A Multidisciplinary Approach for the Management of Iatrogenic Severe Periodontitis Following Orthodontic Treatment with a 12-Year Follow-up

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Orthodontic treatment aims to realign teeth in a functional and esthetic manner. When applied on an unhealthy periodontium, this may lead to advanced periodontal tissue breakdown. The present 12-year follow-up report describes the multidisciplinary management of a severe, iatrogenic, generalized periodontitis case that was caused/aggravated by orthodontic therapy on unhealthy periodontal tissues. Prompt therapy was applied through nonsurgical and surgical approaches, including soft and hard tissue grafting procedures combined with corrective orthodontic treatment on healthy tissues. This report is a clear demonstration that early disease detection and proper diagnosis combined with appropriate therapeutic approaches concomitant with strict supportive periodontal therapy could lead to long-term successful and maintainable outcomes, even in hopeless cases. Int J Periodontics Restorative Dent 2022;42:301–309. doi: 10.11607/prd.5052

Periodontal disease is a multifactorial disease that is initiated by dental plaque and produces a series of inflammatory and immunologic reactions, leading to the destruction of connective tissue and bone. When left untreated, the disease may progress and lead to alveolar bone resorption and, in advanced cases, tooth mobility and loss.1 Many factors can influence the development and progression of periodontitis, including patient characteristics, microbial compositions, and systemic, social, behavioral, genetic, tooth-level, and iatrogenic factors.2 Few articles report on the iatrogenic nature of risk factors that may influence periodontitis progression. Most published articles on iatrogenic dental problems concern prosthetic rehabilitations or fixed appliances for orthodontic purposes, affecting a single tooth or part of the dentition.3–6

The aim of orthodontic therapy is to reestablish a healthy, functional, and esthetic appearance of the dentition through the use of controlled forces on a healthy periodontium. The beneficial effect of orthodontic treatment on soft and hard tissues has been widely reported.7–9 However, inadequate or unsupervised orthodontic treatment can cause iatrogenic periodontal disease, resulting in bone loss and/or recession.

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This case report presents the multidisciplinary management and 12-year clinical follow-up of severe, iatrogenic, generalized periodontitis following orthodontic treatment on unhealthy periodontal tissues (Figs 1 and 2).

Case Report

A 21-year-old woman was referred for periodontal evaluation 1 week after completion of a 2-year orthodontic treatment. The patient was in good general health, did not take any medication, and was a heavy smoker. She was provided with a fixed appliance for the anterior mandible and a removable retainer for the maxilla in order to stabilize the final result. Her chief complaint was the buccal flaring of the maxillary central incisors a few minutes after removing the retainer.

The patient also had grade III mobility of the maxillary anterior teeth and mandibular second molars and grade II mobility of the mandibular anterior teeth (despite the fixed appliance) and first molars, with gingiva that initially appears as healthy (Fig 1a).

Full-mouth plaque score (FMPS) and full-mouth bleeding index (FMBI) were 18% and 92%, respectively, with a mean probing pocket depth of 4.9 mm (see Appendix Table 1, available in the online version of this article at quintpub.com/journals).

The initial full-mouth series of periapical radiographs obtained using the long-cone parallel technique revealed the presence of generalized
Fig 2 Full-mouth radiographs at (a) baseline, (b) 1 year, and (c) 12 years.
severe bone loss reaching the apical third of the incisors, with multiple angular bony defects affecting mostly the mandibular molars (Fig 2a). Based on complete periodontal examination and knowing that the patient had undergone orthodontic treatment, the case was established as undiagnosed severe periodontitis, stage III/grade C (formerly aggressive periodontitis), aggravated by orthodontic treatment.10

According to conventional criteria,11,12 the prognosis was considered good to fair for most of the dentition, unfavorable for the mandibular incisors, and hopeless for the maxillary incisors.

Periodontal Treatment

Nonsurgical treatment

Under high magnification (×4.1), a cause-related therapeutic regimen consisting of full-mouth scaling and root planing was performed in two sessions (within 24 hours) under antibiotic therapy (500 mg amoxicillin tid/500 mg metronidazole bid for 10 days) and chlorhexidine disinfection.13 The patient was put on a strict monthly maintenance program consisting of ultrasonic scaling and oral hygiene reinforcement. Periodontal reevaluation was performed 6 weeks after completion of the initial therapy, and it was decided to

Fig 3  Surgical management of the infrabony defect. (a) Initial clinical presentation of the 6-mm defect. (b) Clinical view after biomaterial application.
surgically treat the wide, deep angular defect at the mandibular right molar.

**Surgical treatment**
A full-thickness mucoperiosteal flap was raised to treat the infrabony defect at the mandibular right molar. The defect was thoroughly debrided, and the 6-mm deep infrabony component was filled with a demineralized freeze-dried bone allograft (OraGraft, LifeNet Health; Fig 3). The patient attended monthly recall appointments for the first year, at which time a high level of oral hygiene was demonstrated, and she continued to attend follow-ups every 3 months for the following years with high compliance.

The 1-year clinical assessment (Fig 1b) and radiographs (Fig 2b) showed very favorable tissue response to the treatment, with complete bony healing of some defects and vertical bone gain (Appendix Table 2).

**Orthodontic Therapy**
At the patient’s request, 3 years after initiating periodontal therapy, orthodontic treatment was provided on a healthy periodontium, limited to the maxillary arch. The aim was to address the mild crowding/malalignment and the black triangles of the anterior sextant resulting from periodontal tissue healing. The treatment lasted 6 months using conventional edgewise metallic brackets and nickel-titanium wires with light, constant force under periodontal monitoring. Treatment also included stripping in order to provide parallel surfaces at the contact point areas. Closing these spaces using Class I elastics dramatically reduced all black triangles. A fixed retainer was bonded on the maxillary anterior teeth at treatment completion.

Residual black triangles between the maxillary left anterior teeth were restored with direct composite resin material (Filtek Supreme, 3M ESPE; Fig 1).

**Supportive Periodontal Therapy**
The patient was kept on a strict 3-month supportive periodontal therapy (SPT) program and yearly clinical and radiographic assessment. Between the 5th and 10th years, gingival recession increased on the maxillary left canine and mandibular first molars with an increased sensitivity. Gingival grafting was advised to the patient in order to thicken the tissues and treat the recessions.

**Gingival Grafting**
The maxillary left canine was diagnosed as a Miller Class III (or RT2) gingival recession. A bilaminar approach using trapezoidal flap access (split-full-split thickness) was performed as described by de Sanctis and Zucchelli. Thus, a free gingival graft was harvested from the palate and subsequently deepithelialized to obtain a connective tissue < 1 mm thick. The graft was fixated to the anatomically deepithelialized papillae using fine suturing materials (6-0 PGA, Resorba) after root debridement and conditioning with 24% EDTA (ethylenediaminetetraacetic acid) gel for 2 minutes (PrefGel, Straumann), followed by abundant saline rinsing. The buccal flap was released in a split-thickness manner, starting with superficial incisions parallel to the bone followed by deep incisions parallel to the mucosa, to obtain a tension-free flap. The flap was coronally advanced and fixed using single-knot sutures as well as a sling suture at the coronal aspect using nonresorbable sutures (6-0 polyamide; Dafilon, B. Braun) (Fig 4a).

A few months later, upon patient request, the mandibular right (Fig 4b) and left (Fig 4c) sides were treated at the same session using the lateral bilaminar envelope approach.16

Postoperative medications for all periodontal plastic surgeries consisted of 600 mg ibuprofen (tid for 4 days), 1,000 mg acetaminophen (bid for 4 days), and 0.12% digluconate chlorhexidine rinsing for 3 weeks. Sutures were removed at the second postoperative week, and tooth brushing was resumed 3 weeks postsurgery using an ultra-soft toothbrush. The patient was seen monthly for the first 3 months, then maintained a strict 4-month recall schedule for maintenance.

**Results**
One year after initial therapy and angular defect grafting, an almost

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complete radiographic resolution was observed (Fig 2b). This result was preserved at 5 years (data not shown) and in the long term (12 years; Fig 2c and Appendix Table 3).

Clinical parameters improved drastically after the first year of treatment (Appendix Table 2), and a mean pocket depth of 3 mm was recorded with an absence of residual pockets > 6 mm. The FMBI and FMPS were both reduced to values < 20% in all the recall visits, denoting a high-level of oral hygiene and reduced inflammation. Pocket depth reduction and clinical attachment gain improved continuously at the 5-year and 12-year follow-ups (Fig 1c and Appendix Table 3), with a stable mean pocket depth of 3 mm.

A noticeable improvement in root coverage and a shift in the periodontal phenotype were observed 3 years after periodontal plastic surgery. Coverages of about 70% on the mesial root of the mandibular right molar and over 90% on both the maxillary left canine and mandibular left molar were achieved, thus reaching the maximum root coverage attainable.

At the latest follow-up examination, 12 years after initiation of therapy, clinical and radiographic assessments demonstrated stable long-term results with a healthy periodontium and an outcome that was esthetically pleasing to the patient. Fig 4 Bilaminar approach for the management of the (a) maxillary left canine and (b) mandibular right and (c) left sides. The preoperative views (first images) show 3-mm recessions with a lack of keratinized gingiva that were treated with deepithelialized connective tissues (middle images) sutured to the adjacent papillae, covered with coronally advanced flaps (last images).
Discussion

Orthodontic therapy in periodontally healthy patients aims to realign teeth in a functional and esthetic manner. Moreover, bone defect resolution and soft tissue recession recovery could be achieved through orthodontic treatment in specific, periodontally controlled cases.7,8,17 The present patient originally presented with advanced mobility associated with buccal flaring of the maxillary anterior teeth immediately after orthodontic therapy. To the present authors’ knowledge, this is the first report addressing generalized advanced periodontal tissue destruction enhanced by orthodontic treatment. Although initial pre-orthodontic data were not available, it was assumed that the patient suffered from an aggressive, undiagnosed form of periodontal disease that was aggravated by orthodontic movement. Orthodontic treatment does not lead to periodontal attachment loss per se, but in the presence of periodontal inflammation, orthodontic movement could result in further uncontrolled periodontal breakdown. Therefore, inflammation needs to be controlled before initiating orthodontic therapy.18-20

At the initial assessment, the case was diagnosed as stage III to IV, Grade C periodontal disease. The first step in periodontitis treatment should be a cause-related therapeutic phase aiming to reduce or eliminate the pathogenic microflora. This was achieved according to the full-mouth disinfection protocol with regular reinforcement, and the patient was kept on a strict, 4-week SPT program.13,21 Interestingly, after 5 years of SPT, gingival recession leading to keratinized tissue loss occurred at the buccal side of the mesial root of the mandibular right first molar. These days, this infrabony defect can be treated in a single surgical approach combining both the soft and hard tissue management, as recently suggested.22-24 The “wall technique” consists of adding a connective tissue graft at the buccal aspect of the defect while managing the angular component.

Currently, success is best expressed as the preservation of the natural dentition associated with patient satisfaction with function and esthetics. It has been reported that severely diseased teeth should be reconsidered at reevaluation before extraction.11,12,25,26 The main therapeutic goal is to reduce tooth loss in patients with advanced periodontal breakdown. This leads to a long-term, positive shift in their quality of life.26

In a recent 10- to 15-year retrospective study, Aimetti et al reported long-term stability of hopeless buccally flared teeth that were treated in a combined periodontal-orthodontic approach.27 Likewise, although several teeth presented with a hopeless prognosis at initial screening, the strict regimen imposed and patient compliance in the present case changed the initial assessment, leading to a shift in the prognosis and subsequent treatment plan.21 It could have been decided to extract these teeth using an evidence-based approach, but the positive clinical improvements after initial therapy and reevaluation resulted in the maintenance of the initially diagnosed hopeless teeth.

More interestingly, the comparison of clinical and radiographic data (initial and posttreatment assessments) in the anterior maxilla and mandible clearly demonstrate gains in bone and vertical attachment. Although the radiographs were not individualized, they were obtained using the long cone parallel technique using XCP-DS Rinn mounts (Dentsply Sirona), and a clear radiographic suggestion of a vertical bone gain was present (Fig 2). These results should be carefully interpreted; however, despite the original aggressive nature of the disease aggravated by the orthodontic therapy, the combined adequate treatment plan and strict maintenance program in a highly compliant patient could have led to such remarkable healing.

Recession occurrence through the SPT has been previously reported in two long-term studies27,28 after orthodontic movement on a compromised periodontium. In the present report, recessions were limited to the maxillary left canine and both mandibular posterior sides.

Implant therapy is not free from biomechanical and biologic complications. Long-term implant success has been reported to vary from 85% to 95%.29,30 Oral implants that were evaluated after 10 years of service did not surpass the
longevity of compromised but successfully treated natural teeth.\textsuperscript{31,32}
Therefore, it is in the patient’s best interest to try saving the natural dentition before all other treatment modalities.\textsuperscript{33}

Conclusions
The successful management of this periodontally compromised patient was achieved through a multidisciplinary approach, starting with the reestablishment of periodontal health through surgical and nonsurgical treatment, followed by orthodontic therapy under strict SPT that was carried out over several years with exceptional patient compliance. This case report is a clear demonstration that teeth salvation with long-term, esthetically pleasing outcomes: An explorative and reliability study. J Clin Periodontol 2017;37:673–681.

Acknowledgments
The authors declare no conflicts of interest.

References


### Appendix Table 1 Periodontal Evaluation at Baseline

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PPD = periodontal pocket depth; F = facial; L = lingual; P = palatal; I = class I; II = class II; – = tooth was not present for the assessment.
Data are presented in millimeters. Facial and palatal PPD evaluations were performed at three sites: mesial, midpoint, and distal. The patient did not have any recession at the initial assessment.

\(^a\)FDI tooth-numbering system.

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### Appendix Table 2 Periodontal Reevaluation at 1 Year

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Data are presented in millimeters. Facial and palatal PPD evaluations were performed at three sites: mesial, midpoint, and distal. No furcation was found at this follow-up.

\(^a\)FDI tooth-numbering system.
### Appendix Table 3  Periodontal Reevaluation at 12 Years

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PPD = periodontal pocket depth; F = facial; L = lingual; P = palatal; – = tooth was not present for the assessment. Data are presented in millimeters. Facial and palatal PPD evaluations were performed at three sites: mesial, midpoint, and distal. No furcation was found at this follow-up.

*FDI tooth-numbering system.*