Systematic Analysis of an Anterior Wear Case to Fulfill Esthetic and Functional Objectives

Michael R. Sesemann, DDS

ABSTRACT

It is beneficial to have a system in place for analysis of clinical data collected from a patient's initial examination. This system has four diagnostic categories that enable the clinician to thoroughly assess the clinical findings and establish a comprehensive diagnosis. An optimal treatment plan can be formulated to positively affect the prognosis of the presenting conditions. With the patient's treatment goals in mind, the clinician can determine the minimum amount of dentistry needed to increase long-term prognosis.

Once clinical findings and diagnostic data are obtained from a patient's initial examination, a systematic evaluation of the data is imperative for proper decision-making.[1] With a system in place, the restorative dentist can create a diagnostic opinion free of emotional bias and formulate an optimal treatment plan that lowers the risk of future problems.[2] By calculating a risk profile in four diagnostic categories and extrapolating how various treatment options affect those values, questions pertaining to which treatment options should be exercised, and which should not, can be answered. In addition to the diagnostic opinion, laboratory procedures such as analysis of properly mounted study casts and the construction of a diagnostic wax-up can aid the clinician in determining the minimum amount of dentistry needed to satisfy the goals of treatment so that biomechanical risk is not increased with the inclusion of unnecessary dentistry.[3] As stated by John Kois, DMD, MSD, "There is no dentistry better than no dentistry."

CLINICAL CASE OVERVIEW

A 42-year-old man presented with a chief concern regarding the wear of his anterior teeth (Figure 1). Upon questioning, he elaborated that the wear seemed to be currently active and progressive, leaving him with a feeling of uncertainty as to the future health of his dentition. He added that the appearance of his incisors seemed to make him look older than his actual age, and as a sales representative, he was self-conscious of his smile in occupational situations (Figure 2 and Figure 3).

The patient's medical history was noncontributory, with his only positive response being an allergy to grain dusts. The only subject that was noted on the patient's dental history form was the use of oral tobacco. He had compliantly kept up with his past recare appointments in a timely manner, and he reported no dental pain or sensitivity at that time.

DIAGNOSTIC FINDINGS, RISK ASSESSMENT, AND PROGNOSIS

Periodontal: Radiographic examination of the patient's periodontal condition revealed optimum alveolar levels with no bone loss (Figure 4). Clinically, there were no signs of mobility and there was no bleeding when conducting six points of sulcular probing around each tooth. Though the presenting conditions of the periodontal tissues could be classified with an excellent prognosis, the existence of the patient's oral tobacco habit tempered such an optimistic forecast.[4]

Risk: Low
Prognosis: Good

Biomechanical: Assessing biomechanical risk and its estimated prognosis centers on the condition of the patient's dentition and dentistry at the time of examination. It is also necessary to formulate a hypothesis of the patient's current and future susceptibility to decay and erosion.[5] Numerous posterior amalgams were identified and assessed as currently clinically acceptable, but they were perceived to be in the latter stages of their service viability[6] (Figure 5 and Figure 6). Anterior composite restorations on tooth Nos. 7 through 10 had visual signs of marginal breakdown, leakage, and clinical failure. A risk/prognosis profile that took into account the reasonable remaining service of the patient's dentistry placed the patient into a moderate-risk category, even though there were no signs of gross active caries or erosion.[7]

Risk: Moderate
Prognosis: Poor

Functional: The patient reported no history of neurologic disorders or historical accounting of sleep bruxism from his spouse. A lack of posterior tooth wear was consistent with those accounts. The level of wear of the anterior dentition was certainly significant.[8] When combined with the patient's report of recent changes in the shapes of his incisor teeth, an active pathology was determined to be present. When the patient's temporomandibular joints (TMJ) were clinically manipulated into centric relation,[9] a posterior interference of tooth Nos. 2 and 31 was noted.[10] A centric relation bite registration and polyvinylsiloxane impressions were taken in order to mount casts for dental laboratory analysis. The

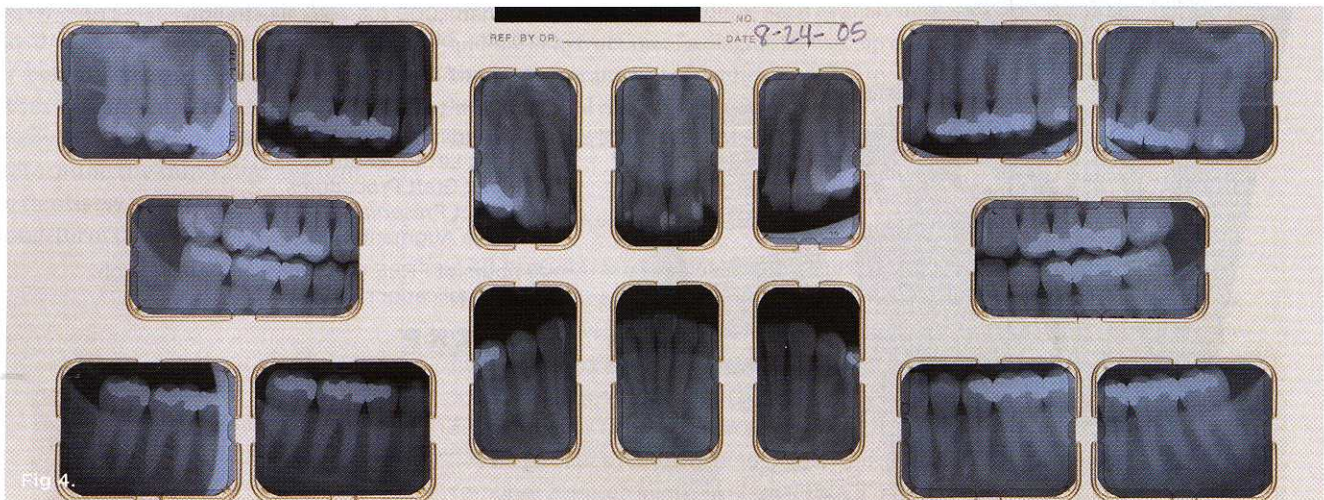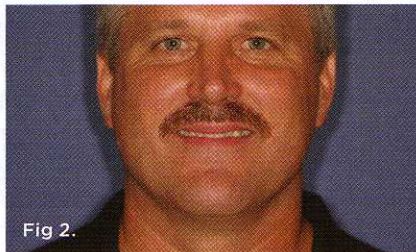

Fig 1.

Fig 2.

Fig 3.

Fig 4.

Fig 1. The patient's smile from a conversational distance reveals a reverse smile line and teeth that are shorter than ideal proportions. **Fig 2.** Full-face image of 42-year-old patient seeking esthetic enhancement and biomechanical stability. **Fig 3.** 1:1 magnification of the anterior teeth discloses attrition and compromised restorations. **Fig 4.** Full-mouth radiographs reveal no bone loss and suggest a good long-term periodontal prognosis.

laboratory findings corroborated the clinical presentation that to obtain maximum intercuspation (MIP), the patient had to posture his mandible anteriorly with his TMJs translating commensurately. When the TMJs were positioned in centric relation and the mandible closed in an arc, the patient occluded on his second molars, tooth Nos. 2 and 31. Since MIP could not be obtained in a centric relation arc of closure because of posterior prematurities, a diagnosis of occlusal dysfunction was rendered.

Risk: Moderate
Prognosis: Poor

Dentofacial: Clinical photography has become a valuable tool for dentofacial analysis in dental treatment planning.[11] It is necessary to have a strict protocol of image compositions in order to fully utilize photography in a constructive diagnostic manner. Full facial views, natural smile, and rest (repose) images and retracted compositions yield good diagnostic data for analytic review after the patient has left the office. Clinically, when asked to give a "normal" smile, the patient's lip dynamics would be classified as low. However, with a broad smile, it was observed that the dental papillae were revealed and the upper lip line was coincident with the gingival crests of the maxillary incisors. The risk/prognosis classification is influenced by the patient's maximum capacity for reveal, as a patient who is guarded with their smile because of esthetic compromises will smile more dynamically when their confidence has been restored. The patient revealed no maxillary tooth structure when his lip was in repose.

Risk: Moderate
Prognosis: Fair

TREATMENT GOALS

The primary treatment goal was to fulfill the esthetic objectives of the patient while satisfying functional parameters for comfort and longevity of the dentistry provided.[12] Treatment recommendations for biomechanics and function would have to be determined through model work and a diagnostic wax-up (Figure 7 through Figure 9). Three-dimensional (3-D) information from the diagnostic wax-up would also resolve the question concerning the amount of dentistry required. Because of the failing composite restorations, the patient's esthetic objectives, and the need to change the maxillary tooth shape
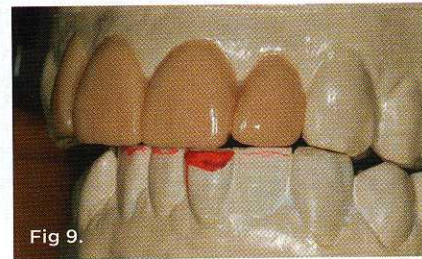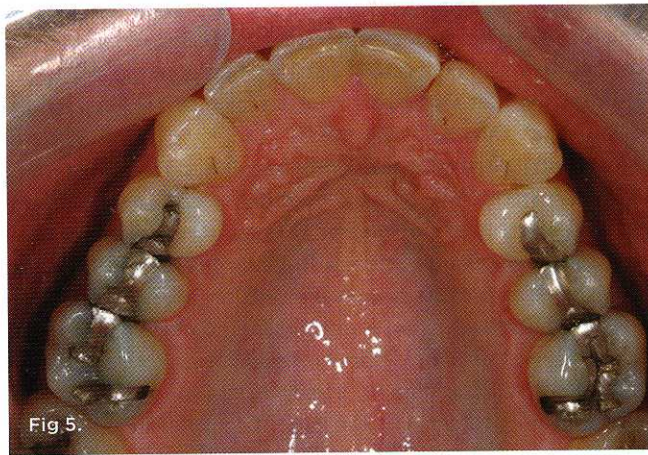

Fig 5.

Fig 6.

Fig 7.

Fig 8.

Fig 9.

Fig 5. The patient's maxillary arch displaying extensive posterior restorative dentistry and incisal edge attrition. **Fig 6.** The patient's mandibular arch. **Fig 7.** Diagnostic wax-up of tooth Nos. 7 through 10 restoring clinical crown length and providing greater anatomic detail of line angles and embrasures. **Fig 8.** Excursive movements of the articulated study models and diagnostic wax-up allow for preliminary estimation of incisal edge compatibility with the natural cuspids. **Fig 9.** Esthetic and functional reshaping of the mandibular anteriors create smooth edges that are less likely to chip, refined incisal embrasures, and slightly more interocclusal clearance for labially verted tooth No. 24.

for function (specifically, the facial relocation of the maxillary incisal edge), maxillary anterior restorations would be needed.

The question that needed to be answered was whether the maxillary cuspids would have to be restored per a sound functional rationale in providing an acceptable occlusal scheme.

TREATMENT PLAN

The treatment plan would involve and affect three diagnostic categories:

Function/Occlusal treatment: Laboratory and clinical equilibration would be needed to eliminate the dysfunctional occlusion, to confirm a sound occlusal scheme anteriorly for efficient function, and to determine the number of restorations needed, ie, whether the cuspids would need to be included restoratively.[13] After conception of the treatment in the dental laboratory it would be carried out on the patient clinically.

Biomechanical and Dentofacial treatment: The gingival architecture would be altered with a gingivoplasty of tooth Nos. 8 and 10

Fig 10.

Fig 11.

Fig 12.

Fig 10. Gingivoplasty carried out with soft-tissue diode laser. **Fig 11.** CAD-CAM leucite-reinforced restorations for tooth Nos. 7 through 10. **Fig 12.** Superimposition of the approved contours of the provisional restorations over the virtual working model allowed the functional morphology of the provisional restorations to be duplicated in the milled restorations.

using a soft-tissue diode laser (Odyssey®, Ivoclar Vivadent, www.ivoclarvivadent.com) (Figure 10) to lengthen the clinical crowns to more closely align with their contralateral partners.[14] All-porcelain restorations for the maxillary anterior four to six teeth as determined from the laboratory analysis would be completed. Specific anterior teeth proportions could be visualized and confirmed by constructing provisional prototypes onto the prepared teeth based off of the wax-up. A repositioning of the maxillary incisal edge in the sagittal plane to provide greater overjet would be necessary to provide the tooth size and shape changes that could satisfy the esthetic objectives. The compatibility of the new maxillary incisal edge position with the lips in function and with phonetics could also be confirmed with the provisional prototypes.

TREATMENT PHASES

Periodontal

Tooth Nos. 8 and 10 presented with visually coronal gingival crests. Because of the disharmony seen when comparing their clinical crown heights to their bilateral counterparts, sounding of the osseous crest (measuring the distance from the gingival margin to the alveolar crest) was carried out under local anesthesia. The data revealed the sounding depths on the facial aspects of tooth Nos. 8 and 10 to be 4 mm, placing them in a low crest category and thereby making them excellent candidates for simple gingivoplasty to extend the clinical crown heights by raising the gingival crests apically.

Occlusion/Functional

After carrying out a laboratory equilibration on properly mounted study casts in the laboratory, the equilibration was carried out on the patient's dentition in the clinical operatory. Elimination of posterior interferences allowed the patient to close into maximum intercuspation from a centric relation arc of closure efficiently and without hindrance. In addition, it was confirmed that a longer incisor dimension of the incisors could be accommodated and protected by the patient's cuspids in anticipated functional movements. The cuspid morphology also allowed disclusion of the posterior teeth in lateral movements to prevent working and balancing interferences. Though the diagnostic wax-up provided a blueprint for construction, the patient's functional occlusion and the compatible lingual morphology of the maxillary incisors would have to be verified in the provisional prototypes.

Restorative

Through the laboratory equilibration and the diagnostic wax-up, it was determined that four all-porcelain restorations would be made for tooth Nos. 7 through 10 (Empress®, Ivoclar Vivadent) (Figure 11).[15] What would be revolutionary with this case is that the lingual morphology of the maxillary provisionals would be scanned and utilized in the design of the upper restorations by
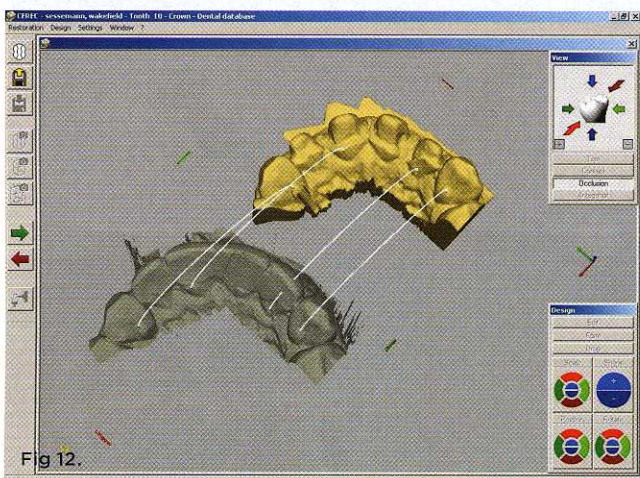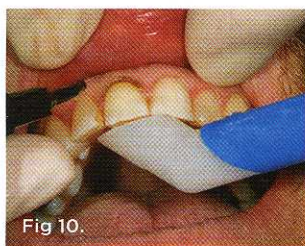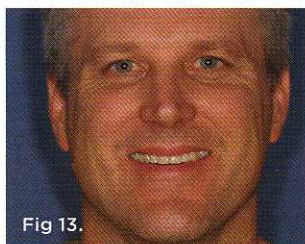
Fig 13. Full-face image after completion of restorations Nos. 7 through 10. **Fig 14.** Patient's smile reflects the esthetic benefits of the completed restorations. **Fig 15.** Anterior teeth have been restored to create proportionate balance and harmony.

superimposing the image of the *adjusted* provisionals over the working model (Figure 12). Hence, the leucite-reinforced restorations would be milled to transfer the acceptable functional morphology of the provisionals to the final restorations. The restorations were characterized facially via a cut-back technique pioneered by Lee Culp, CDT with coverage ceramic on the incisal half of the facial surface. The completed restorations were bonded with a three-step total-etch technique using OptiBond FL° (Kerr Corporation, www.kerrdental.com).[16,17]

CONCLUSION

Analyzing risk in four diagnostic categories—periodontal, biomechanical, functional, and dentofacial—in an analytic manner without emotional bias is an excellent way to determine the extent and nature of a treatment plan. It allows the clinician to succinctly identify a patient's risk factors and extrapolate how various treatment modalities can affect the prognosis. In addition, it is also beneficial to have accompanying diagnostic techniques for determining treatment, especially when it comes to occlusal and functional categories. Precise laboratory techniques such as equilibration of properly mounted diagnostic study casts and/or the fabrication of a diagnostic wax-up *by the dentist* can provide excellent data for completing treatment. The risk/prognosis profile was only mildly improved in the biomechanical category of the

treatment for this patient essentially because a similar amount of dentistry remained; however, the prognosis was improved because the maxillary anterior restorations were no longer faulty. The risk/prognosis profiles in occlusion/function and dentofacial esthetics were significantly improved while satisfying the patient's original treatment objectives (Figure 13 through Figure 15).

ABOUT THE AUTHOR

Michael R. Sesemann, DDS
Private Practice, Omaha, Nebraska

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