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Maximizing Esthetic Results With the Use of Preparation Matrices

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Editor's note: This article is based on a Heraeus-sponsored hands-on workshop at the 25th Anniversary AACD Scientific Session in Honolulu, Hawaii.

Abstract

This article presents a clinical case that was prepared by combining the traditional, simplified depth cutter approach with recontouring and preparation design principles that were determined clinically by the dentist. Plastic preoperative models of this case—along with labial and incisal reduction preparation guides fabricated from the diagnostic wax-up—were used for demonstration purposes during an Annual AACD Scientific Session hands-on course. This course addressed current approaches to tooth preparation that would simplify the preparation design process for difficult space management cases and facilitate predictable and repeatable results.

Although minimal preparations are ideal, laboratory ceramists can become frustrated at the prospect of trying to create restorations with the desired esthetics if an improper preparation design has been created.

Introduction

When faced with a case involving complex space management issues, it is not uncommon for clinicians to be uncertain about where tooth structure should be removed, as well as how much tooth preparation is sufficient or too aggressive. Although minimal preparations are ideal, laboratory ceramists can become frustrated at the prospect of trying to create restorations with the desired esthetics if an improper preparation design has been created.

Preparation of tooth structure requires planning and attention to detail. Traditionally, however, dentists have relied upon visualization of the anticipated outcome and prepared the teeth to those expectations, inadvertently leaving great room for error.

Figure 1: Preoperative smile, showing discolored, rotated, and poorly positioned teeth.

Figure 2: Postoperative smile, displaying harmony and balance.

In the evolution of preparation techniques, depth guides have historically been used to ensure proper facial reduction. However, when this technique is used, it is necessary that the teeth be in the proper arch form (i.e., not deficient facially) in order for the depth cutters to produce accurate results.

Today, conservative dentistry begins with an analysis of an accurate diagnostic wax-up developed with consideration of smile design principles (e.g., midline, canting, arch form, and buccal corridor expansion). These principles lay the foundation for visualizing the final esthetic restorative outcome and determining preparation parameters. Indices can be made based upon the diagnostic wax-up and placed to guide the dentist during tooth preparation.[1]

Another preparation technique stemming from the creation of the diagnostic wax-up is the bonding of provisionals prefabricated from the diagnostic wax-up onto the unprepared teeth, after which depth guides are used on the facials of the provisionals to facilitate routine veneer preparation.[1]

Tooth preparation techniques that combine the use of reduction guides with smile design principles can help dentists to ensure predictable and repeatable results in the pursuit of conservative tooth preparations, while still satisfying today's standards for esthetic outcomes. These techniques help to simplify difficult space management cases by incorporating a systematic routine for the preparation procedure.[2]

Case Presentation

The patient presented with rotated and poorly positioned maxillary teeth (Fig 1). Her chief complaint related to the esthetics of her smile; she identified color and crowding as her primary concerns. This case would best be treated with a combination of orthodontics and minimal tooth reduction restorations. However, when the patient was sent for an orthodontic evaluation, she refused the primary clinical recommendations of orthodontics and bleaching.

Records and Evaluation

Full records were obtained, including models, facebow, photographs, and bite registration mounted on a semi-adjustable articulator. A comprehensive history, physical examination, and occlusal analysis were performed. Temporomandibular joint and periodontal pathologies were not present, and the patient demonstrated acceptable occlusal function.

Cosmetic analysis revealed a medium to low smile line, with the papillae showing. The uneven gingival levels were concealed by her lip line. The patient's maxillary teeth covered the mandibular teeth when she smiled, but her mandibular teeth showed when she spoke.

Treatment Plan

A conservative cosmetic treatment plan was developed that included the placement of eight maxillary bonded porcelain restorations to create harmony and balance in the maxillary arch, and power bleaching (Zoom, Discus Dental; Culver City, CA) on the mandibular arch. The goal was to be conservative in preparation design while meeting

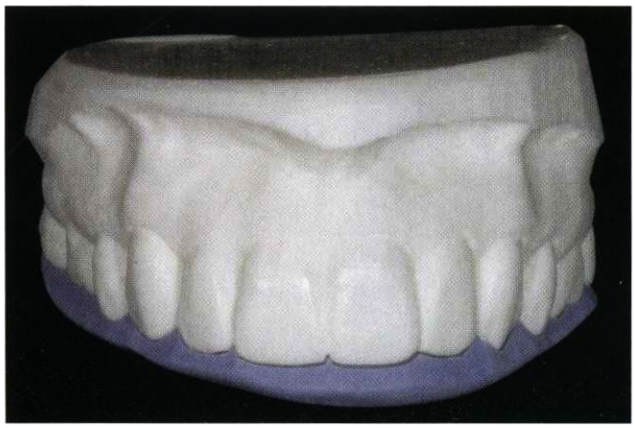

Figure 3: The incisal matrix is placed over a model fabricated from the diagnostic wax-up.

Figure 4: The facial index is seated over the preoperative model. Pencil marks indicate where tooth structure must be removed to create space for the restorative material.

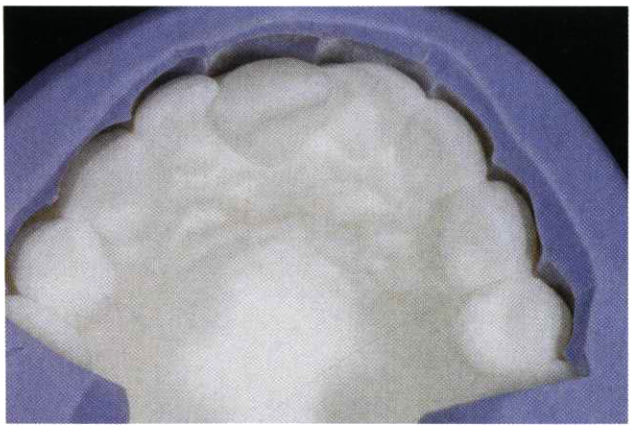

Figure 5: Incisal view of the facial index, showing uniform facial clearance for porcelain in the first slice.

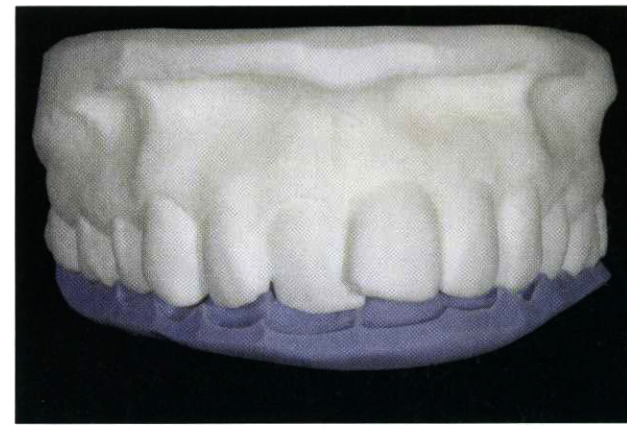

Figure 6: Incomplete seating of the incisal matrix, due to the lingually positioned incisor.

the esthetic demands of the case. This was accomplished with minimal removal of tooth structure on the fewest number of teeth necessary for creating the desired result. The definitive porcelain restorations were delivered to the patient, resulting in a harmonious and balanced esthetic outcome (Fig 2).

TREATMENT

CONSERVATIVE PREPARATION TECHNIQUE

The current approach to tooth preparation addresses the final volume of the teeth, as represented by an additive diagnostic wax-up, with well-adapted labial and incisal silicone matrices (Fig 3). (I demonstrated this technique during a hands-on course at the 25th Anniversary AACD Scientific Session; it illustrated the step-by-step protocol for using matrices to guide the removal of tooth structure.)

First, the labial index is placed over the preoperative model, after which the teeth that are protruding facially can be evaluated (Fig 4). These areas must be brought back into proper arch form alignment by using a diamond bur (Brasseler USA; Savannah, GA). These protrusions are marked in pencil and then trimmed away until the silicone matrix seats passively.[3]

Uniform facial clearance is necessary, but the amount and depth of tooth structure removal depends upon the restorative material to be used, as well as the patient's desired final shade. Therefore, the space created between the preparation and the matrix can vary from .3 mm to 1.5 mm.

Once this parameter is achieved, the incisal portion of the index is sliced away, and the index can be used as a guide for removing the middle third of the preparation.

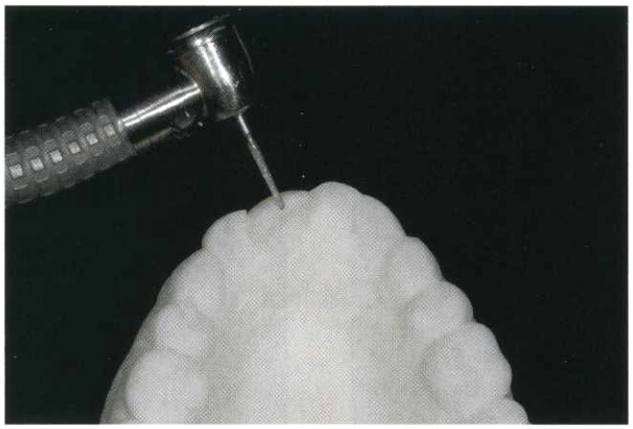

Figure 7: The lingual portion of this tooth is contoured buccally using a diamond bur, until a passive seat in the matrix occurs.

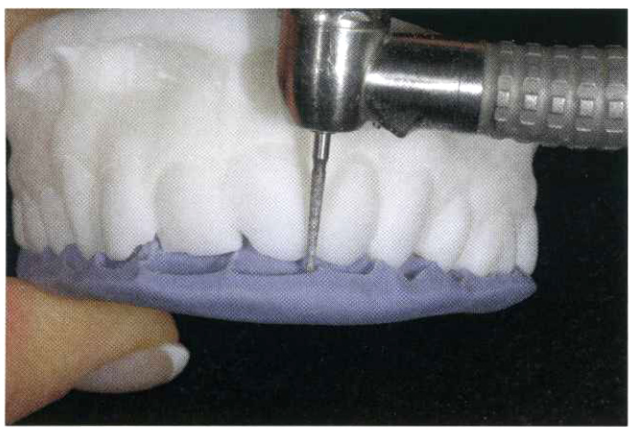

Figure 8: Interdental preparation can be evaluated and executed.

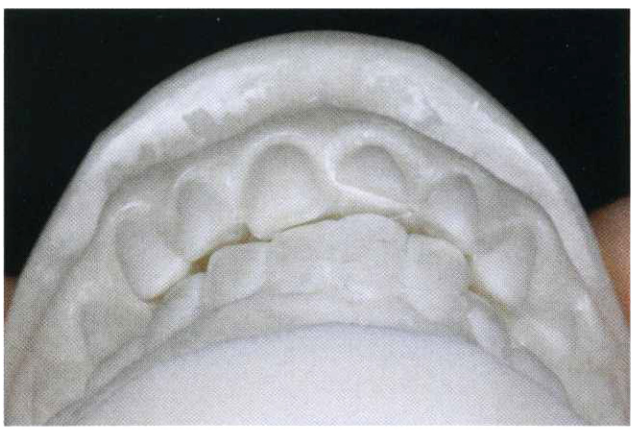

Figure 9: The function and thickness of the ceramic are evaluated.

Note that only one third of the tooth is prepared at a time, based upon the minimal requirements necessary to provide space for the restorative material in that zone. The middle third facial reduction is accomplished by removing stone in this area until a uniform clearance is achieved (Fig 5). Once the middle third is prepared, the middle portion of the index is sliced away, and the index can be used as a guide for removing the remaining cervical portion of the preparation.

The gingival chamfer margin should be placed in the enamel (i.e., following the contour of the soft tissue) to depths of 0.3 mm to 0.7 mm, depending upon the color desired for the final restoration. If the buccal corridor is to be expanded, the premolar preparations may require only a gingival chamfer and roughening of the enamel on the facial aspect, with an incisal overlap on the buccal cusp. The plane of the incisal third must be rolled toward the lingual to allow space for both tooth form and light transmission.

When the facial preparations are accomplished, the use of the facial matrix is complete.

The next step in the process is to place the incisal guide over the prepared model. Seating was complete in this case due to the lingually positioned incisor (Fig 6).[4] The lingual portion of this tooth must be contoured labially until a passive seat of the model in the index is achieved (Fig 7).

At this point, interdental preparation can be evaluated and executed. When looking straight at the model, the tooth must be centered in the incisal matrix. Any portion of the tooth that is outside this boundary must be removed or recontoured. In

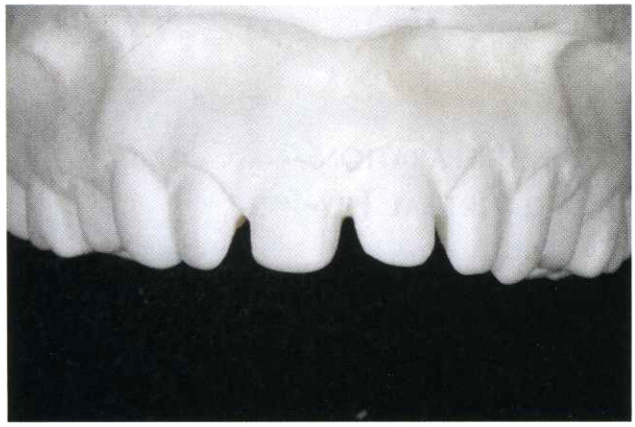

Figure 10: The definitively prepared model displays rounded transition zones, angles, and corners.

Figure 11: The occlusal view of the competed restorations displays a symmetrical arch form and the appearance of instant orthodontics.

this case, the central and lateral incisors require full slice preparation. However, it was only necessary to recontour the interproximal contacts of the remaining teeth in order to center them in the matrix (Fig 8).

The exact incisal lengths should be 2.0 mm from the edge of the incisal matrix. The porcelain will overlap the remaining incisal tooth structure and terminate on the lingual surface in a butt margin, adding strength to the ceramic and providing a vertical stop during cementation.[5,6]

Function and thickness of the ceramic are evaluated when determining lingual margin location and palatal coverage by visualizing the remaining occlusal clearance between the preparation and opposing models (Fig 9). In this case, the left central incisor was positioned facially. When removing that portion of the tooth from the corrected arch form, a sliver of tooth thinner than 1.5 mm remained labio-lingually. This portion of the tooth was susceptible to fracture and, therefore, full palatal coverage was indicated.[7]

Function in all excursions must be tested; and angles, transitions, and corners should be rounded to avoid creating internal stress fractures in the ceramic (Fig 10). When viewed from the labial aspect, the facial porcelain form should be superimposed over the preparations with equal symmetry, so that it appears that "instant orthodontics" were performed (Fig 11).[8]

Summary

In order to treat complex space management cases, it is necessary for dentists to master preparation design principles and the use of technical support tools such as indices. These techniques and tools will guide the dentist toward the conservative removal of tooth structure, while simultaneously ensuring the best esthetic outcome.

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