Lip repositioning; Smile aesthetics; Multidisciplinary treatment

1. Introduction

An aesthetic smile depends on the harmony between the teeth, gingiva, lips, and facial structures, not only on tooth alignment. Today, treatment success is also influenced by the patient's perception of smile attractiveness. Therefore, even successful orthodontic treatment may not fully meet aesthetic expectations if other smile components remain uncorrected. [1, 3]

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Clear aligner therapy is widely used to correct malocclusion and close maxillary midline diastemas. However, smile disharmony may remain after treatment because smile aesthetics are also affected by clinical crown proportions, gingival contours, upper lip position, lip mobility, and facial balance. Failure to evaluate these factors may lead to patient dissatisfaction despite good dental alignment. [4, 6]

Therefore, it is important to do a comprehensive smile analysis before planning aesthetic treatments. Facial assessment, dynamic smile evaluation, and Digital Smile Design can help identify the main cause of excessive gingival display or smile imbalance. Based on the findings, treatment may involve aesthetic crown lengthening, osseous recontouring, restorative procedures, orthodontics, or lip repositioning. [2, 7]

This case report describes a patient who remained dissatisfied after successful clear aligner therapy for maxillary midline diastema closure. Facial analysis and Digital Smile Design identified the causes of the remaining disharmony. The patient was treated with aesthetic crown lengthening, osteotomy, osteoplasty, and lip repositioning surgery. The result remained stable after two years, showing the importance of accurate diagnosis and multidisciplinary treatment planning.

2. Case report

2.1. Clinical Examination

A 33-year-old female was referred after successful clear aligner treatment for closure of a maxillary midline diastema. Although tooth alignment and occlusion were satisfactory, the patient remained dissatisfied because of excessive gingival display, short clinical crowns, and uneven gingival margins. These findings indicated that the residual smile disharmony was primarily related to dentogingival and soft-tissue factors rather than unresolved orthodontic problems. [1, 5]

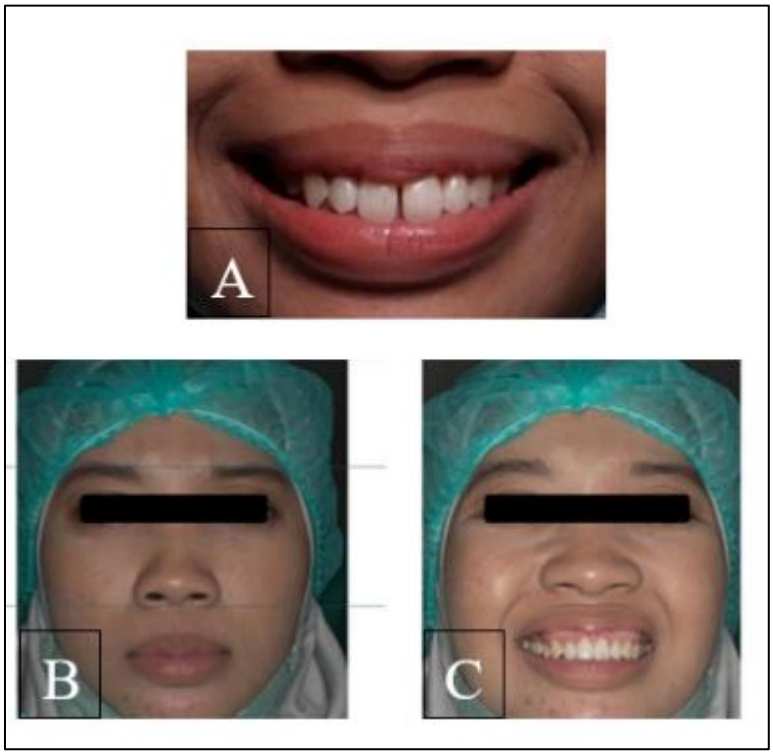

Figure 1 Initial Condition before clear aligner therapy.Extraoral facial analysis (A). Standardized frontal photographs were used to assess facial proportions, upper lip length, and smile dynamics (B). Upper lip length and mobility were within normal limits, with approximately 7 mm of movement during maximum smiling (C)

Extraoral analysis showed balanced facial proportions without evidence of vertical maxillary excess. Upper lip length and mobility were also within normal limits, reducing the likelihood of a skeletal or muscular cause. [2,4,8] Therefore, the main aesthetic discrepancy was considered to originate from the dentogingival complex, supporting the need for periodontal and digital smile evaluation before further treatment.

Based on these findings, Digital Smile Design using the 3Shape platform was performed to evaluate tooth proportions, gingival contours, smile arc, and lip–dentogingival relationships. The analysis confirmed that short clinical crowns and unfavorable gingival architecture were the main causes of the Aesthetic discrepancy. A sequential treatment plan was therefore established, consisting of digitally guided aesthetic crown lengthening with osseous recontouring, followed by healing and reevaluation before lip repositioning surgery. [9, 10]

Figure 2 Digital Smile Design and virtual treatment simulation (A). A customized surgical guide was used to accurately transfer the planned gingival contours during surgery (B). Immediate postoperative photographs showed more harmonious gingival contours consistent with the digital treatment plan (C)

Aesthetic crown lengthening was performed under local anesthesia using a digitally fabricated surgical guide. After transgingival bone sounding confirmed inadequate supracrestal tissue dimensions, internal bevel incisions were made according to the planned gingival outline, followed by removal of the gingival collar. A full-thickness mucoperiosteal flap was then elevated to expose the alveolar bone. Osteotomy and osteoplasty were performed to position the osseous crest approximately 3 mm apical to the planned gingival margin while preserving the interproximal bone. The surgical guide was periodically repositioned to verify the gingival zeniths and contours. After irrigation, the flap was repositioned without tension and secured with interrupted microsutures.[2,11,12]

Immediately after surgery, the maxillary anterior teeth demonstrated increased clinical crown length. Furthermore, the gingival contours appeared more symmetrical and closely aligned with the digital design, despite the presence of mild postoperative edema. The patient was instructed to maintain strict plaque control, use a 0.12% chlorhexidine mouthwash twice daily for two weeks, avoid mechanical trauma, and adhere to a soft diet. Analgesics and anti-inflammatory drugs were prescribed as needed. At the one-week follow-up, healing was uneventful, showing no signs of infection, flap dehiscence, or excessive inflammation, and the sutures were removed following adequate wound stabilization. One month after surgery, the gingival margins were stable, with improved clinical crown proportions and gingival symmetry. However, excessive gingival display remained evident during maximum smiling. Following interdisciplinary reassessment, the residual discrepancy was attributed mainly to upper-lip dynamics. Lip repositioning surgery was therefore selected as the second-stage procedure.

2.2. Lip Repositioning Surgery

Once periodontal healing was complete after crown lengthening, the patient underwent another comprehensive assessment of smile dynamics. Persistent excessive gingival display remained visible during maximum smiling despite the improved gingival architecture and clinical crown proportions.

Following discussion among the restorative dentist, periodontist, and orthodontist, lip repositioning surgery was selected as a minimally invasive adjunctive treatment.[13] This approach was intended to reduce excessive superior displacement of the upper lip during smiling while avoiding more aggressive surgical procedures. [2, 8]

The procedure was performed under local anesthesia. A partial-thickness flap was designed in the maxillary labial mucosa, and a strip of mucosal epithelium was carefully removed while preserving the underlying connective tissue and muscular attachments. The mucosal margins were then approximated with interrupted resorbable sutures. This repositioned the upper lip more coronally and limited its upward movement during smiling. The labial frenulum was preserved, and symmetrical tissue adaptation was maintained throughout the surgical field.

Figure 3 The surgical site exhibited favorable early healing while maintaining symmetrical upper lip position and satisfactory patient comfort during routine function

Postoperative instructions included limiting excessive lip movement and vigorous facial expressions during the first two weeks, maintaining careful oral hygiene, and using 0.12% chlorhexidine mouth rinse twice daily. [1, 3]

Five days after surgery, the wound margins showed satisfactory adaptation with minimal edema. No hematoma, infection, or wound dehiscence was observed. The patient reported mild discomfort during smiling, which resolved during the first postoperative week.

At subsequent follow-up visits, progressive soft-tissue healing and maturation were observed. The upper lip showed reduced superior displacement during smiling, resulting in decreased gingival exposure and improved harmony among the lips, gingiva, and maxillary anterior teeth.

The final smile appeared natural, with preservation of facial expression and lip function. No phonetic disturbances, sensory changes, or functional limitations were reported. The interdisciplinary treatment transformed a dentally acceptable but aesthetically compromised smile into a more harmonious dentofacial result. The patient reported complete satisfaction with the final outcome, together with improved self-confidence.

Figure 4 The combined multidisciplinary approach resulted in increased clinical crown display, improved gingival symmetry, reduced gingival exposure during smiling, and enhanced harmony among the teeth, gingiva, lips, and facial structures

The patient was enrolled in a periodic maintenance program with scheduled clinical evaluations. At the two-year follow-up appointment, the periodontal tissues remained healthy without signs of inflammation, attachment loss, gingival recession, or scar formation. The gingival margins remained stable, preserving the clinical crown dimensions established during crown lengthening.

Smile analysis demonstrated maintenance of the improved dentolabial relationship achieved immediately after treatment. No clinically significant recurrence of excessive gingival display was observed, and the patient continued to express satisfaction with the Aesthetic appearance of her smile. Functional assessment confirmed normal lip mobility, adequate oral competence, and absence of speech or masticatory impairment.

Figure 5 Two-year follow-up. No clinically significant relapse, gingival rebound, or deterioration of smile aesthetics was observed during the follow-up period, indicating favorable medium-term stability of the treatment outcome

The favorable long-term outcome suggested that the sequential, aetiology-driven multidisciplinary approach contributed to stable integration of the periodontal, dental, and soft-tissue components of smile aesthetics. The treatment successfully addressed the patient's primary concern while preserving periodontal health and functional integrity.

3. Discussion

The present case demonstrates that successful orthodontic correction does not always result in an Aesthetically satisfactory smile. Although the maxillary midline diastema was successfully closed with clear aligner therapy, the patient remained dissatisfied because the residual discrepancy involved the relationship among the teeth, gingiva, upper lip, and facial structures rather than tooth alignment alone. This finding supports a facially driven approach to smile design, in which orthodontic outcomes should be evaluated as part of a broader dentofacial aesthetic system.

Management of excessive gingival display should be directed according to its underlying aetiology, which may include vertical maxillary excess, a hypermobile upper lip, dentoalveolar extrusion, altered tooth proportions, or a combination of these factors. In this patient, extraoral photographic analysis revealed balanced facial proportions, thereby excluding vertical maxillary excess and eliminating the need for orthognathic surgery. Dentoalveolar supraeruption was also not considered the primary cause. In contrast, short clinical crowns, slightly uneven gingival levels, and unfavorable tooth proportions indicated a dentogingival contribution, while dynamic smile analysis demonstrated excessive upper-lip mobility. Therefore, the gummy smile was considered to have both periodontal and soft-tissue components.

Digital Smile Design clarified the contribution of the short clinical crowns and uneven gingival architecture by enabling assessment of the gingival zeniths, tooth proportions, smile arc, and dentolabial relationships. The digital plan was transferred to a surgical guide to improve interdisciplinary communication and clinical accuracy. Aesthetic crown lengthening was performed as the first treatment stage because transgingival bone sounding revealed insufficient supracrestal tissue dimensions. In addition, the presence of buccal exostosis required flap elevation, osteotomy, and osteoplasty to establish physiologic bone contours and a stable relationship between the alveolar crest and the planned gingival margin. Following periodontal healing, clinical crown proportions and gingival symmetry improved significantly; however, excessive gingival display remained during maximum smiling because of persistent upper-lip hypermobility. Lip repositioning was therefore performed as a second-stage procedure to limit superior lip displacement and optimize the relationship between the upper lip and the corrected dentogingival complex.

The stable gingival margins, reduced gingival exposure, and improved dentolabial harmony observed at the two-year follow-up suggest that staged treatment addressing each contributing aetiology may provide more predictable outcomes than a single isolated procedure. This case also highlights the importance of collaboration among orthodontists, periodontists, and restorative dentists in identifying the true causes of residual smile disharmony and determining the appropriate treatment sequence. Nevertheless, because this report represents a single case without validated patient-reported outcome measures, its findings should be interpreted cautiously. Further prospective studies are required to evaluate standardized diagnostic protocols, long-term stability, and patient satisfaction following multidisciplinary treatment of excessive gingival display.

4. Conclusion

This case demonstrates how comprehensive etiologic assessment can guide treatment planning in a patient presenting with residual smile disharmony after successful clear aligner therapy. The sequential use of Digital Smile Design, aesthetic crown lengthening, and lip reposition surgery was associated with improved smile aesthetics and stable clinical findings over a two-year follow-up in this patient. As a single case report, these observations should be interpreted cautiously; however, they highlight the potential value of an aetiology-driven multidisciplinary approach in selected patients with similar clinical presentations.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors declare that there were no conflicts of interest related to this case report.

Statement of ethical approval

This case report was conducted in accordance with the principles of the Declaration of Helsinki. Institutional ethical approval was waived because this manuscript reports routine clinical management of a single patient with written informed consent.

Statement of informed consent

Written informed consent was obtained from the patient for publication of this case report and the accompanying clinical photographs. All identifying information has been removed to protect patient confidentiality.

Data availability statement

The clinical data supporting the findings of this case report are available from the corresponding author upon reasonable request. Patient confidentiality has been maintained in accordance with institutional and international ethical guidelines.

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