Treatment Planning and Sequence for Implant Therapy in a Young Adult With Generalized Aggressive Periodontitis

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Treatment planning for full-mouth rehabilitation in patients with generalized aggressive periodontitis often requires a staged approach. Few articles have addressed treatment planning and sequencing issues in this patient population. This report describes the multidisciplinary management of a young adult by a combination of periodontal and implant therapy and rehabilitation with fixed prostheses. At a 2-year follow-up, the patient’s periodontal health and peri-implant conditions were stable. Prosthodontic rationale and treatment planning concepts in a patient with multiple challenges are discussed.

Key Words: aggressive periodontitis, treatment planning, implants, hybrid prosthesis, staged treatment, angled abutments

INTRODUCTION

Aggressive periodontitis is characterized by rapid progression and destruction of periodontal tissues, which is often associated with the early onset of the disease, an elevated degree of therapy resistance, and a high tendency toward relapse.1 Treatment for patients with aggressive periodontitis frequently involves a combination of traditional and modern periodontal therapy. While it is desirable to retain natural teeth whenever possible, the decision to extract some or all teeth in these patients depends on the periodontal prognosis and prosthodontic treatment plan. It is also important that patient motivation, esthetics, and occlusion dictate this decision. The extracted teeth could be replaced successfully with implant therapy, similar to periodontally healthy individuals; however, an adequate maintenance schedule phase is necessary after the initial treatment.2,3

Due to limited evidence, the literature is inconclusive about the long-term outcome of implant therapy in periodontitis patients.4 However, a few long-term studies done up to 10 years have shown promising results.2,5,6 Based on a comprehensive literature review, Karoussis et al7 have shown no statistically significant differences in implant survival between patients with a history of chronic periodontitis and periodontally healthy individuals. However, it has been noted that periodontitis patients may display greater peri-implant bone loss, periodontal pocket

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depth and incidence of peri-implantitis compared with periodontally healthy subjects over a long-term period.\(^2,^4,^7\)

Patients with generalized aggressive periodontitis may require a staged approach for full mouth extractions to psychologically aid in acclimatization to complete edentulism. Oftentimes, such patients are young adults, and the psychological impact of sudden loss of all teeth in the mouth may be tremendous. Another reason for using a staged extraction approach is to provide a proper base for placement of the immediate denture.\(^8\)–\(^10\) This method calls for extraction of all or most of the posterior teeth first to allow the posterior ridges to heal adequately and facilitate accurate final impressions. A pair of opposing posterior natural teeth is generally retained to assist in establishing the occlusal vertical dimension for the immediate denture.\(^9\)–\(^10\) After a few weeks of healing, optimal final impressions are made and the denture is fabricated. The anterior teeth are then extracted and the immediate denture is inserted.\(^10\)–\(^11\) A well-fabricated immediate denture made in this manner is indispensable during the treatment period before a final prosthesis can be fabricated.\(^12\)

Treatment planning for an esthetic implant-supported fixed prosthesis in the edentulous maxilla is known to be complex.\(^13\)–\(^15\) Various esthetic parameters such as amount of tissue loss, position of anterior teeth in relation to the residual ridge, smile line, lip support, and the need for gingiva-colored prosthetic material affect the design of the prosthesis. Therefore, patients have been classified into 4 types for diagnosis and decision-making for design of the fixed prosthesis.\(^16\) Class I patients are those who require gingiva-colored prosthetic material to obtain esthetic tooth proportions, optimal prosthesis contour, and adequate lip support. Class II patients are those who require gingiva-colored prosthetic material only to obtain esthetic or ideal tooth proportions and for prosthesis contour. Lip support is not a consideration in this category because the difference in lip projection with and without any prosthesis is generally insignificant. Class III patients will not require any gingiva-colored prosthetic material. Class IV patients are distinct as they are the only class of patients who have a high or a gummy smile; they may or may not require gingiva-colored prosthetic material, based on the outcome of the preprosthetic intervention to reduce the excessive amount of bone and correction of the gummy smile.\(^16\)

**CASE REPORT**

A 39-year-old African-American male was referred to the periodontist for evaluation of periodontal health and consideration of replacing missing posterior teeth with dental implants. Evaluation of the patient’s dental history and radiographic examination revealed that the patient had been diagnosed with generalized aggressive periodontitis 10 years ago. He had received nonsurgical periodontal treatment, multiple extractions, and irregular periodontal maintenance over the years (Figure 1). The patient was asymptomatic and had an unremarkable medical history. He was referred to his physician for a complete physical examination, which ruled out any undiagnosed medical condition.

A comprehensive periodontal examination was performed, which showed a plaque score of 80% and a bleeding score of 70%. The patient had supragingival and subgingival calculus. The periodontal probing depth ranged from 3–9 mm, and suppuration was evident on several teeth. Multiple teeth had a mobility of grade II and grade III. Pathological tooth migration was observed on several of the maxillary anterior teeth. Radiographic examination showed severe bone loss and a combination of horizontal and vertical bony defects. The mandibular anterior teeth had a probing depth range of 3–6 mm. They had short clinical crowns and the probing depths were mostly pseudopockets. No
mobility was observed. Periapical radiographs showed minimal horizontal bone loss. A prosthodontic consultation was then obtained, and diagnostic casts were mounted on a semiadjustable articulator.

**Diagnosis and treatment plan**

The patient was diagnosed with generalized aggressive periodontitis, secondary occlusal trauma, partial edentulism, and bimaxillary protrusion with anterior crossbite. His facial profile showed a prognathic maxilla and mandible (Figure 2). After a careful analysis of the clinical situation and patient’s expectations, different treatment options were presented to the patient. With the exception of mandibular anterior teeth, all teeth in the mouth had a poor-hopeless prognosis, and it was decided to extract them followed by replacement with prosthetic teeth. The retained mandibular anterior teeth were planned for nonsurgical and surgical periodontal therapy. Periodontal therapy was aimed at root instrumentation, pocket elimination, and exposure of the anatomical crown. As the patient desired fixed prosthetic solutions for replacement of his teeth, he was treatment-planned for a screw-retained metal-resin fixed prosthesis (hybrid prosthesis) supported by 6 implants in the maxilla; screw-retained metal-ceramic fixed partial dentures (FPDs) were planned for the posterior mandible. Regular periodontal maintenance was to supplement the active treatment phase.

**Initial treatment**

The patient received full mouth supragingival and subgingival debridement and detailed oral hygiene instructions. The patient’s plaque control was evaluated.
frequently during the treatment planning and consultation phase, and he demonstrated significant improvement (plaque score <30%). A staged-extraction protocol was used, and posterior teeth from both arches were first extracted (Figure 3). Fabrication of the immediate maxillary denture commenced after complete healing of the extraction sites (Figure 4). The diagnostic casts were mounted on a semi-adjustable articulator, and an ideal maxillary diagnostic wax-up with correction of the anterior crossbite was completed. The positions of the mandibular posterior teeth were then determined based on the opposing maxillary teeth (Figure 5). A maxillary complete denture was then fabricated, and the mandibular wax-up
was preserved as the patient refused to wear an interim mandibular removable prosthesis. Periodontal surgery was then performed on the mandibular anterior teeth to eliminate pseudopockets as well as to accomplish root instrumentation. The maxillary anterior teeth were extracted without any complications, and the immediate maxillary complete denture was inserted. The patient was prescribed 0.12% chlorhexidine rinse (Periogard, Colgate-Palmolive, Morristown, NJ) for use twice daily.

**Implant planning**

After 4 months of healing, diagnostic imaging and clinical evaluation were done for implant placement. As the clinician, the patient, and his family accepted the esthetics of the immediate maxillary denture, it eliminated the need for a new diagnostic wax-up. Based on esthetic parameters provided by this denture, he was diagnosed as a Class I patient for fabrication of a fixed implant-supported prosthesis for the edentulous maxilla (Figure 6). The immediate denture was duplicated in clear autopolymerizing resin (Splint Acrylic Resin, Great Lakes Orthodontics, Tonawanda, NY) for 3 purposes: (a) fabrication of a radiographic guide for cone-beam computerized tomography (CBCT) image (Figure 7); (b) fabrication of a surgical guide; and (c) performance of prosthetic space analysis. Evaluation of CBCT images revealed that the anterior maxilla was deficient buccolingually, and the maxillary sinuses were pneumatized. As the patient presented with a proclined maxilla, it was anticipated that it would be a challenge to angle the implants lingually in order accommodate optimal position of screw-access channels in the final prosthesis. It was expected that anterior ridge augmentation would ameliorate the situation, but the possibility of using angled abutments in the final prosthesis was not ruled out.

Six maxillary implants were planned in the position of teeth no. 3, 5, 7, 10, 12, and 14. Onlay block grafting to augment the anterior maxillary region and osteotome-assisted maxillary sinus floor elevations in the posterior region were planned. Adequate ridge height and width for implant placement in the mandible in the positions of teeth no. 19, 21, 28, and 30 were verified.

**Maxillary preprosthetic surgery and mandibular implant surgery**

Autogenous block grafts were harvested from the patient’s left ramus, the implant sites in the anterior maxilla (no. 7 and 10) were horizontally augmented, and primary closure of the soft tissues was obtained (Figure 8). The healing of the donor and recipient sites was uneventful. Thereafter, 2 implants (Standard Plus, Straumann, Waldenburg, Switzerland) were placed on each side of the posterior mandible using the surgical guide fabricated from the mandibular diagnostic wax-up. The mesial implants were of dimensions 4.1 × 12 mm, and the posterior implants were 4.8 × 12 mm. The implants had primary stability upon closure, and healing abutments were placed (Straumann) for nonsubmerged healing.

**Mandibular prosthesis**

Two months after surgery, the healing abutments were removed, and the implants demonstrated no mobility, bone loss, or clinical signs of infection. It was decided to proceed with the fabrication of the definitive restorations in the mandible in order to provide posterior mandibular support and better function for the patient during the treatment phase of the maxilla. An implant-level final impression was made using polyether impression material (Impregum Pentasof, 3M ESPE Dental Products, St Paul, Minn), and a definitive cast was poured in type IV stone (Denstone, Heraeus Kulzer, South Bend, Ind). Using bite registration aids (Straumann) connected by resin (Triad, Dentsply, York, Pa), a jig was made over the implants and maxillomandibular relationships were re-
corded against the maxillary complete denture. Screw-retained metal-ceramic FPDs were then fabricated. The definitive abutments (Synocta 1.5 mm, Straumann) were tightened to 35 N/Cm, and the occlusal screws were hand-tightened at this stage. It was anticipated that the final tightening would be done when the maxillary prosthesis would be inserted (Figure 9).

Maxillary implant surgery

Two months after insertion of the mandibular FPDs (4 months after the bone graft procedure in the anterior maxilla), a second CBCT image was acquired for the maxilla. This was done to evaluate the healing of the block grafts and the resulting ridge dimensions. Radiographic evaluation revealed that the block grafts demonstrated adequate integration into the recipient bed. Using a surgical guide, 6 maxillary implants (4 X 11 mm) were placed in the planned positions (Osseospeed, Astra Tech, Waltham, Mass) (Figure 10). Simultaneous osteotome sinus floor elevation was accomplished in the region of teeth no. 3, 5, 13, and 14. Cover screws (Astra) were placed and primary closure was obtained over the implants, and the implants underwent submerged healing for 2 months.

Maxillary prosthesis

After 2 months, all implants were uncovered and demonstrated no mobility, bone loss, or clinical signs of infection. An implant-level final impression was made using polyether impression material (Impregum Pentasoft), and a definitive cast
was poured in type IV stone (Denstone). A diagnostic cast was also prepared for the mandibular arch, which now included the posterior FPDs. Standard prosthodontic principles were then followed, which included verification of the maxillary master cast, maxillomandibular relationship records, and a trial wax denture. As the patient desired duplication of esthetics of his immediate complete denture in the final prosthesis, the process of teeth arrangement was uncomplicated. Using a putty matrix from this teeth arrangement, the choice of abutment and type of metal framework was made. As anticipated, use of angled abutments was necessary to compensate for the direction of the implants in the proclined maxilla (Figure 11). As all of the implants were relatively parallel, angled abutments (Angled Abutment, Astra Tech) were used to ensure the optimal positioning of the screw access channels in the final prosthesis. A cast metal framework was then fabricated over the abutments from silver-palladium alloy, using the putty matrix as a guide to attain optimal contours.

The passivity and fit of the finished metal framework was then confirmed on the master cast using visual, tactile, and the Sheffield’s 1-screw test. After trying in the patient’s mouth, prosthetic teeth were transferred over the metal framework using a prefabricated index. A final esthetic try-in was performed to confirm accurate transfer of teeth; esthetics, phonetics, and occlusion were reverified; and the final prosthesis was fabricated in heat-polymerized acrylic resin (Lucitone, Dentsply).

**Insertion, follow-up and maintenance**

The angled abutments were tightened to the manufacturer recommended force of 20 Ncm, and the maxillary prosthesis was then inserted in the patient’s mouth. The occlusal screws of the maxillary and mandibular prostheses were then tightened to 15 Ncm, and final occlusion was verified and adjusted. The screw channels were filled with silicone (Fit Checker, GC America Inc, Alsip, Ill) and sealed with composite resin after 4 weeks (Figure 12a and b). The patient was given postoperative cleaning instructions using superfloss, proxabrushes, and electrical water irrigation system. He was educated about maintenance and all potential complications related to the prosthesis (Figure 13). The patient was initially placed on a 4-month recall for periodontal maintenance. During these recalls, periodontal status was assessed, routine supragingival and subgingival debridement was performed, and oral hygiene instructions were reinforced (Figure 14A). At a 2-year recall, all implants were stable, and the prosthesis did not have any complications. The periodontal condition of the remaining natural teeth was stable; the probing depth ranged from 2–4 mm, plaque score was 31%, and bleeding score was 20%. Periapical radiographs revealed bone levels around the implants were within normal limits (Figure 14B). The patient remained satisfied with both prostheses (Figure 15).

**DISCUSSION**

The patient was diagnosed with aggressive periodontitis based on the rapid bone loss he experienced and the absence of an underlying medical condition. Although minimal local factors are often a characteristic of aggressive periodontal disease, it is not a primary diagnostic criterion. In this patient, the rapid periodontal bone loss cannot be explained solely by the presence of local factors, considering that the patient already had severe periodontal disease in the third decade of his life. Moreover, the periodontal treatment received, albeit irregular, was expected to have slowed down the progression of the disease; nevertheless, the patient experienced continued periodontal destruction leading to tooth loss. This denotes the aggressive nature of this patient’s disease.

Different implant-supported prosthodontic options were considered for the
patient, which included: (1) removable overdenture retained by individual attachments; (2) removable overdenture retained by a bar; (3) screw-retained fixed prosthesis in metal-resin; (4) screw-retained fixed prosthesis in metal-porcelain; (5) cemented, fixed prosthesis in metal-resin; (6) cemented, fixed prosthesis in metal-porcelain.

Figure 14. a. Periapical radiographs of all implants taken at a 4-month follow-up. b. Periapical radiographs of all implants taken at a 2-year follow-up show bone levels within normal limits. Compare with Figure 14a.
lain; and (7) single screw-retained metal substructure with individually cemented crowns. The patient refused a removable prosthetic option, and other fixed options described above were not considered due to financial reasons.

Though cephalometric analyses were not performed, patient history, clinical examination, and CBCT analysis revealed that the patient had bimaxillary protrusion. Therefore, implants placed in the anterior maxilla had anteriorly directed angulations despite the bone augmentation procedure. Consequently, the use of angled abutments was anticipated in order to have optimal placement of screw-access channels. This was also the reason that the maxilla was treated with a bone-level implant system (Astra Tech) as opposed to a tissue-level implant system (Straumann) that was used in the mandible. Though use of the same implant system on both arches would have been preferable for simplicity, the tissue level implant (Straumann) was not considered in the maxilla because: (1) the manufacturer of this implant system does not recommend the use of angled abutments on this type of implant (Synocta System; Straumann) for complete arch fixed (hybrid) prosthesis, and (2) this implant manufacturer does not provide a nonindexed University of California at Los Angeles-type prosthetic abutment for this type of implant (Standard Plus, Straumann).

It was decided to retain the 6 mandibular teeth because they had a good periodontal prognosis. Extraction of these labially inclined teeth may have provided better control in establishing optimal horizontal and vertical overlap of anterior teeth, as in a completely edentulous situation. However, the patient was motivated to retain these teeth as it added psychological benefit to him and his family for not being completely edentulous. Therefore, the maxillary incisors had to be arranged in an end-to-end position over the mandibular natural teeth. Placing the maxillary anterior teeth any more labially would have resulted in a protuberant maxillary lip (Figure 13). It can be argued that a single stage extraction of all maxillary teeth with or without immediate implant placement may have shortened the treatment time for this patient. However, a single stage extraction may be unacceptable in many young adults due to the psychological impact of losing all teeth simultaneously. Immediate placement of implants was not considered due to insufficient bone in the maxillary anterior region and the necessity for maxillary sinus floor elevation in the posterior region. Immediate loading of maxillary implants was not considered as an option because the patient was satisfied with his interim maxillary denture. Therefore, a clear advantage of the procedure for this patient could not be established. Furthermore, there is limited evidence in the literature for immediate and early loading of implants for fixed prosthesis in the maxilla, especially on grafted bone.20–22

The patient was educated that periodontal therapy and maintenance along with his motivation could ensure long-lasting periodontal health of his natural teeth. This has been pointed out in other similar case reports as an important element for long-term success.23–25 The patient was also cautioned that his mandibular teeth might need to be extracted and replaced with implants if future periodontal disease creates a poor prognosis. Therefore, screw-retained FPDs were favored over cementable FPDs in the
posterior region due to their retrievability, in the event that these implants were to become a part of a full arch prosthesis in the future.

**CONCLUSION**

This clinical report described the treatment planning and sequencing in the management of a young adult with generalized aggressive periodontitis. The treatment was accomplished in a strategic manner by using staged extractions and periodontal therapy, followed by bone grafts and implant placement. The subsequent prosthodontic therapy was also accomplished in stages. This approach helped to maximize patient adaptation and comfort, as well as allowed for evaluation of the patient’s compliance with periodontal therapy. Furthermore, it helped the patient financially, by allowing distribution of treatment expenses over a period of time. This approach may be a suitable option in the management of young adults with generalized aggressive periodontitis who require full mouth extraction and replacement by prosthesis.

**ABBREVIATIONS**

CBCT: cone-beam computerized tomography
FPD: fixed partial denture

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