Orthodontic treatment for a patient with advanced periodontal disease: 11-year follow-up

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This case report demonstrates the interdisciplinary treatment of an adult patient with a Class II malocclusion, convex profile, incompetent lips, gummy smile, and advanced periodontal loss. Initial periodontal-endodontic treatment was followed by orthodontic and orthognathic surgical therapies. An esthetic facial profile, a pleasing smile, an appropriate occlusion, and overall good treatment outcomes, including the periodontal condition, remained stable 11 years after active orthodontic treatment. (Am J Orthod Dentofacial Orthop 2013;144:455-65)

Advanced periodontal disease is primarily characterized by severe attachment loss and reduction of alveolar bone support.1 Since the numbers of adults seeking orthodontic treatment are increasing, orthodontists are becoming more likely to manage patients with adult periodontitis.2-5 The most common orthodontic problems in periodontally affected patients include proclination of the maxillary anterior teeth, rotation, overeruption, migration, tooth loss, irregular interdental spacing, and traumatic occlusion. Those changes in the dentition are a consequence of the diminished support provided by the affected periodontium.2,4,6-8 Adequate orthodontic and periodontal treatment has been shown to improve the periodontal condition and reestablish a healthy and well-functioning dentition.1,5,8

The vertical maxillary excess that causes excessive exposure of the gingiva on smiling is an esthetic problem. If this gummy smile were characterized by anterior vertical maxillary overgrowth, the outcome might not always be successful with conventional orthodontic therapy alone. In these patients, surgical therapy, such as that provided by a LeFort impaction or maxillary gingivectomies, is often indicated to achieve a good smile.6,9

This case report describes the management of a gummy smile in a woman with a Class II malocclusion and advanced periodontal disease (horizontal and vertical alveolar bone loss). The outcomes throughout the 11-year follow-up in this periodontally affected patient show successful results, with improvements of esthetics and function through an interdisciplinary approach.

DIAGNOSIS AND ETIOLOGY

A woman, age 37 years, came for orthodontic treatment with the chief complaint of maxillary anterior dental appearance, and she desired to improve her face. The facial photographs showed an excessive display of gingivae on smiling, a convex profile, and incompetent lips. The intraoral photographs and dental casts evidenced an overjet of 12 mm, an anterior open bite, a deviation of the maxillary midline of 2.5 mm to the left, and a complete Class II molar relationship on both sides. The incisors and the canines were crowded, with mild migration and moderate rotation (Figs 1 and 2). The cephalometric analysis showed a Class II jaw-base relationship, an ANB angle of 7°, labially tipped incisors, bipostrusion (1:NA, 14 mm and 35°; 1:NB, 12 mm and 38°; IMPA, 100°), a mandibular plane angle of 33°, and an occlusal plane angle of

A

The McNamara analysis showed mandibular retrusion in relation to the cranial base. Panoramic and periapical radiographs showed all permanent teeth, except for the maxillary right second molar and right and left third molars. An apical radiolucent area suggested a periapical lesion of the mandibular left first molar. The patient suffered from advanced periodontal disease with generalized horizontal bone loss in both arches and vertical bone defects between the maxillary left first and second molars and in the mandibular right canine area (Figs 3 and 4; Table).

The primary cause for the onset and progression of gingival inflammation and periodontitis is bacterial plaque. Inflammation can lead to rapid and irreversible breakdown of the periodontium. Excessive gingival display or a gummy smile can be divided into several categories according to etiologic factors. In this patient, it occurred by overgrowth of the maxillary anterior dentoalveolar height.

**TREATMENT OBJECTIVES**

The treatment objectives were to (1) correct the vertical and maxillomandibular discrepancies to obtain a normal occlusion, thus improving (2) function and (3) facial esthetics; (4) eliminate crowding; (5) reduce bipostrusion, achieving ideal overjet and overbite; (6) acquire good plaque control and clinically healthy gingivae by periodontal treatment; and (7) reduce or keep the defects at the same level and fixed retention between teeth with bone loss.

**TREATMENT ALTERNATIVES**

The occlusal analysis, cephalometric findings, facial analysis, and dental casts were the determining factors for a periodontal-endodontic-orthodontic-surgical approach to the treatment of this patient.

The initial periodontal conditions needed improvement. From discussions involving the periodontist,
endodontist, and orthodontist, it was decided to extract the maxillary second and mandibular first premolars in order to upright the proclined incisors. Afterward, maxillary superior repositioning with LeFort I surgery, combined with mandibular advancement and advancement genioplasty, would be necessary.

TREATMENT PROGRESS

Before placement of the orthodontic appliances, the patient received treatment from a periodontist for 3 months, consisting of scaling, root planing, and oral hygiene instructions. A 4-month observation period confirmed patient cooperation and the stability of the periodontal results. During this period, endodontic retreatment of the mandibular first molar was performed, followed by extractions of the mandibular third molars, maxillary second premolars, and mandibular first premolars.

The maxillomandibular tooth axes were improved during preoperative orthodontic treatment by fixed edgewise appliances with 0.022 × 0.028-in slot brackets in both arches. In the maxillary arch, a typical sequence of archwires, starting with 0.0175-in coaxial, followed by 0.016-in, 0.018-in, 0.020-in, and 0.019 × 0.025-in stainless steel archwires (3M Unitek, Monrovia, Calif), was used. Afterward, a high-pull J-hook headgear was used as anchorage against the maxillary first premolars during distalization of the canines.

In the mandibular arch, segmented archwires with vertical loops were used to upright the mandibular canines, followed by the same sequence of archwires as in the maxillary arch, to eliminate crowding and provide alignment and leveling. The J-hook was used against the canines until complete distalization was achieved.

Retraction of the anterior maxillary teeth was performed with 0.019 × 0.025-in stainless steel archwires with sliding mechanics supported by a high-pull J-hook headgear. This contributed to torque control, bodily movement, and intrusion of the maxillary anterior teeth. The J-hook headgear was adapted to the closing loop archwire at 100 g per side, and the patient was instructed to use it at least 14 hours per day. The force was checked monthly to adjust and keep it continuous. Anterior retraction was conducted for 8 months.

Subsequent impressions were obtained to evaluate the intercuspation and simulate the surgical movements. After cast surgery and predictive
tracing, a 5-mm maxillary superior repositioning, mandibular advancement of 5 mm with a bilateral sagittal split ramus osteotomy, and advancement genioplasty of 5 mm were planned. The patient received 0.020 × 0.025-in rectangular archwires with clipped hooks and postoperative recommendations.

The patient was monitored closely for 1 month and was then referred for postoperative orthodontic treatment. The postoperative stage aimed at finalization. Active treatment lasted 48 months. After that, a removable circumferential retainer was placed in the maxillary arch, and a canine-to-canine lingual retainer was bonded in the mandibular arch. The patient was placed in a retention control program with periodic visits. During the active phase of treatment, she had monthly speech rehabilitation and myofunctional therapy sessions to promote correct lingual function. Clinical evaluations by her periodontist were made at 3-month intervals.

**TREATMENT RESULTS**

The posttreatment photographs of the patient and her smile confirmed that good esthetic results and dental relationships were achieved. The lips became competent, and the dental midlines were coincident with the facial midline. The posttreatment intraoral photographs showed good interdigitation of the lateral segments and ideal overjet and overbite. A Class I canine relationship on the left side and a mild Class II relationship on the right side were obtained. The Class II molar relationship was maintained with a slight deviation between the maxillary and mandibular midlines (Figs 5 and 6).

The panoramic radiographs confirmed correct parallel root positioning, and the lateral radiographs, posteroanterior skull radiograph, cephalometric tracings, and superimpositions confirmed the dental and skeletal changes after treatment (Figs 7 and 8). As a result of the mandibular advancement and the counterclockwise mandibular rotation, the ANB angle decreased from 7°.
to 4.5°, making the profile straight [Table]. The most significant cephalometric changes were the maxillary impaction (Fig 8, B) and the lingual tipping and retraction of the incisors. The mandibular incisors improved their position in the basal bone (IMPA, 93°), and the molars moved mesially (Fig 8, D and E).

Periodontal support was sound, and bone level repair can be observed in the final results in the left first and second molars in both arches (Fig 7, C). Functional movements were normal, and no signs or symptoms of a temporomandibular disorder were evident.

**DISCUSSION**

This patient had severe periodontal disease with periodontal attachment loss. A complete Class II molar relationship, with 12 mm of overjet, open bite, and bimaxillary protrusion, was aggravated by the periodontal conditions. With marked protrusion of the anterior teeth, lip seal is not possible, resulting in mouth breathing and a predisposition to gingivitis. Even though plaque is a determining factor in periodontitis, mouth breathing is also potential cofactor. In this situation, periodontal preparation was important and should be performed before initiating orthodontic treatment followed by reduction of the projection of the incisors. In our patient, the increased overjet was improved, and there was lip retraction as a result of retraction of the maxillary teeth.

### Table. Cephalometric summary

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Ocel:SN, Occlusal plane angle; AIFH, anterior facial height.
incisors, eliminating the abnormal habits and occlusal factors of periodontal disease.\textsuperscript{3,5,15,23}

When planning surgery for patients with vertical discrepancies, lip position is an important factor. Many factors are involved in lip protrusion, and it is obvious that the amount of protrusion can be controlled by various orthodontic and surgical procedures. Retracting or protracting the incisors surgically or orthodontically can achieve a concordant lip position. The flared incisors in this patient rolled out the lower lip (Fig 1). When the incisors are uprighted, the lower lip is retracted, and the deep sulcus is reduced, achieving a concordant lip position.\textsuperscript{5,15,23,24} In this context, for this adult, the orthodontic treatment planning determined the anteroposterior positions of the incisors,\textsuperscript{25} and the orthognathic surgery improved the facial esthetics and provided good bone-base relationships to support the teeth and proper function (Fig 5).\textsuperscript{15,16,24}

In compliance with these principles, the tooth extractions planned to treat this bialveolar malocclusion allowed retraction of the anterior teeth, solved the space deficiency in the mandibular anterior region, and prevented incisor proclination as a consequence of leveling the mandibular arch.\textsuperscript{14,15,17,19} Retraction of the anterior segment was done, supported by the high-pull J-hook,\textsuperscript{18} and the protruded incisors were repositioned (1:NA, from 35° to 20°; 1:NB, 38° to 28°; IMPA, 100° to 93°) (Table; Fig 8, C and E).\textsuperscript{26} This prior appropriate decompensation provided surgical correction without limitation.\textsuperscript{16,17} Additionally, the retraction also promoted uprighting of the crowns because the maxillary incisors were inclined below the rotation center, also contributing to close the open bite of this patient (Fig 8, A and C).\textsuperscript{22,27}

In adult patients with vertical maxillary excess, the outcome might not always be successful with orthodontic therapy alone; surgical therapy is often
chosen to gain an esthetic facial profile and a good smile.\textsuperscript{4,6,9,13,16,17,28} A simple surgery could not produce the necessary facial changes for this patient, and the McNamara analysis\textsuperscript{10} evidenced mandibular retrusion in relation to the cranial base; thus, 2-jaw surgery was indicated.\textsuperscript{19,29,30} Therefore, maxillary impaction and mandibular advancement were performed to correct the occlusion, and mentoplasty was done to provide additional esthetic improvement, thus solving the patient’s main problems: the excessive gingival display on smiling, the convex profile, and the mandibular retrognathism.\textsuperscript{1,8,9,15-17} The soft-tissue changes associated with maxillary impaction presented here are in accordance with previous studies, which have shown elevation of the nasal tip with an increase in the nasolabial angle, an increase in alar base width, and shortening of lip length.\textsuperscript{4,31} The angle of convexity, $y$-axis to Frankfort horizontal, $Z$-angle, AIFH, and FMA were near the standard values at treatment completion, thereby demonstrating the reduction of convexity as expected, with counterclockwise mandibular rotation (Table; Fig 8, A and D).\textsuperscript{15,17} The orthognathic surgery improved the smile, straightened the profile, and increased the patient’s self-esteem.\textsuperscript{17} The cephalometric superimposition shows the great reduction of inclination of the anterior teeth (Fig 8, C and E). In these patients, interdisciplinary therapy might enhance the likelihood of saving and restoring a deteriorated dentition.\textsuperscript{8,14,16} The harmonization of the dental arches facilitates oral hygiene,\textsuperscript{4,7,22} and the appropriate combination of orthodontic and periodontal treatment has been shown to improve periodontal conditions with good oral hygiene.\textsuperscript{7,6,11} At the end of treatment, bone resorption was stabilized, the vertical bone defect was improved, and radiographic bone gain was observed (Fig 7, C), in agreement with previous reports.\textsuperscript{5,7,8,23,32}

When planning orthodontic treatment in adults with a history of periodontal disease, it is suggested to allow 2 to 6 months after the periodontal therapy until bracket placement for periodontal tissue remodeling, restoration of health, and evaluation of patient compliance.\textsuperscript{1,4,7,8,14} Also, the patient should begin a program of regular follow-up visits to the periodontist and the orthodontist.\textsuperscript{2,4}

Some conflict exists as to the long-term effects of orthodontic bands on the periodontium. Despite the inconclusive results in the literature, bonding instead of banding the molars appears to be a safer solution because bracket design also has a significant

**Fig 6.** Final dental casts.
impact on the bacterial load and the periodontal parameters. The planning of retention and the stability of orthodontic treatment require greater consideration in adults with periodontitis. Probably, the most appropriate method for retention is the coaxial multistranded stainless steel wire retainer bonded to the lingual side of each tooth. This option was chosen because it is easy to fabricate, is not visible, and allows the teeth to retain their physiologic mobility. In addition to the aforementioned care, the orthodontic movement must be perfectly controlled, and light appropriate forces should be delivered to enable periodontal remodeling without triggering iatrogenic effects.

Ultimately, in this patient, the results demonstrated that an interdisciplinary approach leads to optimal qualitative, functional, and esthetic management, providing the best treatment plan in a complex clinical situation. Ideal orthodontic presurgical decompensation and postoperative finishing allowed success of the intervention and stability of the results. Follow-up at 11 years posttreatment (Figs 9 and 10, Table) confirmed the good choice of treatment planning and the tendency to improve the results over time.

**CONCLUSIONS**

Periodontally compromised orthodontic patients can be satisfactorily treated, achieving correction of
the malocclusion and a marked improvement in esthetics when an interdisciplinary approach is used. Ultimately, as presented here, the combination of periodontal-endodontic-orthodontic therapy and orthognathic surgery can allow the achievement of satisfactory outcomes from esthetic, occlusal, and functional standpoints if physiologic forces are used, periodontal inflammation is controlled, and meticulous oral hygiene is maintained throughout active therapy.

REFERENCES


Fig 9. Facial and intraoral photographs at 11 years after treatment.

Fig 10. Radiographs at the 11-year follow-up and superimposed cephalometric tracings at treatment completion (red line) and the 11-year follow-up (brown line) on the sella-nasion plane at the sella.