

# Removable Prosthetics— A Ten Step Approach



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## INTRODUCTION

Full and partial dentures have not held a place of reverence compared to fixed prosthetics, implants, and cosmetic dentistry, and many dentists avoid incorporating removable prosthetics into their practices. In many cases, however, removable appliances can be the most challenging and, frequently, the most elegant treatment option. Additionally, a removable solution delivered with excellence often can be the best option to minimize and address certain risk factors. The key is maintaining the same diagnostic and treatment plan thoughtfulness used for other approaches.

## A SYSTEMATIC APPROACH

A systematic approach is a repeatable, step-by-step process covering all variables essential to a given procedure. The Kois 10 Step Management System is such an approach that provides clinicians with a systematic way to manage both fixed and removable prosthetics through a straightforward method of identifying, assessing, and managing risk. It helps us more readily discover a solution to the problem. The

more we can anticipate the predictable and prepare for the unexpected, the more likely we are to produce a favorable outcome whether the patient is completely or partially edentulous.

The following outlines how the 10 Step System applies specifically to removable prosthetics.

### ***Step One—Develop Maxillary Incisal Edge Position***

The vertical position of the maxillary incisors is established using esthetic parameters and the horizontal position is established using both esthetic and functional parameters. The vertical position of the teeth more closely affects the esthetic outcome and the horizontal position more closely affects the functional outcome. These esthetic parameters are determined with anatomic landmarks and photographs showing how the teeth look in relationship to the face. It is helpful to review the current position of an existing prosthesis or any remaining teeth in order to establish a baseline. A photograph of

lips in repose should display 1 mm to 2 mm of tooth structure, varying on the basis of age and gender. A full smile photograph should demonstrate upper lip dynamics, the midline, and how the teeth follow the lower lip. Choosing a larger tooth for a high lip dynamic patient can be helpful to reveal less prosthetic tissue. The anatomic landmark used to help determine vertical height of the incisors is the measurement from the denture border at the cuspid eminence to the incisal edge of the cuspid. This distance usually is a range of 20 mm to 22 mm.

Anatomic landmarks and photographs also are used to establish the functional parameters or horizontal position of the maxillary incisal edge. A photograph of lips in repose should show optimal lip support. Assessing the amount of remaining bone intraorally is another indication of how the denture flange should be contoured for optimal lip support. The more bone present, the less thickness of labial flange is required for lip support. In the lateral face photograph, the labial surface of the central incisor should be vertical in the face and perpendicular to the occlusal plane. The anatomic landmark used in the horizontal position is the incisive papillae. There should be a distance of 7 mm to 10 mm from the center of the incisive papillae to the incisal edge, with this measurement decreasing the more protrusive the maxilla.

### **Step Two—Develop Maxillary Posterior Occlusal Plane**

Our goal is to position the upper teeth level in the face from the frontal view and the anterior–posterior view. In a patient with teeth or an existing prosthesis, a preoperative full-face photograph is analyzed to see what looks right and what needs to be changed. The Kois Dentofacial Analyzer is a tool used to transfer this information from the patient to the articulator. In a completely edentulous patient, a wax rim and fox plane are helpful in determining an initial starting point. The wax rim former is another tool used in the laboratory to

help reach the final goal of paralleling the upper occlusal plane to Camper's Line, a line from the inferior ala of the nose to the middle of the tragus of the ear.

### **Step Three—Develop Mandibular Incisal Edge Position**

The esthetic/vertical parameter is evaluated with the lips at rest and ranges from 0.5 mm to 2 mm, depending on the patient's age and gender. More tooth display is generally seen in older males. A preoperative lips in repose photograph is used to analyze the current tooth position in a patient with teeth or an existing prosthesis. A wax rim is used as a beginning reference in a completely edentulous patient. One way to locate the horizontal/functional parameter is by using the "S" sounds.<sup>1</sup> The vast majority of Class I individuals move horizontally 2 mm to 4 mm from centric relation (CR). Most individuals with a Class II jaw relationship will move the mandible forward 4 mm to 10 mm. Edge-to-edge Class III occlusal relationships exhibit no horizontal movement during speech. The horizontal position of the lower teeth is placed as close as possible over the existing ridge to provide more stability in the lower denture.

### **Step Four—Develop Mandibular Posterior Occlusal Plane**

The lower teeth should be level in the face from left to right in the frontal view and anterior–posteriorly with the lower incisal edge. The coronal aspect of the posterior occlusal plane will be located within one half to two thirds of the height of the retromolar pad. The lingual control line, a line from the mesial of the cuspid to the lingual aspect of the retromolar pad on each side of the mandibular arch, should not be violated in order to maintain space for the tongue in a buccal–lingual direction.

### **Step Five—Intra-Arch Tooth Position (Arrangement and Form)**

In completely and partially edentulous patients, the dentist has the ability to use

his or her creative eye to fulfill the patient's expectations. Therefore, it is important to interview the patient before beginning treatment in order to determine his or her perceived outcome. For example, some patients who have had a diastema all their life want it replicated. Others may want to have natural, less uniform-looking teeth. Because there are hypothetically an infinite number of options, the clinician is free to use his or her artistic eye in order to deliver an esthetic result that satisfies the patient.

### **Step Six—Gingival Tissue Assessment**

The higher the lip dynamic, the more important it is to characterize the denture tissue. An intra-oral photograph of the patient's gingival characterization is useful in helping the laboratory duplicate the appearance of the gingival tissue, which can vary depending on the patient's complexion. In removable prosthetics, horizontal symmetry, scallop, and form are not only important for esthetics, but also to facilitate self-cleansing of the external denture surface during mastication. A skilled removable technician can excel in these areas with meticulous waxing, proper acrylic selection, and precision processing of the prosthesis. In addition to the facial esthetics of the gingival tissues, the palatal rugae are added to the prosthesis for clarity of speech, particularly the "th" sounds; masticatory aid with lumpy food; and minimizing spitting when talking.

### **Step Seven—Therapeutic Considerations**

*"As I got more involved in removable prosthetics it became apparent that balanced occlusion in centric relation is the first and most important thing that must be accomplished."*—Jack Turbyfill

This is often the most difficult step to master due to the non-rigidity of the denture and partial bases. The orthopedic position of the mandible (P1) will be CR or an adapted CR as the treatment position. In completely edentulous patients,



Figure 1: Excess gingival tissue display increased the dentofacial risk.



Figure 2: Minimal interocclusal space due to the hypereruption of posterior segments.



Figure 3: Rampant caries necessitated extraction of all upper teeth to decrease biomechanical risk.



Figure 4: Rampant caries necessitated extraction of all lower teeth to decrease biomechanical risk.



Figure 5: Horizontal position of the maxillary incisal edge was acceptable in the existing dentition.



Figure 6: The upper teeth would be positioned more apically to decrease the dentofacial risk.

this can be accomplished using a gothic arch tracing with a central bearing point to seat the denture bases. In combination cases or with partially edentulous patients, an anterior stop/Kois Deprogrammer often is used to record a repeatable position. The posterior centric contact points or home (P2) will be designed using lingualized occlusion, with the maxillary lingual cusp occluding in the central fossae of the mandibular teeth.<sup>1</sup> Bilateral equal intensity and simultaneous contacts upon chewing and swallowing are the end goal. The pathway (P3) is designed to avoid all eccentric contact points. Warmed occlusal indicator wax is placed over the mandibular posterior teeth and the lingual inclines of the maxillary teeth, and the patient is asked to eat canned peaches.<sup>1</sup> Any contact outside of the mandibular fossae is removed to eliminate any chewing interferences and finalize the prosthesis. There should be no anterior contact with the prosthesis in the normal chewing envelope.

The patient may learn to bite on his or her front teeth with the prosthesis. Therefore, group function in a protrusive movement is desired. Upon clinical examination of a patient having difficulties with a current prosthesis, a constricted chewing pattern often is seen.

Careful consideration must be used to evaluate the underlying hard and soft tissue to ensure that the functional requirements of the patient are met. Adding implants for an overdenture can increase the average bite force from 31 lbs to 51 lbs.<sup>2</sup>

### Step Eight—Restoration Design

If there are teeth remaining, a risk assessment must be performed to determine a long-term strategy for dental health. While this article is not intended to address these issues, treatment decisions that lower risk whenever possible are always preferred over those that increase risk.<sup>3</sup> Striving to reduce risk across the range of parameters from which the diagnosis was based ultimately

serves to lower stress and failure and increase treatment prognosis and predictability.<sup>3</sup> In removable prosthetics, clinicians must be careful to avoid compromising the entire case when any of the supporting teeth or implants are highly at risk.

### Step Nine—Gingival Management/Control Loss of Attachment

A risk assessment of genetic considerations (e.g., family history, race), environmental situations (e.g., smoking, diabetes), and tooth specific factors (e.g., mobility) must be evaluated to determine which teeth will remain to support the removable prosthesis. In conjunction with the evaluation of bone support, the cause of mobility must be determined as primary or secondary occlusal trauma. As the risk increases due to tooth mobility and bone loss, the prognosis decreases accordingly; therefore, adequate support for occlusal forces and prosthesis stabilization is



Figure 7: Lips in repose with 1 mm of tooth display.



Figure 8: The tooth position gives the denture a more natural appearance.



Figure 10: Characterized acrylic mimics the natural gingival color and contours, and porcelain anterior teeth give the patient a more esthetic outcome.

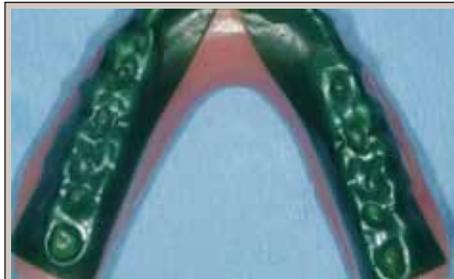


Figure 11: Having the patient eat peaches on the softened occlusal wax helps evaluate intensity and location of the contacts in the chewing envelope and confirm P2 and P3 requirements for occlusal stability of the dentures.

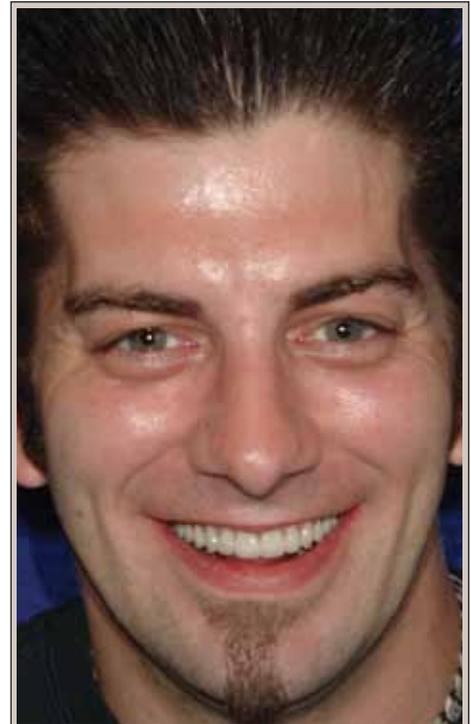


Figure 9: Esthetic smile, with upper teeth following the curvature of the lower lip.

limited. It is always helpful in the initial interview to ask the patient when and why the teeth were removed. This helps to determine the risk and prognosis of the remaining teeth.

### Step Ten—Restoration Enhancement/Concerns

The edentulous ridge must be evaluated to determine predictability of the removable prosthesis. The amount of remaining ridge and the amount of movable mucosa can increase or decrease the retention and stability of the prosthesis. Increased vertical height of the ridge results in greater horizontal stability and chewing efficiency. As the soft tissue covering the ridge becomes more movable with excessive submucosa, stability and chewing efficiency is decreased. The prosthetic impressing technique should adequately record the denture bearing mucosa without overextensions, underextensions, and pressure points. Prior to the impressing

technique, it is important to achieve firm and healthy mucosa. A long-term resilient soft liner in severely resorbed ridges may be a viable option for some patients. Properly placed and cared for silicone or silicone rubber resilient denture liners can provide relief for more than 70% of patients with chronic residual ridge soreness for between 3 to 5 years and often longer.<sup>4</sup>

### CASE ONE

A 28-year-old man presented with concerns about his appearance and discomfort when chewing (Figure 1). The patient's medical history was non-contributory. Gingival inflammation and no bone loss resulted in a periodontal diagnosis of gingivitis and low periodontal risk (Figure 2). The functional risk assessment also was deemed low. However, the extensive loss of tooth structure due to caries made functional risk difficult to assess with certainty (Figure 3 and Figure 4). No signs and symptoms of temporomandibular joint disorder (TMD)

were noted, and both joints comfortably accepted load. High dentofacial risk assessment was determined by a dolichofacial appearance and excessive tooth and tissue display (Figure 5).

The treatment plan consisted of comprehensive extractions and upper and lower complete dentures to lower the severely high biomechanical risk. As a first step in the 10 Step Management System for treatment planning, the maxillary incisal edge position was designed to be positioned apical to the preoperative position by 2 mm of the incisal edge of the temporary on tooth No. 9 (Figure 6 and Figure 7). The preoperative horizontal position of the natural tooth structure was duplicated in the final restoration. The posterior maxillary occlusal plane was moved apically to become level in both planes with the approved incisal edge position (Figure 8). The mandibular incisal edge was positioned apical to the pretreatment situation to facilitate a



Figure 12: A 65-year-old woman was unable to eat a well-rounded diet and was disappointed with the appearance of her teeth.



Figure 13: The anterior mandibular teeth were impinging on the palatal tissue.



Figure 14: Abrasion and caries necessitated extraction of the remaining upper teeth to decrease biomechanical risk.



Figure 15: Significant attrition and active caries caused the majority of the mandibular teeth to have a poor to hopeless prognosis. The teeth with the lowest biomechanical risk (Nos. 20, 21, 27, and 28) were kept for retention and stability of the lower prosthesis.



Figure 16: Complete display of anterior incisors and tissue with limited smile.



Figure 17: Tooth No. 7 was chosen as the desired vertical position for the anterior teeth. Teeth Nos. 8 and 9 will be lengthened.

1 mm reveal of tooth structure with the lips at rest. The mandibular posterior occlusal plane was positioned in alignment with the established mandibular incisal edges' position.

The patient's desire for straighter teeth and a whiter smile were incorporated into the treatment plan (Figure 9). Consideration was made for characterization of gingival tissues that might be visible during high lip movement (Figure 10).

A coble balancer and gothic arch tracing were used to aid in recording an accurate relationship of the mandible to the maxilla in CR. Final occlusal detailing was done by removing eccentric inferences that revealed themselves when the patient was asked to chew peaches on softened wax (Figure 11).

Careful management of post-extraction healing was facilitated with tissue conditioning, as needed. Consideration was

made for proper retention and stability of the prosthesis at the time of delivery and into the future.

## CASE TWO

A 65-year-old woman presented with the chief concern of her overall health from a limited diet. She was embarrassed with the appearance of her teeth and would have loved to confidently smile again (Figure 12). The patient's past medical history revealed multiple cancer diagnoses and treatments, diabetes, and other conditions that made for a fragile medical situation. Isolated infrabony defects and mild horizontal bone loss resulted in a moderate periodontal risk (Figure 13). A high caries assessment and multiple teeth with large alloys and minimal tooth structure resulted in a high biomechanical risk (Figure 13). Excessive wear from an aberrant

chewing pattern resulted in a moderate to high functional risk assessment (Figure 14 and Figure 15). No signs and symptoms of TMD were noted, and both joints comfortably accepted load. High dentofacial risk was determined by maximum tooth and tissue display (Figure 16).

The treatment plan consisted of restoring the natural teeth, managing health considerations, and respecting the patient's financial concerns. Two teeth on each side of the arch (i.e., teeth Nos. 20, 21, 27, and 28) were restored with full-coverage restorations to provide retention and stability for the removable prosthesis. An upper denture and a Kennedy Class I, Mod I partial was fabricated in an effort to reduce biomechanical risk.

As a first step in the 10 Step Management System for treatment planning, the maxillary incisal edge position was



Figure 18: Average lip mobility with 3 mm of tooth display is acceptable for a woman.



Figure 19: Correct lip support with the teeth positioned vertically in the face.



Figure 21: Bilateral posterior equal-intensity contacts assist in retention of the upper denture with minimal anterior flange.



Figure 22: A hydrocast functional impression was used to record tissue position before relining the free-end saddle.



Figure 20: The patient chose an age-appropriate tooth shade and a non-uniform arrangement to make the smile appear natural.

designed to be 2 mm coronal of the broken incisal edge position of tooth No. 8 (Figure 17 and Figure 18). The preoperative horizontal position of the natural tooth structure was duplicated in the final restoration. The posterior maxillary occlusal plane was placed level in both planes with the approved incisal edge position (Figure 19). The mandibular incisal edge was positioned 5 mm coronally to the pretreatment situation to facilitate a 1 mm reveal of tooth structure with the lips at rest. The mandibular posterior occlusal plane was positioned in alignment with the established mandibular incisal edge position.

A nonuniform tooth arrangement and an age appropriate tooth shade were used to fulfill the patient's desire for not having a "denture look" (Figure 20). A minimally characterized anterior flange was used to mimic tissues during high lip movement (Figure 21).

An anterior stop/Kois Deprogrammer was used to aid in recording an accurate

relationship of the mandible to the maxilla in CR. Final occlusal detailing was done by removing eccentric interferences that revealed themselves when the patient was asked to chew peaches on softened wax.

Tissue conditioning for 6 months allowed the gingival tissues and extraction sockets to heal properly. Functional impression material was used to stabilize the free-end saddle of the lower partial (Figure 22).

## CONCLUSION

The 10 Step Management System is just as applicable to removable prosthetics as fixed prosthetics. The increased difficulty in removable prosthetics is found in accurately recording soft tissue with a predictable impressioning technique and accurately recording bilateral equal intensity posterior contacts with CR jaw relation techniques. Mastering these two techniques can increase satisfaction and lower stress for the patient and the dentist.

## ACKNOWLEDGMENT

The author would like to thank John Zarb, CDT, for his laboratory support with Case One, and Stacy Cribbs and J.B. Bryant, CDT, for their laboratory support with Case Two.

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