CLINICAL REPORT

The Use of a Diagnostic Matrix in the Management of the Severely Worn Dentition

Phuong D. Doan, DDS;[1] and Gary R. Goldstein, DDS[2]

The management of the interim phase of a complete oral rehabilitation in patients with severely worn dentition is often challenging due to loss of occlusal vertical dimension, loss of tooth structure, uneven wear of teeth creating an uneven plane of occlusion, and para-functional habits. This paper will demonstrate how a clear thermo-forming matrix fabricated from the diagnostic wax-up can be used as a guide to facilitate treatment.

INDEX WORDS: interocclusal distance, occlusal vertical dimension, physiologic rest position, loss of vertical dimension

CLINICIANS ARE often faced with the challenge of restoring severely worn dentition. A critical aspect for successful treatment of these patients is to determine the occlusal vertical dimension (OVD) and the interocclusal rest space (IRS). A systematic approach to managing this type of complete oral rehabilitation can lead to a predictable and favorable treatment prognosis.

This article will present a sequence of treatment, including the use of a diagnostic matrix, as a guide to the management of a severely worn dentition.

Clinical Report

A 58-year-old Caucasian male presented with the chief complaint of "I have worn down my teeth a lot and I cannot chew properly. I need to have them fixed." Clinically, the patient demonstrated partial edentulism, several maxillary and mandibular teeth showing severe attrition to the free gingival level, an uneven occlusal plane anteroposteriorly and mediolaterally, several teeth with caries, and an asymptomatic click of the left temporomandibular joint (Figs 1–3). Clinically, the patient's facial appearance showed signs of a collapsed OVD. The preoperative IRS was 9 mm. Periodontal condition and soft-tissue examination showed no pocket depth of over 2 mm or mobility of any remaining teeth. Radiographic evaluation demonstrated excellent bone support for the remaining teeth.

Recent past dental history included only palliative visits during which he had several extractions. He started noticing that his teeth were getting shorter about 20 years ago; however, he chose to leave the problem unattended. The patient reported no pain or discomfort. His goal was to improve the function and esthetics of his dentition.

The patient was diagnosed with class IV partial edentulism according to the American College of Prosthodontics classification system for partial edentulism.[1] (The Classification System has recently been renamed the Prosthodontic Diagnostic Index [PDI], and allows patients to be classified based on the severity of their pretreatment dental condition) This classification categorizes partially edentulous patients according to the location and extent of the edentulous areas, the condition of abutments, the occlusion, and the residual ridge characteristics.

[1]*Chief Resident, The Jonathan and Maxine Ferencz Advanced Education Program in Prosthodontics, New York University College of Dentistry, New York, NY*

[2]*Professor, Department of Prosthodontics, New York University College of Dentistry, New York, NY*

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Correspondence to: Phuong D. Doan, 345 East 24th St., Clinic 5W, New York, NY 10010. E-mail: pd259@nyu.edu

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Figure 1. Preoperative—frontal view.

Prosthodontic Treatment

The findings were explained to the patient, and treatment options were presented. The treatment goals were (1) to restore the lost OVD, (2) to correct the occlusal plane, (3) to restore function, and (4) to restore the esthetics of the patient's dentition.

The treatment consisted of a phased treatment plan. Phase I included evaluation of the existing physiologic rest position (PRP), OVD, and IRS; the fabrication of interim fixed and removable prostheses at the restored OVD; and assessment of the esthetics and phonetics. Phase II treatment will be finalized after evaluation of Phase I.

Phase I Treatment Sequence

1. Two sets of Irreversible Hydrocolloid (Jeltrate Plus, Dentsply® Caulk, York, PA) impressions were made in stock trays (Spacer™ Trays, GC America, Alsip, IL). The patient's existing OVD and PRP were recorded.
2. Diagnostic casts were mounted on a Hanau semi-adjustable articulator (model # 190–291101, Teledyne Waterpick™ Technologies, Shelton, CT) using a face-bow transfer (Hanau Spring-Bow model # 182–8, Waterpick™ Technologies), and a centric relation record was made with pink wax (Base Plate Wax, Henry Schein®, New York, NY) at the existing OVD. A diagnostic wax-up was done at the estimated restored OVD (Fig 4 A–C). The patient's IRS was determined by taking the difference between the patient's existing PRP and the OVD as described by Toolson.[2] In this particular patient, the difference was 9 mm. In addition, the parallelism of the ridges was used as a guide to reestablish the OVD.[3] Because the patient had no history of temporomandibular joint discomfort, it was decided to restore 8 mm of lost OVD. The plane of occlusion was made parallel to the interarch plane at a vertical height directed by teeth #30 and #31 (which were intact and did not need restoration) and the retromolar pads.
3. The patient was then referred to an endodontist for root canal therapy of teeth #5–11, #25, and #26. The original coronal tooth structure of these teeth was so severely worn that adequate retention for the restorations would have been compromised unless root canal therapy and subsequent fabrication of dowels and cores were performed to increase the length of the teeth.

Figure 2. Preoperative maxilla—occlusal view.

Figure 3. Preoperative mandible—occlusal view.

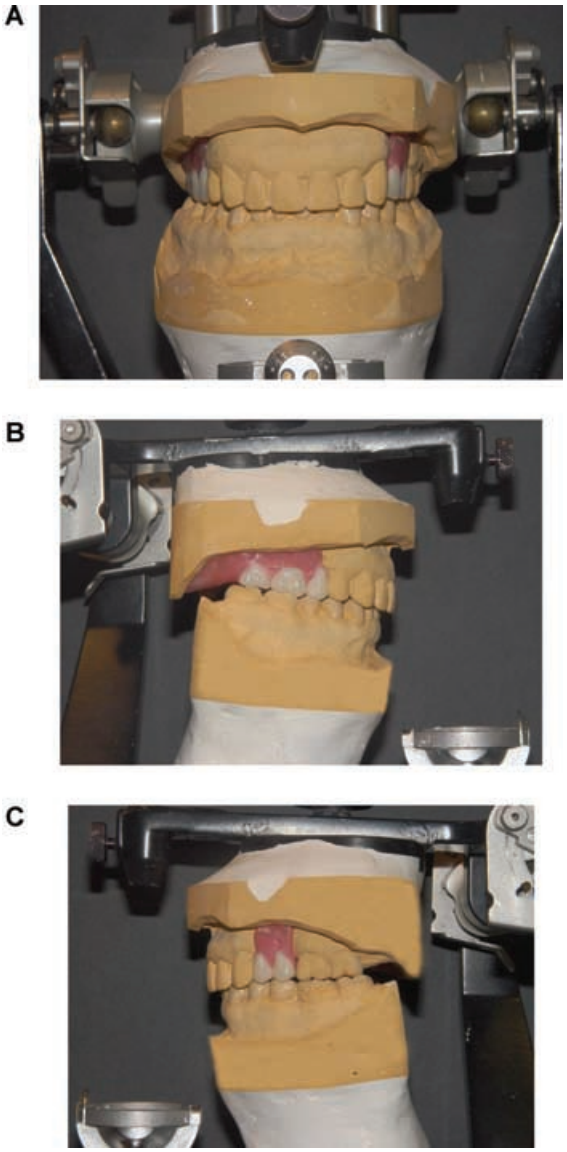

Figure 4. (A) Mounted casts of the diagnostic wax-up: frontal view. (B). Mounted casts of the diagnostic wax-up: right view. (C) Mounted casts of the diagnostic wax-up: left view.

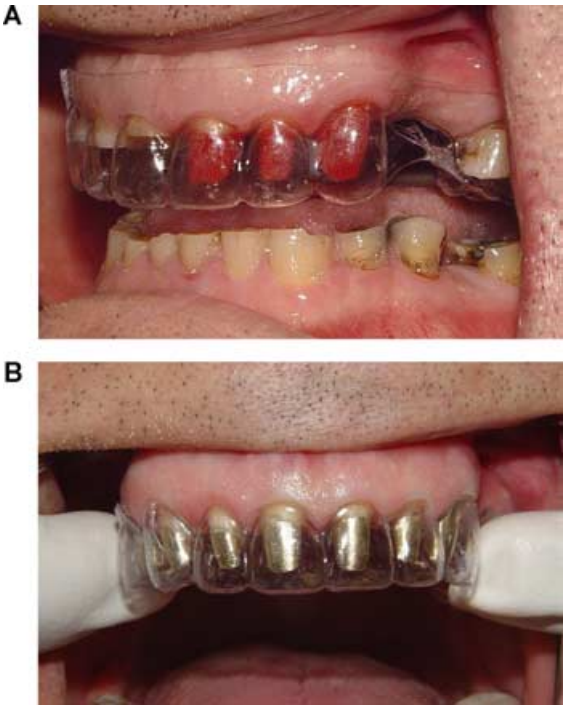

Figure 5. (A) and (B). Intraoral view of the diagnostic matrix in place.

4. The maxillary diagnostic wax-up was completed and duplicated using an irreversible hydrocolloid impression material (Jeltrate Plus) and type III dental stone (Microstone, Dentsply® Caulk). A matrix was fabricated from the duplicate cast using a clear thermoforming material (Henry Schein®).
5. The matrix was then checked for fit and used as a guide during the fabrication of the autopolymerizing acrylic resin patterns (Pattern Resin, GC America) for dowels and cores of teeth #5–11 (Fig 5 A and B). Prefabricated dowels and cores were done for teeth #25 and #26 using a prefabricated titanium dowel (ParaPost XT™, Coltène/Whaledent Inc., Cuyahoga Falls, OH) and dual-cured core material (LuxaCore® Dual, Zenith/DMG, Englewood, NJ).
6. Teeth #14, #15 and #18–29 were prepared for full coverage.
7. Impressions for the mandibular and maxillary interim prostheses and maxillary interim cast RPD were made using a polyether impression material (Impregum and Permadyne, 3M ESPE, St. Paul, MN) with the cast dowels and cores of teeth #5 to #11 in place, but not cemented.
8. Casts of the prepared teeth and dowel/cores were mounted on the Hanau articulator (model # 190–291101, Teledyne Waterpick™ Technologies) using a Face-Bow transfer (Hanau Spring-Bow model # 182–8, Waterpick™ Technologies) and a centric relation record was made with pink wax (Base Plate Wax, Henry Schein®) at the predetermined

Figure 6. Interim prostheses—frontal view.

restored OVD. These casts and the casts of the diagnostic wax-up were sent to the laboratory for fabrication of the fixed interim prostheses and interim maxillary cast removable partial denture (RPD).

(i) The fixed interim prostheses were broken into 5 segments: #5–11, #14–15, #18–21, #22–27, and #28–29.

(ii) The design for the removable cast partial denture consisted of:

a. A palatal strap major connector.
b. Abutment tooth #5 with a disto-occlusal rest, a distal minor connector, and buccal and lingual cast circumferential clasps.
c. Abutment tooth #11 with a cingulum rest, a distal guide plane, and buccal infrabulge clasp.
d. Abutment tooth # 14 with a mesio-occlusal rest, a mesial minor connector, and buccal and lingual cast circumferential clasps.

9. After checking the fit of the fixed and removable interim prostheses, the cast dowels and cores of teeth #5–11 were luted with Zinc Phosphate cement (Henry Schein®). The fixed interim prostheses were then relined with autopolymerizing acrylic resin (Alike, GC America) and delivered with the RPD (Figs 6–8).
10. After insertion of the interim prostheses, the patient reported a slight difference in his pronunciation of the 's' sound; however, this problem resolved itself after 10 days. The patient reported no muscular or temporomandibular joint discomfort.
11. Follow-up treatments were done to evaluate the patient's comfort, arch form, and potential OVD problems. The PRP was accommodated, and the patient presented with a 3 mm IRS within a few months.

Figure 7. Interim prosthesis—maxilla—occlusal view.

Discussion

The etiology of occlusal wear for this patient is not fully understood; however, it can be hypothesized that the patient had a parafunctional occlusal habit and started grinding his anterior teeth. Once the anterior teeth got shorter, the patient lost anterior guidance and developed posterior interferences. The posterior interferences in lateral excursions can activate the masseter and temporalis muscles, enabling the patient to generate more forces to grind his teeth more aggressively.[4] A mutually protected occlusal scheme was used to prevent the destruction of the new prostheses.

Figure 8. Interim prosthesis—mandible—occlusal view.

Mutually protected articulation is described as "an occlusal scheme in which the posterior teeth prevent excessive contact of the anterior teeth in maximum intercuspation, and the anterior teeth disengage the posterior teeth in all mandibular excursive movements."[5] Studies have shown that in lateral excursive movements, the anterior teeth can best receive and dissipate the forces[6] and posterior contacts in excursions appear to provide unfavorable forces to the masticatory system because of the amount and direction of the applied forces.[7-9] In addition to using the mutually protected occlusal scheme, an occlusal splint was fabricated for night wear, and the patient was instructed and trained to keep his teeth apart when not actively chewing.

With this patient, an overlay RPD to verify whether the new OVD could be tolerated was not considered. Because the initial IRS was 9 mm, and the patient had no prior history of muscular or joint problems, restoring 8 mm of lost OVD directly with the removable and fixed interim prostheses seemed prudent. This technique afforded the patient an immediate positive change in his esthetics and resulted in high treatment compliance. Also, since the patient was being seen weekly, any adverse reactions could be attended to immediately. If the initial IRS was in the 3 mm range, fabrication of an overlay RPD would have been considered to incrementally restore as much of the lost OVD as the patient could tolerate.

Now that Phase I has been completed, Phase II treatment will be initiated. Phase II treatment will include a 7-unit metal ceramic fixed partial denture (FPD) from teeth #5 to #11 (to ensure adequate support for the RPD); a two-unit metal ceramic FPD for #14 and #15; a maxillary semi-precision RPD, single unit metal ceramic crowns for #18, 19, 20, 21, 28, and 29; ceramic crowns for teeth #22–27; and an occlusal guard. Another treatment option for the maxillary arch included implant-supported prostheses for the edentulous areas instead of the semi-precision RPD, but the patient was happy with the interim RPD and elected not to pursue implants.

Summary

A technique using a diagnostic matrix to help plan the restoration of lost OVD in a clinical scenario has been presented. The restored OVD has shown to be physiologically and esthetically acceptable to the patient.

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