Advancing Dentistry Through

Science

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Minimizing Risk

A clinical case review

Can we expect that our diagnosis and risk evaluation will always lead us to the most predictable treatment the first time?

When a patient's diagnosis includes a constricted chewing pattern and potential parafunction, the treatment options include orthodontic repositioning of the anterior teeth, restoring lost tooth structure, and management of the parafunction. The following case demonstrates the principles of risk-based treatment planning and the difficulty in identifying all of the evidence in an effort to ensure success in our restorative treatment plans.

The patient, a 35 year old man, was concerned with the chipping and thinning of his maxillary incisal edges and unhappy with the appearance of his teeth. (Figure 1) His medical history was noncontributory. The patient reported that an equilibration had been initiated 10 years earlier, to treat a centric occlusion/ maximum intercuspation discrepancy. This treatment was never completed, however, because during the process, the patient experienced increased discomfort, tension headaches, sore teeth, and jaw problems. Additionally, the patient reported that he periodically had a habit of clenching his teeth together. He further stated that when he bites his teeth together, he does not feel all of them touch. (Figure2)

During the comprehensive examination the patient answered, "yes" to all of the Kois functional diagnostic questions. He reported seeing changes in his teeth within the last five years (chipping and thinning) and that he experienced discomfort when chewing foods such as bagels, hard breads and chewing gum. The patient also expressed that he sometimes would awaken with awareness of his teeth and when his night guard came out in the morning, his front teeth were his only contacts. An evaluation photograph of the patient at age 17 proved inconclusive. (Figure3)

To asses the patient's risk, utilizing the Kois Diagnostic Opinion form, it was determined he was of low risk periodontally, as he had good bone support, with a good prognosis.

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(Figure 4 and Figure 5) There was evidence of slight recession and abrasion on tooth #9 but this did not affect his risk or prognosis. Biomechanically, there were some small amalgams, a few areas of erosion, but no decay, so he was considered to be low risk with a good prognosis in this area as well. (Figure 6) Functionally, there were wear facets present on the facial aspects of the mandibular anterior teeth and the lingual surfaces of the maxillary anterior teeth and a lack of posterior tooth wear. (Figure 7 and Figure 8) These areas of moderate attrition from normal forces were consistent with a diagnosis of constricted chewing pattern, which carries a moderate risk. (Figure 9) Dentofacially, the patient had medium lip dynamics, wanted to modify the color of his teeth, had some rotations and was ultimately going to change the maxillary and mandibular incisal edges of his anteriors. (Figure 10 through Figure 13) This gave the patient a moderate risk with a good prognosis. (Figure 14)

In order to determine a starting point or reference point (P1), the patient wore a deprogramming appliance. As suspected, the jaw came forward, consistent with a diagnosis of constricted chewing pattern. Interestingly, the appliance had streak marks, which raised suspicions of parafunction. The patient's night guard appliance also had lateral (side-to-side) streaks, indicative of parafunction, but this wear could not be duplicated on the teeth. (Figure 15) The destructive wear on the front teeth (thinning) was not associated with the lateral excursive movements of parafunction. Although a parafunction habit could not be completely eliminated in the diagnosis, which, incidentally, would raise the risk, the main problem and destruction to the incisors was from a constricted chewing pattern.

Cephalometric tracings were completed prior to and after implementing the deprogramming protocol. (Figure 16) Although the cephalometric radiograph did not diagnose or determine the direction of treatment, it was an important guideline for treatment and helped to confirm the suspicions of a constricted chewing pattern diagnosis. The orthopedic position of the mandible after deprogramming was slightly anterior in a comparison of the pre- and the post-deprogrammed tracings. Additionally, the reading from the upper central to SN (Sella-Nasion) was measured at 100° and the interincisal angle measured 142°, slightly deviating from the expected norms. (Figures 17 and Figure 18)

Using the Kois 10 Step Management Considerations form, the various treatment options were carefully evaluated and selected. (Figure 19 and Figure 20) Initial treatment consisted of orthodontic therapy to correct the anterior rotations, tip the maxillary anterior teeth (#6-#11) out facially, and intrude the mandibular anterior teeth (#22-#27). The incisal edge of the mandibular anteriors was acceptable, but the patient preferred to have them restored. In communicating this to the orthodontist, it was important to emphasize the need for intrusion of the lower anteriors to establish space, but create no change in occlusal vertical dimension. As a result of the orthodontics, a more favorable horizontal relationship of the anterior teeth was established (correcting the constricted chewing pattern) and sufficient inter-arch space was built in for both postorthodontic equilibration and restoration of the anterior teeth with minimal tooth preparation. (Figure 21)

A 6-month stabilization period was advised after orthodontic therapy and before equilibration or restorative procedures were initiated. During this stabilization period, overlay retainers were worn for the entire 6 months, followed by deprogramming for 3 weeks, after which the orthopedic position of the mandible remained unchanged. This suggested the orthodontic therapy had created a more favorable relationship of the anterior teeth and released the constriction. Equilibration was performed after deprogramming with a deprogramming appliance. Ultimately, restoration of the anterior teeth and the worn-away tooth structure was accomplished with enamel-bonded feldspathic veneers.

The preparation design for the restorations on the palatal aspects of the maxillary incisors was determined by the existing wear facets, which minimized any further tooth reduction. (Figure 22) The cingulums of the incisors remained intact and the facial and proximal preparations remained in enamel. This design reduced the biomechanical compromises to the teeth. (Figure 23)

Slight spacing created between the maxillary anterior teeth when they were flared out in the orthodontic phase, required proximal preparation. (Figure 24) This was done in the areas of the maxillary incisors, while spaces distal to the cuspids were not closed as the patient agreed this was not an esthetic compromise. (Figure 25 through Figure 27)

With the patient's medium lip dynamics and moderate esthetic risk, the facial recession and abrasion on maxillary left central incisor was judged a minor esthetic concern. (Figure 28) The cervical margins were therefore prepared to remain slightly supragingival and entirely in enamel. By creating the 'contact lens' effect in the final restorations the margins were not visible after bonding. (Figures 29 and Figure 30)

The mandibular cuspids required restoration of the incisal edges to re-couple with the maxillary cuspids and restore normal guidance. Therefore, only minimal facial tooth preparation was needed, with the final restoration redefining the incisal portion to restore the tooth structure that was lost from attrition. The cervical

margins remained supragingival in enamel and no proximal reduction was required. The patient requested restoration of the incisal edges of the mandibular incisors to cover the exposed dentin. The preparations were completed with a reduction strategy similar to that of the mandibular cuspids. (Figure 31)

All restorations were bonded using Kois Center bonding protocols. After bonding was completed the occlusion was refined to maintain bilateral simultaneous contact (P2 - home) with the cuspids and posterior teeth holding shim stock, while the incisors allowed the shim stock to pull through. While sitting up with 200-micron horseshoe articulating paper between his teeth, the patient performed the chew test to illustrate any heavy streaks, which were guidance interferences that were adjusted out. This served to refine the function on the lingual surfaces of the maxillary anterior teeth and establish a smooth pathway (P3). (Figure 32 and Figure 33)

Within 3 months of the completion of treatment, the patient returned with a fracture at the distoincisal of the mandibular right cuspid's veneer. He reported that the fracture had occurred while he was asleep. The veneer was remade and bonded with the guidance slightly flattened on the patient's right side to decrease friction. The fracture occurred again within the next 3 months and again during sleep.

The episodic nature of this patient's parafunction and the preoperative wear pattern on the patient's dentition, which was consistent with constricted chewing pattern, served to mask the presence of the patient's destructive forces of parafunction. Thus, the existence of periodic parafunction, which holds a higher than moderate functional risk profile, had to be considered even if the destructive pattern of attrition on the teeth was from a constricted chewing pattern. Interestingly, the fractures always occurred during sleep. This is indicative of a nighttime sleep disorder, such as parafunction, rather than a daytime occclusal disorder as in constricted chewing pattern. The fracture only occurred on the tooth that was most at risk, the mandibular cuspid. This tooth was designed and positioned to handle lateral loading to the system and was covered with a porcelain veneer. The opposing maxillary cuspid handled the load on the palatal surface but the tooth enamel was still intact, indicating parafunctional forces could not have fractured this intact, unrestored cuspid. Porcelain, however, cannot tolerate parafunctional forces. Coverage with veneers puts a restored tooth more at risk of fracture than an unrestored tooth when subjected to abnormal parafunctional forces. This ultimately required protection of the anterior restorations and dentition with a flat night guard. (Figure 34) Since the placement of the night guard lateral grooves have appeared, confirming the diagnosis of episodic sleep bruxism. (Figure35) Consequently, there have been no further failures in the restorations.

This case demonstrates that, when faced with failure to our restorations despite a thorough risk-based treatment plan, reevaluation of the diagnosis and further analysis is critical in order to ensure long-term success. Rather than change the design of the restorations and increase biomechanical risk, when faced with restorative fractures, consideration of episodic parafunctional forces, in cases like this, is a good approach. Periodic parafunctional forces are a good prognostic indicator of potential restorative fractures.

Furthermore, a patient can have more than one diagnosis; they can have an occlusal disorder and a sleep disorder. Destructive forces during sleep can be more predictably managed with a night guard. The moderate functional risk, from the patient's constricted chewing pattern during mastication, was successfully reduced using orthodontic therapy to create a more favorable horizontal position of the anterior teeth. The biomechanical risks to the restored teeth were not ultimately increased by using orthodontic correction to change the position of the anterior teeth through intrusion and flaring. This repositioning allowed room for minimally invasive enamel supported preparation designs. (Figure 36) The dentofacial risk was addressed by using feldspathic veneers, a restorative strategy with a translucent design that more easily replicates natural tooth vitality and hides the cervical margin. The patient was a low periodontal risk; therefore a recall frequency of 6 months sufficiently addressed this patient's needs. As a consequence of this diagnostic and treatment approach, the patient's teeth were successfully restored. The final restorations continue to be esthetic and functional for this patient, with no increase in risk to the system. The patient wears a nighguard every night and has not had any more fractures. By properly restoring the breakdown to his dentition that occurred from daytime chewing and nighttime grinding, the final achieved result decreased his risks and should maintain a long-term successful outcome.

ACKNOWLEDGMENTS:

Restorative dentistry by: Dr. John C. Kois, and orthodontics by Dr. Brett C. Fidler.

Figure 1: Initial full face.

Figure 2: Medical and Dental History.

Figure 3: Historical picture of patient at 17 years of age.

Figure 4: Panoramic Radiograph showing patient at initial presentation.

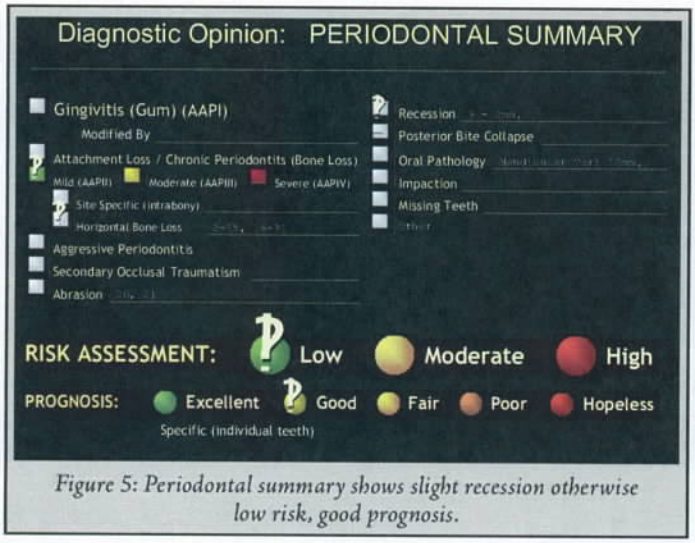

Figure 5: Periodontal summary shows slight recession otherwise low risk, good prognosis.

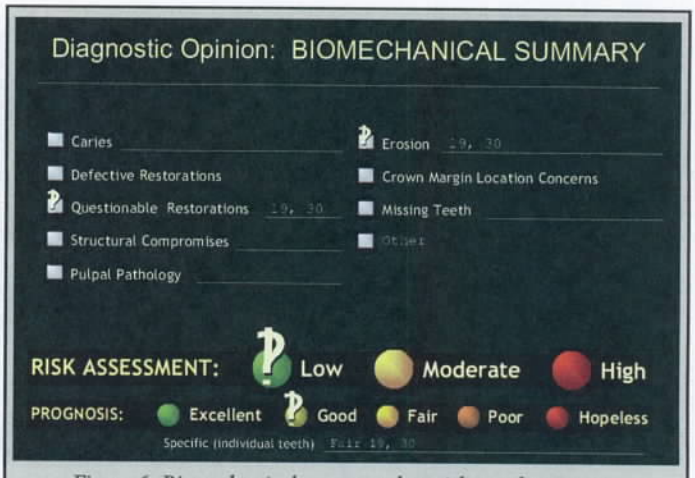

Figure 6: Biomechanical summary low risk, good prognosis.

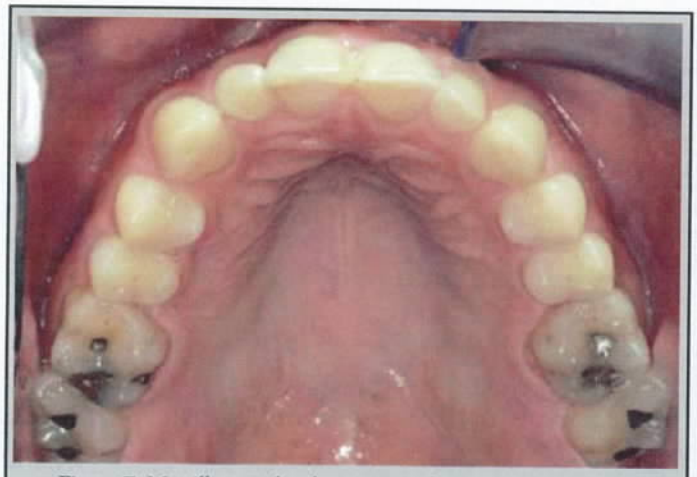

Figure 7: Maxillary occlusal view, note the wear pattern on the lingual surfaces of the incisors.

Figure 8: Mandibular occlusal view showing incisal wear pattern on the incisors and cuspids.

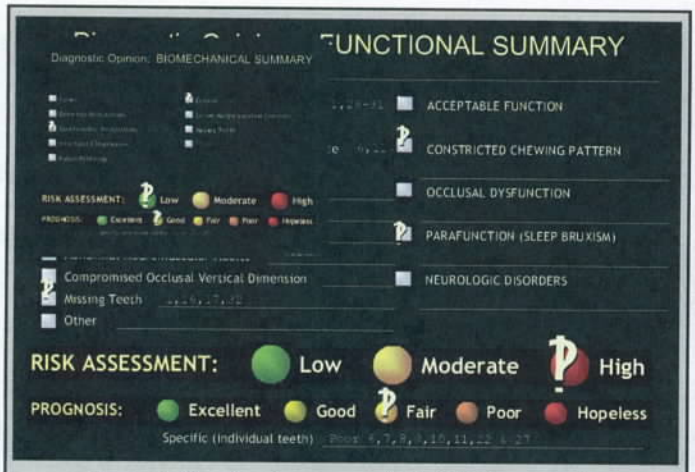

Figure 9: Functional summary, high risk fair prognosis.

Figure 10: Patient in MIP showing rotations and spacing of patient's teeth at presentation.

Figure 11: Right Lateral MIP.

Figure 12: Left Lateral MIP.

Figure 13: Initial Lateral Profile.

Figure 14: Dentofacial summary.

Figure 15: Patients original night guard.

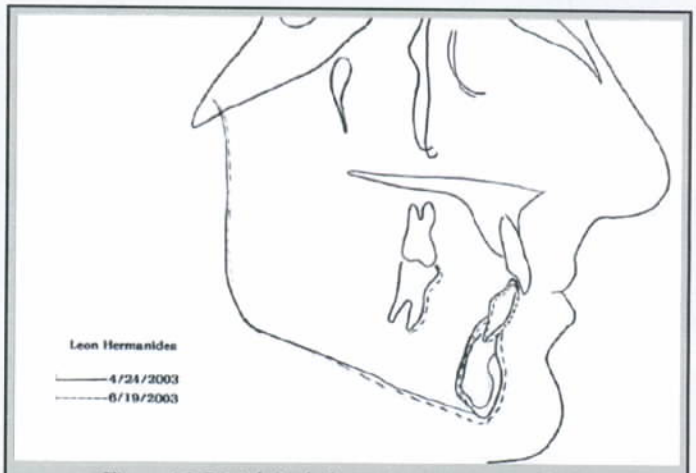

Figure 16: Initial Cephalometric tracing pre and post deprogramming superimposed.

Figure 17: Post treatment Cephalometric Radiograph.

Cephalometric Measurements

Cephalometric Measurements	Norm	Before	After
1. SNA	82 +/- 3	77°	77°
2. SNB	79 +/- 3	76.5°	76.5°
3. ANB	3 +/- 2	0.5°	0.5°
4. SN-MP	32 +/- 5	32°	32°
5. UAFH/LAFH (N-ANS/ANS-Me)	.8	0.8	0.8
6. Upper Central to SN	103 +/- 6	100°	106°
7. Lower Incisor to MP	90 +/- 5	92°	92°
8. Interincisal Angle	135 +/- 11	142°	130°

Figure 18: Figure 28: Before and after Cephalometric Measurements. (From Adapted PowerPoint)

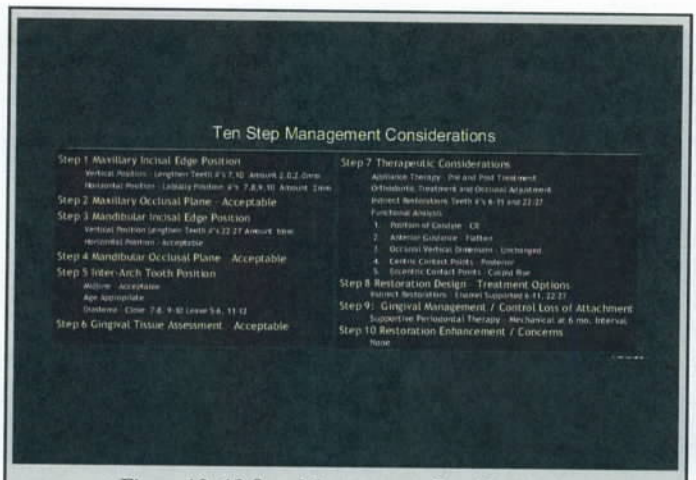

Figure 19: 10 Step Management Considerations.

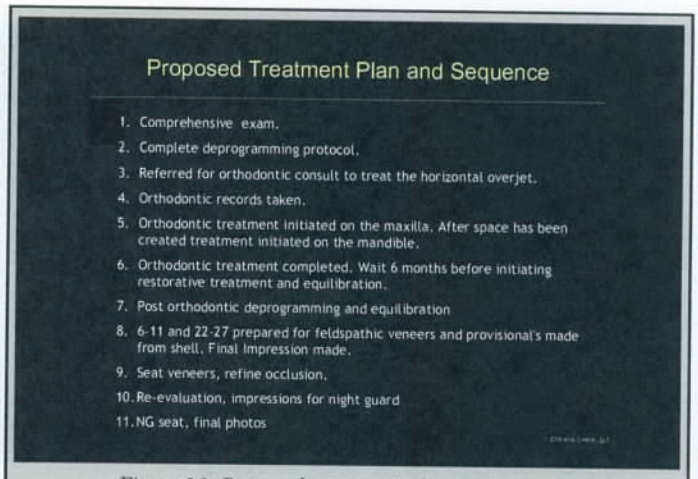

Figure 20: Proposed treatment plan and sequence (From Adapted PowerPoint)

Figure 21: Orthodontic endpoint, note the spaces created to allow for equilibration and restorative material

Figure 22: Pretreatment maxillary cast note the wear facets incisal to the cingulums.

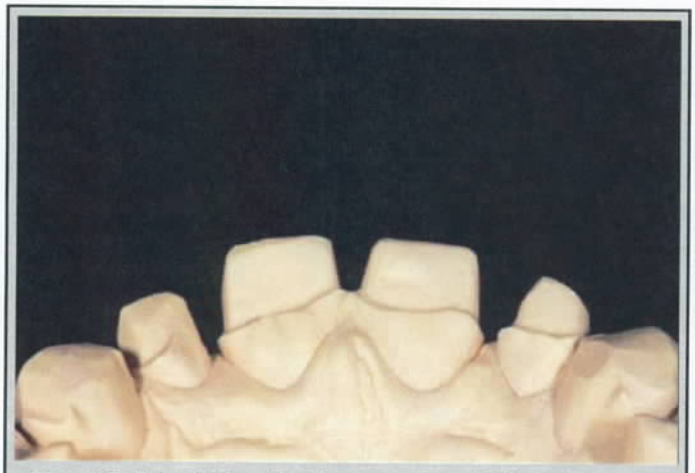

Figure 23: Palatal View of tooth preparations with finish lines at the apical extent of the wear facet.

Figure 24: Models of the tooth preparations.

Figure 25: Post treatment lateral view.

Figure 26: Right lateral post treatment.

Figure 27: Left lateral post treatment.

Figure 28: Post treatment full face.

Figure 29: Post treatment MIP.

Figure 30: Maxillary anterior view.

Figure 31: Mandibular anterior view.

Figure 32: Post treatment maxillary occlusal view.

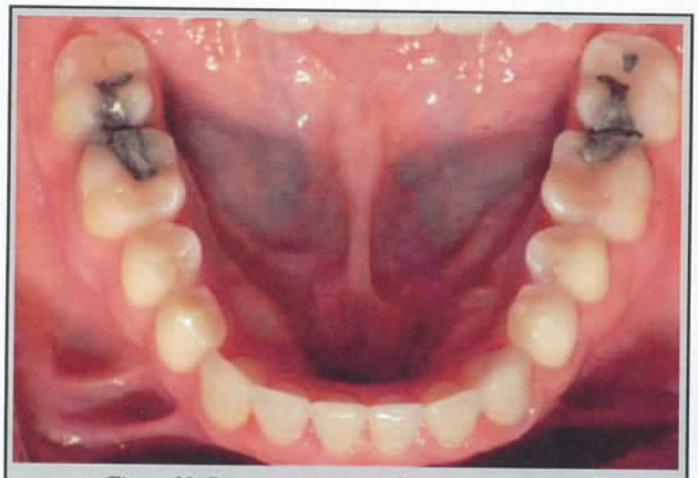

Figure 33: Post treatment mandibular occlusal view.

Figure 34: Seated flat plane maxillary night guard.

Figure 35: Horizontal wear on night guard, visible between black lines.

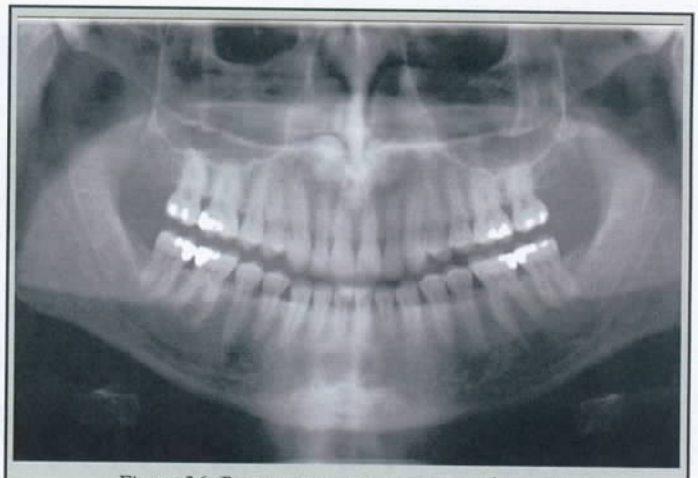

Figure 36: Post treatment panoramic radiograph..