

The JOURNAL of Cosmetic Dentistry

The Official Journal of the Academy of Cosmetic Dentistry®



VOLUME 23 • NUMBER 3
FALL 2007

SPECIAL ISSUE

COMPLEX ESTHETICS

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Maximizing Success and Minimizing Risk with Esthetic Implant Treatment Solutions



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INTRODUCTION

The growing amount of information that practitioners are required to assimilate when establishing a diagnosis and developing a treatment plan brings with it an increasing amount of complexity for both practitioners and their patients. Formulating treatment decisions based on what is truly best for the patient and important to the long-term success of treatment can at times be daunting. Striving to eliminate the weak links to long-term success helps to establish priorities when making treatment-planning decisions. Patients need to understand the need for treatment, as well as the importance of addressing parameters such as periodontal disease or functional concerns that are not currently affecting their lives, but that could eventually have an impact on treatment success.

Ideally, treatment-planning decisions should achieve the desired esthetic objectives while working to reduce areas of high risk.

In developing a treatment plan, skilled clinicians must balance the necessity to address their patients' chief complaints with the interdisciplinary information and knowledge gathered to establish an accurate diagnosis. A successful result ultimately depends on a multidimensional, diagnostically driven triage system that strives to increase benefit and reduce risk across the range of parameters upon which the diagnosis was based.

RISK AND PROGNOSIS

A great deal of information must be gathered and assimilated in order to make a diagnosis and develop a treatment plan that maintains the patient's best interests as the primary focus. Elements of risk and prognosis are combined to triage the significance of the various treatment-planning parameters

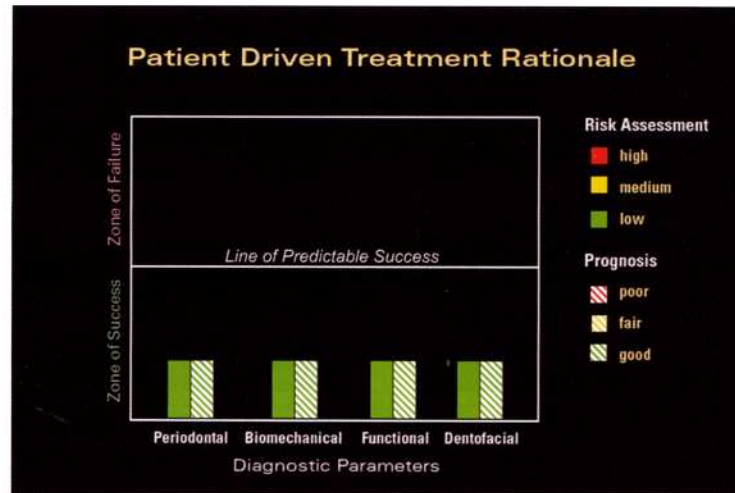


Table 1: Graphic representation of risk and prognosis—ideal health.

(Table 1). Treatment decisions that increase risk theoretically worsen prognosis and should be avoided. Ideally, treatment-planning decisions should achieve the desired esthetic objectives while working to reduce areas of high risk.

Risk is defined as the danger that injury, damage, or loss will occur. Risk assessment is based on information from each patient's past and current documentation. *Prognosis* is defined as a forecast of the probable result of a disease or a course of therapy.

Risk is only one factor that goes into determining prognosis. Other contributing factors are the cyclical nature of disease, the presence or absence of the contributing factors of disease, the patient's expected lifespan, diet, and how well the patient cares for his or her teeth. When establishing risk and prognosis during the diagnostic phase, it is imperative to move from the systemic and physiologic parameters to the dentofacial or esthetic parameters. Diagnostically, one must first determine the foundational and functional

risks involved and subsequently establish long-term prognosis prior to investing consideration into esthetics. Risk and prognosis should first be established for the patient's existing situation and secondarily extrapolated for the proposed course of therapy or treatment. Graphing the diagnostic parameters can quickly reveal which parameters have risk and prognosis in the area of concern.¹ Treatment decisions should strive to avoid increasing risk in areas that are currently low and lower risk when possible in areas that are high.

DIAGNOSTIC PARAMETERS

Risk and, ultimately, prognosis must first be established in the four fundamental diagnostic parameters: Periodontal, biomechanical, functional, and dentofacial/esthetic.

PERIODONTAL RISK

The essential elements in establishing periodontal risk are the presence or absence of bone loss and the presence or absence of contributing systemic factors such as diabetes or smoking.²

Periodontal risk, regardless of the patient's age, increases with the presence of bone loss or contributing systemic factors.³ Periodontal risk can be lowered in high-risk periodontal patients by moving toward implant-supported restorations.

BIOMECHANICAL RISK

Biomechanical risk deals primarily with the patient's susceptibility to caries and the extent of structural compromise present in the existing dentition. The higher the decay rate and structural compromise, the higher the risk.⁴ Biomechanical risk can be lowered or minimized by aggressively treating caries, avoiding aggressive tooth preparation, and choosing implant-supported restorations when teeth are severely compromised.

FUNCTIONAL RISK

Establishing functional risk involves the categorizing of attrition, individual tooth mobility, and the presence or absence of temporomandibular disease (TMD). Increasing amounts of tooth loss and mobility that are directly attributed to functional forces and/or symptoms



Figure 1: Maxillary fixed bridge in place for more than 20 years.



Figure 2: Significant bone is less evident on the distal aspect of tooth #10.



Figure 3: Moderate compromises in the structural integrity of the teeth establish a medium amount of risk and fair prognosis.



Figure 4: Gingival display and full-tooth reveal establish high dentofacial risk.

of TMD increase functional risk. Lowering functional risk involves creating an efficient system that distributes and minimizes forces and is harmonious with the function of the temporomandibular joints.³

DENTOFACIAL RISK

Dentofacial risk is based on tooth display and ideal tooth position in relationship to the face. This risk is higher in patients that have maximum tooth and tissue display. Dentofacial risk can be lowered primarily by establishing ideal intra-facial tooth position; and, secondarily, ideal intra-arch tooth position.

CASE PRESENTATION 1

A 48-year-old female presented for comprehensive examination and treatment. Her medical history was non-contributory. She was interested in exploring options for replacing the existing maxillary anterior fixed bridge that had been in place for more than 20 years (Fig 1); she hoped that contemporary materials and techniques could provide her with a more esthetic result. In addition to the fixed bridge, the patient's pertinent dental history included interproximal decay treated with direct alloy restorations and tooth loss due to periodontal disease.

DIAGNOSTIC PARAMETERS

Periodontal Risk. There was moderate bone loss throughout, with site-specific areas of severe bone loss around teeth #10 and #30 (Fig 2). Purulent exudate was evident upon probing around #10. Tooth #19 had been lost due to periodontal breakdown. The patient was deemed high risk for periodontal breakdown and given a poor long-term prognosis.

Biomechanical Risk. Past history of direct restorations on the posterior teeth indicated structural compromise and increased potential for future pulpal involvement in those teeth. The bridge abut-

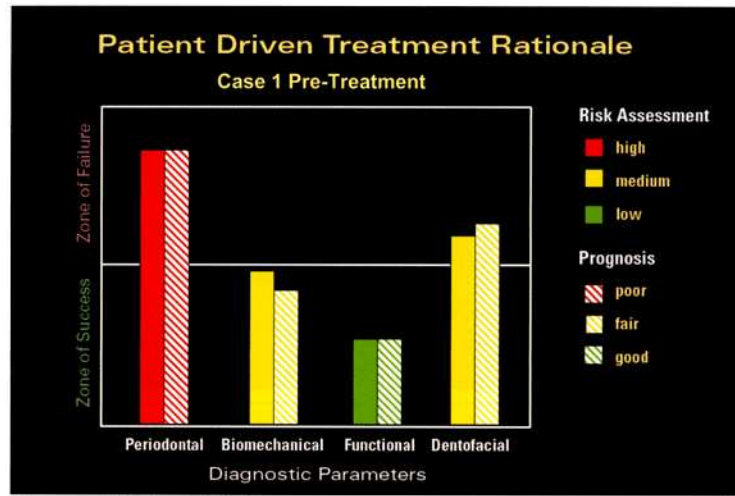


Table 2: Clinical Case 1: Pre-treatment diagnostic parameters.



Figure 5: Comprehensive orthodontics to move the gingival complex coronal through the maxillary incisor region.

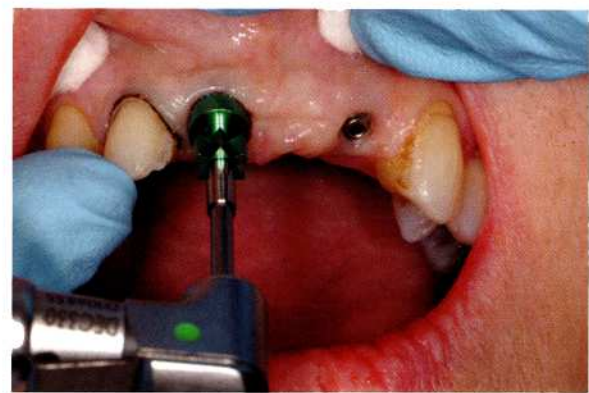


Figure 6: Fixture position and veneer preparation are captured using an open-tray impression technique for optimal accuracy.

ments had been endodontically treated. The biomechanical risk assessment was deemed moderate and contributed to a fair long-term prognosis (Fig 3).

Functional Risk. The patient had little if any attrition of the functional surfaces of the teeth. There was no mobility attributed to functional forces. She had no history of TMD and her temporomandibular joints could comfortably accept load testing. The functional risk assessment was placed in the low range and she was given a good functional prognosis.

Dentofacial Risk. High lip dynamics and 3 mm of maxillary tooth reveal at rest (Fig 4) were noted. Secondary to the vertical considerations, some intra-arch irregularities existed, specifically the labial inclination of the maxillary right lateral incisor. The fact that the patient revealed the maxillary teeth and gingiva in a full smile placed the risk assessment for dentofacial considerations in the medium-to-high range, with a corresponding fair-to-poor prognosis.⁶

Risk and prognosis for all the parameters were combined so that the patient could understand the driving forces behind treatment decisions.¹

Table 2 shows that the periodontal and dentofacial risks were of key importance in properly managing this case. Treatment decisions revolved around reducing risk in these key areas, so as to increase the chance for long-term success.

TREATMENT PLAN

An implant-supported fixed bridge was treatment planned to replace the failing fixed bridge in order to eliminate the periodontal risk and the biomechanical risk in this area. Although tooth #10 had a hopeless prognosis and required extraction, the decision to remove tooth #8, which had a fair prognosis



Figure 7: Patient desired improved esthetics of anterior segment.



Figure 8: Patient achieves desired esthetics and greater chance of long-term success with implant-supported restoration.

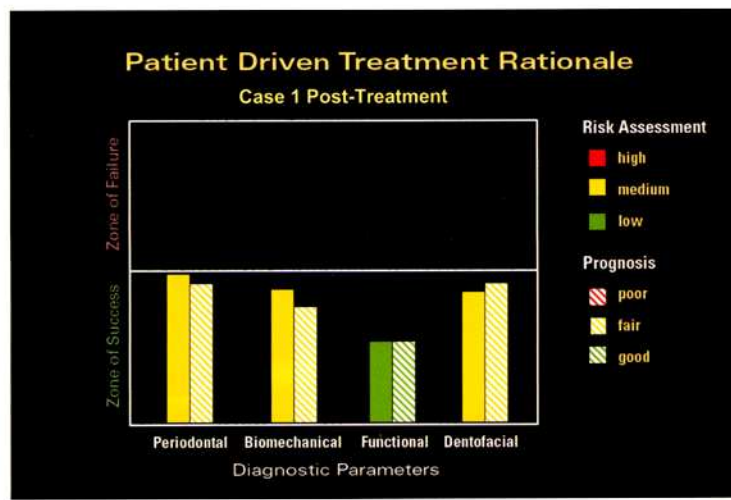


Table 3: Clinical Case 1: Post-treatment diagnostic parameters.

biomechanically, was made to avoid having two adjacent implants in the esthetic zone in a patient of high dentofacial risk. Pre-prosthetic orthodontic treatment was prescribed to move free gingival margins of the anterior teeth into a more favorable position.

TREATMENT PHASE

The treatment phase spanned two and a half years. It involved comprehensive orthodontics (Fig 5) to facilitate the coronal positioning of the free gingival margins of the maxillary incisors, the extraction of teeth #8 and #10, immediate placement

of implants in the #8 and #10 positions (Fig 6), an implant-supported bridge at ##8-10, and a porcelain veneer on #7.^{7,8}

CASE SUMMARY

Periodontal risk for this patient was lowered by using implant-supported restorations. Dentofacial risk was managed through the use of orthodontics. The increase of biomechanical risk was avoided by maintaining enamel support for the veneer on tooth #7.⁹ Function was addressed by equilibration after orthodontic treatment (Table 3).¹⁰ By combining risk manage-

ment with smile design principles, the patient and the restorative team can be assured of the best chances for a long-lasting, esthetic result (Figs 7 & 8).

CASE PRESENTATION 2

A 54-year-old female presented for examination and treatment. She revealed in her medical history that she was allergic to sulfa. She also noted that she had a dental history of grinding and clenching. Her desire was to have predictable dental work that would improve her appearance and would be functionally



Figure 9: Pre-treatment image, full-face.



Figure 10: Pre-treatment image, natural smile.



Figure 11: Pre-treatment image, natural smile, lateral view.



Figure 12: Retracted view illustrating undulating mandibular occlusal plane.



Figure 13: Occlusal view showing amount of previous dentistry.

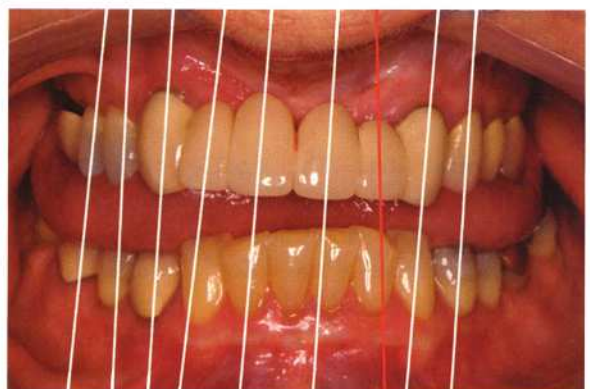


Figure 14: Axial inclinations of maxillary dentition.

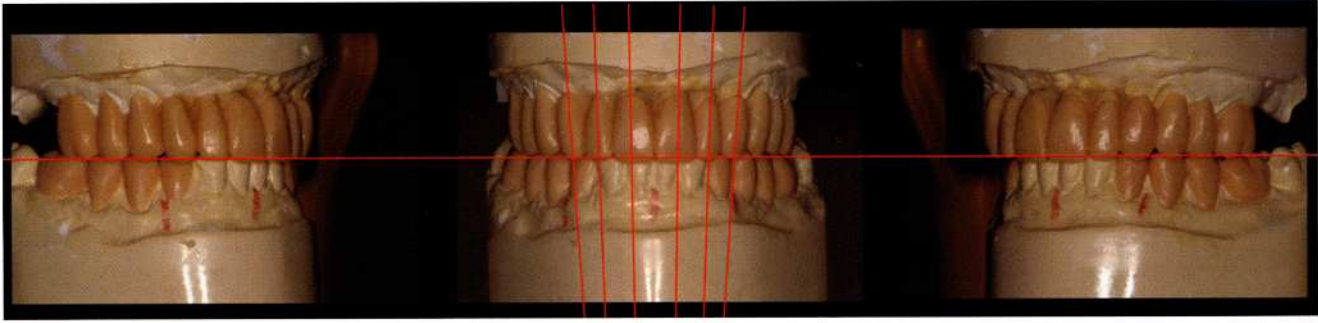


Figure 15: Initial wax-up to preliminarily establish increased vertical dimension.

sound (Figs 9–11). She admitted to being very anxious about seeking such extensive treatment, because her history of dental care had included treatment solutions that fell short of their anticipated longevity.

DIAGNOSTIC PARAMETERS

Periodontal Risk. Probing depths were normal except for a recording of a 6-mm sulcus on the mesio-lingual of tooth number #3. The sounding of the alveolar crests around #6 and #11 revealed major dehiscences of the alveolar morphology on the facial aspects of the bridge abutment teeth (Fig 12). The bridge exhibited mobility due to the periodontal compromise around the abutments. The patient's periodontal risk profile was deemed moderate overall, with site-specific areas of high risk and hopeless prognoses for teeth #6 and #11.

Biomechanical Risk. The significant compromise in the structural integrity of the patient's teeth, as well as the presence of multiple failing restorations, placed her biomechanical risk assessment in the "high" category (Figs 13 & 14).

Functional Risk. Even though the patient revealed a history of "grinding and clenching," there was

no evidence to support a diagnosis of nocturnal bruxism, which would have placed her in a high-risk category functionally. Instead, the patterns of tooth wear were determined to be the result of an inefficient chewing system and dysfunction. The patient was placed in a "medium" risk category functionally due to the diagnosis of dysfunction (Fig 15).

Dentofacial Risk. The patient's low lip dynamics and minimal display of tooth structure placed her at low risk dentofacially.

TREATMENT PLAN

The treatment plan for this patient required opening the vertical dimension to move her brachyfacial facial form toward a more mesiofacial situation and create better harmony of the teeth within the framework of the face.^{11–13} This was accomplished by replacing crowns on the mandibular posterior teeth; and by placing full-coverage restorations on the maxillary posterior teeth and an implant-supported fixed bridge to replace teeth ##6–11. This bridge reduced the periodontal and biomechanical risk and provided stable anterior guidance. The functional risk was managed by using centric relation as a stable

reference point, creating bilateral, simultaneous posterior contacts and establishing a smooth anterior guidance with a shallow trajectory that was in harmony with the neuromuscular system.¹⁰

TREATMENT PHASE

Establishment of an appropriate vertical dimension was first approached by fulfilling the esthetic requirements of creating balance and harmony for the patient's facial features; and secondarily by creating functional harmony within the masticatory system (Fig 16). Due to the complexity of the case, it was decided to approach the restoration with "segmented" dentistry, including a prosthetic anterior partial designed to increase the occlusal vertical dimension during block graft healing and implant fixture osseointegration (Figs 17 & 18).¹⁴ The mandibular posterior segments were completed following ridge augmentation and the establishment of an acceptable vertical dimension (Fig 19). Once the implants were integrated in the upper arch, the upper prosthetics were completed at the same vertical dimension. The entire treatment, including surgical and prosthetic

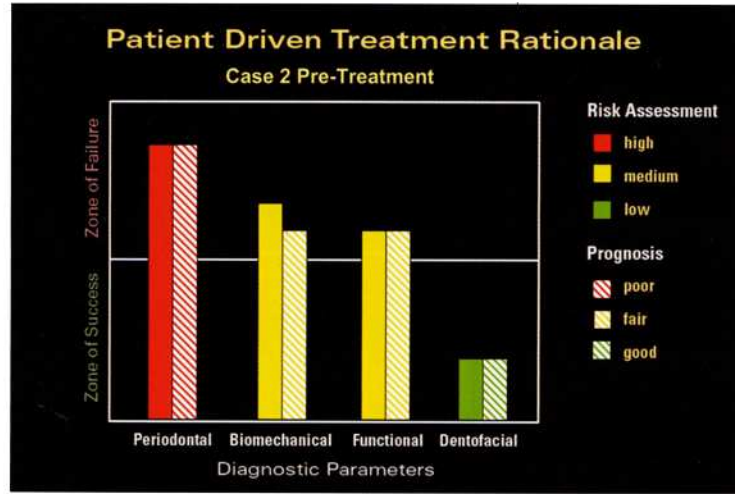


Table 4: Clinical Case 2: Pre-treatment diagnostic parameters.



Figure 16: Removable appliance for anterior provisionalization and verification of increased vertical dimension.

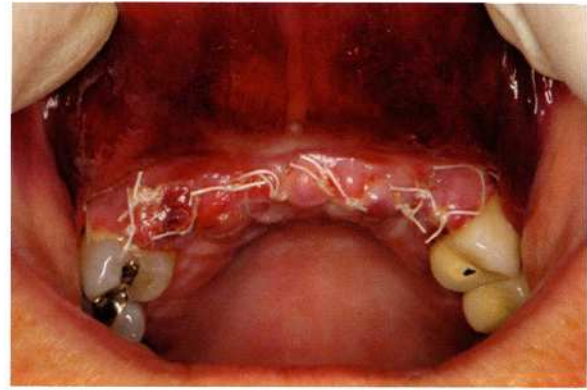


Figure 17: Evaluation of maxillary ridge augmentation, 24 hours postoperative.

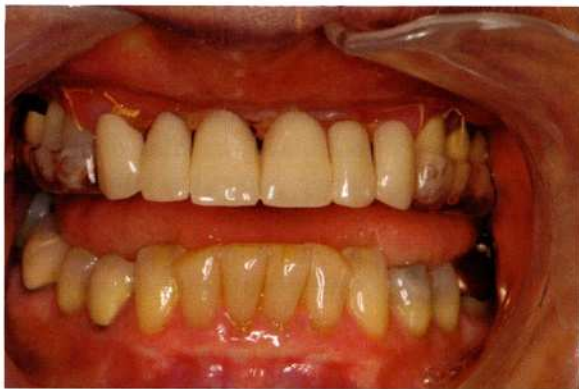


Figure 18: Removable appliance in place, 7 days postoperative.

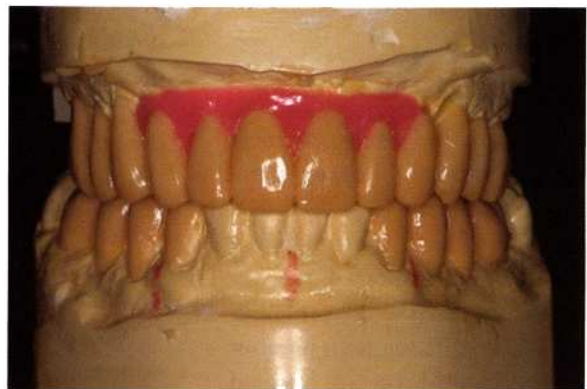


Figure 19: Final wax-up at clinically verified vertical dimension.

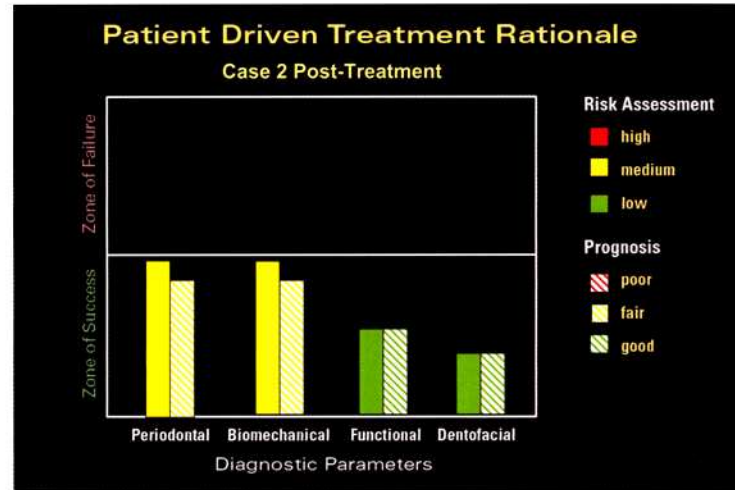


Table 5: Clinical Case 2: Post-treatment diagnostic parameters.



Figure 20: Post-treatment full-face view showing improved facial balance.

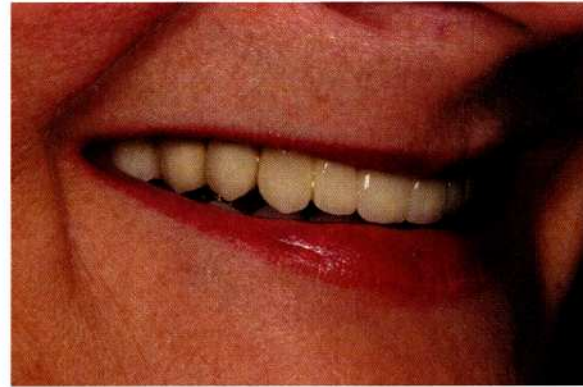


Figure 21: Post-treatment, natural smile, lateral view.

components, spanned a course of eight months.

CASE SUMMARY

The patient has been extremely pleased with the facial changes created by the dentistry (Figs 20 & 21). Special attention to the functional aspects of the case allowed us to reduce risk and increase the probability of a successful long-term prognosis. Biomechanical risk was lowered in the maxillary anterior segment by selecting an implant-supported restoration. Table 4 gives a graphic representation of the patient's high levels of risk before treatment. Table

5 (post-treatment) shows improvement in all areas; however, because of the significant amount of dentistry that was completed on the patient's remaining teeth, her biomechanical risk could be reduced only to a "moderate" level.

CONCLUSION

As practitioners, we inherently understand that certain diagnostic indications decrease the chances for our restorative treatments to succeed. Even when we are relatively inexperienced clinicians, we realize that significant dentoalveolar bone

loss, high caries rates, significant attrition, and excessive tooth and gingival displays create challenging situations and less-than-predictable outcomes. Graphing the four diagnostic parameters can quickly reveal which parameters have risk and prognosis in areas of concern. The anticipated results of the proposed course of therapy or treatment can in turn be evaluated. Treatment decisions are supported by lowering risk when possible, and countered when they involve increasing risk. For patients with greater susceptibility to periodontal and biomechanical

cal breakdown, implants offer the advantage of reducing risk in these areas. In addition, a proper diagnosis combined with the incorporation of esthetic principals for proper implant placement and restoration can provide a highly esthetic result. Extracting periodontally and/or biomechanically compromised teeth and selecting implant-supported restorations is a useful treatment modality that can satisfy the esthetic requirements for a patient, as well as increase the case's long-term prognosis.

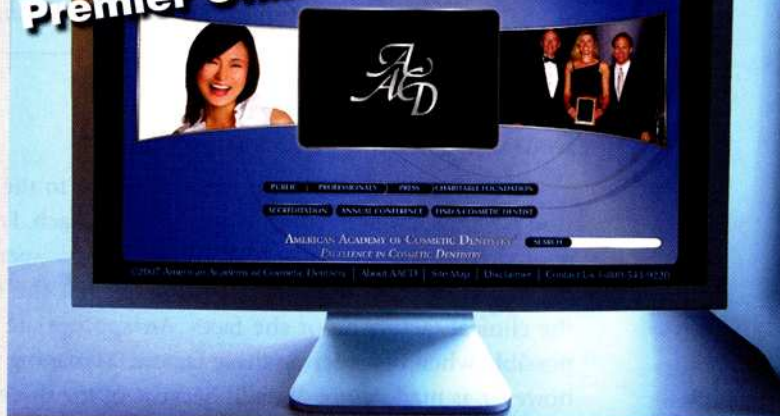
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