

Diagnostic Full-coverage Provisionals for Accurately Communicating Esthetic and Functional Data

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ABSTRACT: *This article will discuss and illustrate the benefits of providing diagnostic provisionalization as an aid to the esthetic and functional completion of the restorative case, regardless of complexity. Although a variety of treatment decisions must be determined on a case by case basis, it is imperative for successful completion of a case that once a final vision has been established in diagnostic treatment planning, it must be accurately communicated among the three principal investors: the dentist, the laboratory technician, and the patient. Proper case planning, followed by the fabrication of an anatomically correct diagnostic wax-up, allows for prototypical construction of a patient's provisionals. Further refinement of the provisionals after their initial fabrication can provide excellent communication of dental harmony, dentofacial relationships, elements of color, and occlusal/functional harmony. It is the subsequent refinement of the initial prototypes that allow the provisionals to be diagnostic.*

Ever since the inception of indirect restorations in dentistry there has been a need for temporary coverage of the prepared teeth while the permanent restorations are being fabricated at the dental laboratory. Throughout time there have been numerous materials and systems [eg, prefabricated aluminum and polycarbonate shells, polymethylmethacrylate (PMMA), polyethylmethacrylate (PEMA), and bisacryl composite resin] offered as a solution for this task. From the inherent properties of each of these materials and the various methods by which each may be used, a

practitioner would deduce an appropriate system to utilize. When performing multiple, adjacent preparations for a restorative case, prefabricated individual shells would not be feasible, let alone anatomically correct, for a given situation. Instead, methods for indirect and direct fabrication of custom-shaped provisionals were conceived.

Today's dental patient arrives at the dental office with high expectations related to the esthetic component of his or her anticipated dentistry. In addition, the patient assumes that the treating dentist and laboratory technician will attend to the functional aspects of treatment. Regardless of complexity, it is imperative that the dentist and laboratory technician have a system in place that allows adjustment and progressive verification of the indirect restorations in order to predictably obtain a successful final result.

When the restorative case is in the anterior of the mouth, a knowledge of the material properties related to accuracy, polymerization shrinkage, color stability, surface roughness, strength, and the amount of exothermic heat given off during polymerization factor into the determination of what may be the best material to use clinically.^{1,2} In the following case study examples, the provisionals were fabricated in a direct fashion, in the mouth; a bisacryl composite provisional material was utilized because of the desirable characteristics that class of material provides relating to the aforementioned properties.³

For the purpose of focusing this manuscript on the clinical aspects of provisional fabrication, it will always be assumed that an anatomically correct diagnostic wax-up, made off of properly mounted



FIGURE 1 Bisacryl provisional material is placed in a matrix fashioned from the diagnostic wax-up prior to placement in the mouth.



FIGURE 2 A Boley gauge can be utilized to help the clinician obtain length and width measurements of the patient's provisionals for bilateral symmetry.



FIGURE 3 The provisionals are roughened for the addition of composite, which will increase their length.



FIGURE 4 A 37% phosphoric acid is applied to etch the older provisional material in order to form a good bond with the composite material.



FIGURE 5 Low-viscosity composite is applied to previously completed provisionals.



FIGURE 6 The final layer of low-viscosity composite is shaped and smoothed with a narrow sable hair brush.

diagnostic casts, has been completed prior to the preparation appointment. The diagnostic wax-up must be an accurate, *obtainable* representation of the potential restorative transformation. A firm setting, laboratory condensation silicone putty can then be utilized to fabricate a provisional matrix.

The matrix is then utilized for direct fabrication of the initial provisional. After a try-in for verification of complete seating of the matrix in the mouth, the matrix is filled with a bisacryl provisional material and seated over the prepared tooth or teeth (Figure 1). Subsequent to an initial setting period, the matrix is removed from the mouth and the provisional is removed from the matrix, or separated from the prepared teeth. It is then re-seated over the prepared teeth until a hard set is achieved. This removal and re-seating of the provisional ensures that the restoration will separate from the dentition after complete polymerization.

After an initial form has been created, excess material is trimmed away to fit the provisional to the prepared margins of the dentition. At this point, the provisional can be expertly trimmed with burs and disks to refine the initial anatomic form. In order to make the provisionals diagnostic, they will be fabricated to relay information related to four critical areas: dental harmony, dentofacial relationships, elements of color, and occlusal and functional harmony.

DENTAL HARMONY

Rules of structural esthetic elements of the face, teeth, and gingiva have been documented extensively.⁴⁻⁸ The need to provide clinical crown sizes that are bilaterally symmetrical is in direct correlation with the patient's upper lip dynamics. If the patient shows most or all of the maxillary dentition upon smiling, there is a strong need to make contralateral teeth similar in vertical height. Conversely, if the patient exhibits low lip dynamics and does not show the maxillary dentition fully upon smiling, the delivery of bilaterally symmetrical indirect restorations may be de-emphasized per agreement between the dentist and the patient.

In addition, horizontal relationships of the anterior sextant should exhibit widths that are proportionately esthetic. Although the lateral incisors and cuspids can exhibit individual silhouettes that differ from their contralateral partners, the central incisors should be quite close to mirror images.

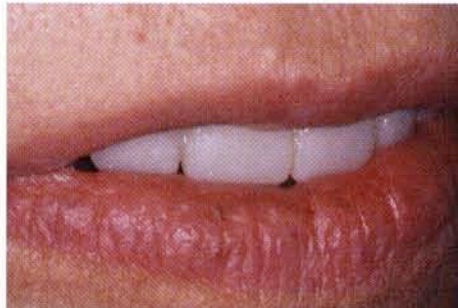


FIGURE 7 The maxillary edge position is verified for function through phonetic exercises.



FIGURE 8 Final image of anterior restorations illustrates how the meticulous characterization is maintained without adjustment.

Utilization of a measuring device (eg, a Boley gauge) can provide the practitioner with a good idea of whether addition or subtraction procedures should be employed to achieve bilateral symmetry (Figure 2). The use of carbide burs in conjunction with silicone dioxide polishing disks can provide necessary reductions.

While adding material can be more time consuming, it is an easy and reliable process. By simply roughening the bisacryl material (Figure 3) and etching the intended surface with the addition of 37% phosphoric acid for 45 to 60 seconds prior to washing away (Figure 4), a practitioner can add a layer of light-cure resin and cure for 10 seconds to create a bondable surface. Low-viscosity composite material can then be added in a sequential fashion until the desirable length and/or contour has been obtained (Figure 5). Brushing a final layer with a soft sable brush creates a surface that will need minimal, if any, finishing and polishing (Figure 6).

The link between esthetics and phonetics began in the era of removable prosthodontics.⁹ The vertical length of the maxillary anterior dentition and its conformity to the wet area inside the vermilion border of the lower lip plays a critical role in phonetic efficiency.¹⁰⁻¹² Of primary importance are "F" and "V" sounds. To check and/or verify this relationship, the patient is instructed to softly say words such as "fifty-five" or "victory." The incisal edges of the maxillary provisionals should touch the lower lip lightly and effectively in the area described above to crisply articulate the consonant sound (Figure 7).

If the vertical lengths of the anterior teeth can be accurately conveyed to the laboratory technician, restorative units can be fabricated and seated with confidence, knowing that meticulous characterizations, artistically created, will not be lost in post-bonding adjustments (Figure 8).



FIGURE 9 This view demonstrates the patient's natural smile prior to restoration of teeth Nos. 7 through 10.



FIGURE 10 These provisional restorations illustrate the dentofacial relationship with the lower lip.



FIGURE 11 This image exhibits conservative, leucite-reinforced porcelain^a restorations on teeth Nos. 7 through 10.



FIGURE 12 This image shows the patient "in repose" at pretreatment.



FIGURE 13 The patient exhibits changes in repose with provisional restorations.



FIGURE 14 Pretreatment image of the patient's natural smile exhibits teeth in the A4 shade range.



FIGURE 15 Retracted image shows the high degree of chroma in the patient's natural dentition.

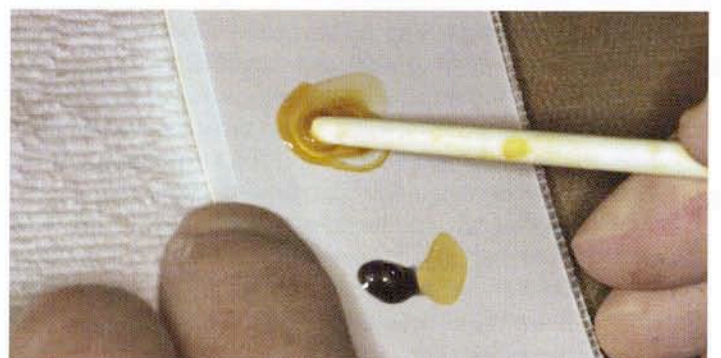


FIGURE 16 Dilution of the tints (eg, yellow and grey)^b with unfilled resin can adjust the intensity of the tints' chroma to the desired level.

DENTOFACIAL RELATIONSHIPS

There is a strong relationship between the incisal edge of the maxillary dentition, the amount of tooth revealed, and facial symmetry and balance.¹³⁻¹⁵ Dentofacial objectives must be determined, communicated, and verified regardless of upper lip dynamics.

Two of the significant dentofacial relationships that the dentist must verify with the patient and provide to the laboratory technician are the smile line of the maxillary arch in relation to the lower lip and the amount of the maxillary teeth seen when the upper lip is at rest, a position termed "in repose." The smile line should parallel the lower lip when a comfortable smile is attempted (Figures 9 through 11). The addition of incisal length to the maxillary teeth, which allows more tooth structure to show while the lip is at rest, is one of the most dynamic esthetic changes dental clinicians can

provide when helping a patient obtain a more youthful presentation of his or her facial image (Figures 12 and 13).

After adjustments, photographic images of the unanesthetized patient with the provisionals serve as an excellent aid for verification of the patient's objectives. To verify the new provisionals with the patient's facial musculature, the "provisional check appointment" is typically scheduled 48 to 96 hours after the anterior preparation appointment. The time between appointments is intentional to allow the patient to become familiar with the feel of the different morphology of the provisionals. *Note: with long-distance patients this may be impossible, and the time is shortened to the following day (24 hours).*

^a IPS Empress®, Ivoclar Vivadent, Amherst, NY

^b Cosmedent tints (honey yellow and grey), Cosmedent, Inc., Chicago, IL

After the images have revealed a level of patient and dentist satisfaction that both parties are comfortable with, an impression is taken for fabrication of a cast of the provisionals. This cast provides a three-dimensional guide that is of significant importance in conveying the information for the fabrication of the final restorations to the laboratory technician. It also serves as an all-important, three-dimensional verification contract between the dentist and the laboratory technician that the incisal edges of the final restorations must fit within the imprint of a matrix fabricated from the cast of the provisionals.

ELEMENTS OF COLOR

The effects of color and how to reproduce them naturally have long been studied in dentistry.¹⁶ There are times when the color shift from a patient's pretreatment condition to his or her final restorative solution is too drastic to accurately contemplate and verify through dialogue alone. Shade changes that are greater than two steps of value may require the patient to see the intended shade selection within the frame of the lips in order to determine if the shade change is what he or she intended (Figures 14 and 15).

There are also times when a patient must be shown an example of the benefit of color at the gingival aspect of the anterior teeth and/or the difference in color between the incisors and the cuspid teeth to illustrate natural effects of color. All too frequently, the patient's initial directives of making the restorations as white as possible are made without knowledge of the benefits of polychromatic dental color schemes and/or the chromatic differences that appear from tooth to tooth within the same arch.

Making provisionals polychromatic can be simplified considerably with the addition of tints. Dilution of the tints with clear resin can adjust the intensity of the tints' chroma to the desired level (Figure 16). A yellow color diluted for approximate effectiveness can be brushed onto the gingival third of the maxillary anteriors, with the cuspids receiving a little greater band of color incisogingivally. The yellow colorant also can be utilized into the interproximal area to create a natural value difference from the high-value, middle one-third of the maxillary incisors (Figure 17). A second application, spread over a little greater area, feathers the demarcation of the stain line, while also intensifying the gingival area at the gingival aspect (Figures 18 and 19).

A grey tint is utilized to create incisal translucency effects and lobule definition by simply extending the grey tint a half a millimeter more gingivally from the incisal edge at the junction of the adjoining dental lobes. A dilute amount of grey also can be brushed over the interproximal areas to provide the illusion of depth from the resulting lower value. In nature, this effect is created by the enamel stratification into the interproximal areas and the existence of deflective light surfaces of that enamel in natural teeth (Figures 20 through 22). After "coloration," the entire external surface of the provisional is coated with a glaze or resin coating.^{c,d}

By providing a visual prototype for the patient to wear and view within the confines of his or her own lips, the patient is able to see how a different shade and value interact with his or her complexion.

^c Luxaglaze® Light-cured Varnish, Zenith Dental/DMG, Englewood, NJ

^d BisCover™, Bisco, Inc., Schaumburg, IL

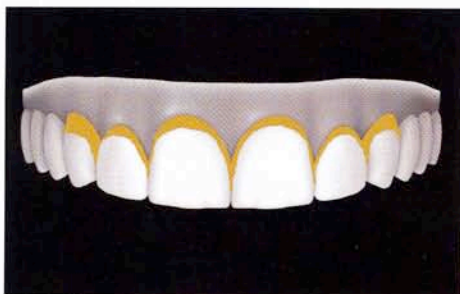


FIGURE 17 This view illustrates the initial placement of honey yellow coloration at the gingival thirds of the provisionals.



FIGURE 18 Further placement of honey yellow stratifies the intensity of the yellow tint coronally and adds color into the interproximal.



FIGURE 19 The honey yellow tint is applied to the provisional with a thin sable brush.



FIGURE 20 This illustration shows the placement of a diluted grey or violet tint to mimic incisal translucency.



FIGURE 21 A second application of grey tint helps lower the value of the interproximal area to mimic the lower value of the natural teeth in this area.



FIGURE 22 The diluted grey tint is applied with a thin sable brush.



FIGURE 23 This view shows the natural smile of a patient seeking smile enhancement dentistry.



FIGURE 24 The natural smile of the patient during the provisional phase of dental treatment allows the patient to visualize a radical change in shade and value.



FIGURE 25 Outside-in movement of the mandible against the maxillary arch is used to verify gnathologic harmony with the morphology of the provisionals.

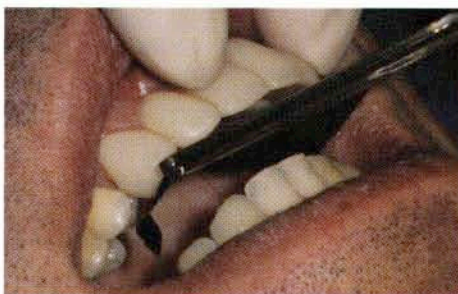


FIGURE 26 Positioning of the occlusal paper for simulated chewing allows proper morphological adjustments to the provisionals; this can minimize adjustments to the final restorations.

In addition, the restorative team can more confidently fabricate the restorations to the desired color scheme. Also, with a transitional phase, the patient is more apt to have firm agreement as to what his or her final esthetic objective is in regards to hue, chroma, and value (Figures 23 and 24).

OCCLUSAL/FUNCTIONAL HARMONY

It is imperative that complex or comprehensive restorative dentistry involves the verification of dental morphology that is in harmony with the temporomandibular joints (TMJs) and the muscles of mastication. Acknowledgment that the TMJ is the starting position of a viable occlusal scheme is borne out of traditional gnathological concepts.¹⁷ The position of the anterior teeth and their relationship to the face also are affected by functional and occlusal relationships.^{18,19} Alteration of occlusal vertical dimension (OVD) can provide a biologically compatible adjunct to dental treatment by improving upon dentofacial relationships, visual proportions in facial heights, and providing positive changes for force management of the masticatory system.²⁰

Kois summarizes his functional occlusal philosophy as the establishment of the “Three Ps” (3-P).²¹ Representing the first “P” is that a healthy and stable TMJ must be verified or established. This treatment relationship of the TMJ is called the “position” in the 3-P terminology.

Subsequent to establishing a sound treatment position of the TMJ, it is essential that there be a posterior occlusion characterized by bilateral, simultaneous contacts of the patient’s dentition from

the cuspids to the most distal tooth in the arch. Kois calls this interarch, bilaterally dependent dental relationship of posterior dental contacts the “place.” This is the position of intercuspation equilibrium that the patient wishes to go to when the mind directs itself to touch the upper and lower posterior teeth to one another.

Of particular importance, and one that is related to the travels of the mandible to find the “place,” is the “pathway,” which is the final “P” of Kois’ “Three Ps.” The pathway refers to the morphologic contours of the maxillary teeth, which provide a working relationship with the mandibular incisal edges that help guide the posterior teeth to “the place.” The pathway is obviously strongly interrelated to the morphology and esthetics of the anterior teeth in both the maxillary and the mandibular arches.

In order to fully provide a functional occlusal pathway for the patient, the provisionals must be checked in two different ways. The clinician can check the lateral pathways by having the mandible move from maximum intercuspation outwards to the left and right. That can provide a verification of how the morphology accommodates the intended pathway (Figure 25).

However, to fully verify the functional pathway of the mandible against the maxillary arch, the markings must be made in an “outside-in” fashion, utilizing the muscle movements in a manner that they are normally used kinesthetically. To do this, the clinician simply places articulation paper between the anterior dentition and asks the patient to simulate chewing motions for a piece of food on the left posteriors followed by the right posteriors, or visa-versa (Figure 26). This is done with the patient sitting up at no less than 45 degrees. Any marks or smudges on the lingual surfaces of the maxillary anteriors found after simulated chewing, between the incisal edges and the maximum intercuspation marks, should be adjusted until no interferences exist for these functional movements.

By checking both gnathological and functional occlusal pathways when the patient is in provisionals, the dentist can communicate the functional morphology to the laboratory technician with impressions and/or casts of the provisionals. If the laboratory technician knows this morphology, he or she can make the final restoration(s) accordingly so that adjustments to them can be minimized at the seating appointment.

CONCLUSION

Contemporary dentistry needs to be carried out in an environment where stringent objectives must be met. In addition to the patient’s high demands for specific esthetic restoration, the clinician finds himself or herself needing to provide the laboratory technician with visual and three-dimensional communication that can aid the fabrication of the case and satisfy functional parameters.

Spending additional time in the provisional phase of the patient's treatment, by providing diagnostic temporaries that can help define parameters for dental harmony, dentofacial relationships, elements of color, and occlusal/functional relationships, can simplify an extremely complex process. If the communication between the dentist, laboratory technician, and the patient can be aided by the fabrication of diagnostic provisionals, and in doing so increase the predictability of a successful outcome, the additional time in lengthening the provisional phase of treatment will have been well-provided.

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