4020_200604PPAD_Fondriest.qxd 5/4/06 1:09 PM Page 217

USING PROVISIONAL RESTORATIONS TO IMPROVE RESULTS IN COMPLEX AESTHETIC RESTORATIVE CASES

James F. Fondriest, DDS*

Provisional restorations provide more than an intermediate functional and protective covering of teeth that have been prepared for indirect restorations. They provide the opportunity to build a relationship with the patient, to more clearly achieve the patient's aesthetic expectations, to build patient hygiene skills and habits, and to learn what is ideal for patients occlusally, phonetically, and aesthetically. This presentation examines the benefits of provisionalization and how to effectively communicate the information learned in this stage to the laboratory for replication in the definitive restorations.

Learning Objectives:

This article demonstrates how provisional restorations can be used to build a collaborative relationship between the prosthodontist, patient, dental specialists, and laboratory technician. Upon reading this article, the reader should:

- Understand how to use provisional restorations to develop patient expectations and to build a clear understanding of treatment goals.
- Understand how provisional restorations can be used to limit occlusal and phonetic difficulties that can occur in these restorations.

Key Words: aesthetics, provisional, provisionalization, function, phonetics, waxup

**Private practice, Lake Forest, IL.*

James F. Fondriest, DDS, 560 Oakwood Avenue, Suite 200, Lake Forest, IL 60045
E-mail: jimfondriest@cs.com

4020_200604PPAD_Fondriest.qxd 5/4/06 1:09 PM Page 218

Building a successful aesthetic restorative practice requires more than an ability to sell a case and accurately prepare teeth. The thriving clinician grows and differentiates his or her practice by building personal bonds with his or her patients and working collaboratively with patients and dental specialists to create aesthetic treatment plans that are appropriate and customized for each person.

An appropriate and personalized treatment plan requires clinical photographs of the patient (Figures 1 through 3), radiographs, mounted models, and knowledge of the patient's expectations. These items should direct exploration of the treatment possibilities. Once a preliminary treatment is established, if the treatment has any complexity, the clinician should share and evaluate the initial records with specialists to develop all parties' understanding of the treatment options. Meetings with specialists can be as simple as exchanging e-mail images and following up phone calls. There are occasions when the entire interdisciplinary team will need to meet to discuss the case together.[1] It is often of value to have done some additive or reductive waxing to the patient's models prior to these meetings.[2]

Involving specialists and the patient in the treatment design creates ownership. If one helps create the treatment plan, he or she is more vested in the final result. For example, a patient is often effectively engaged in the treatment design when shown profile view images of his or her "gummy" smile. The natural response of the patient is to ask about treatment options. This approach led the patient in this case presentation to decide how much and where to incorporate crown lengthening (Figure 4).

Allowing the patient time to process the information learned from the workup and consultations will be valued by the patient. It is important for the clinician to bring the patient into the process by sharing what has been learned and asking for his or her input. Many patients may not have the knowledge to describe their goals, but they know when they see it, and appreciate the dentist allowing them to be involved during the workup and treatment stages. With a better grasp of their own circumstances and treatment future, patients usually make wise and personally appropriate decisions.[3] For example, by the time the patient had healed from periodontal surgery and was reevaluated (Figure 5), she chose not to have orthodontics or more perioplastic surgery even though it would further improve aesthetic results.

If the issues in the case are complex, delaying final decisions is appropriate. Encouraging patients to become a student of smiles (eg, by encouraging them to cut out

Figure 1. Preoperative image of the patient at full smile, prior to crown lengthening.

Figure 2. Right lateral view of the patient's dentition prior to crown lengthening and subsequent restorative care.

Figure 3. Left lateral view of the dentition prior to crown lengthening. Note the uneven diastemata.

4020_200604PPAD_Fondriest.qxd 5/4/06 1:09 PM Page 219

Figure 4. Scribed model and requested tissue reduction guide given to the periodontist, indicating tissue heights and incisal edge reduction agreed upon by the patient and restorative dentist.

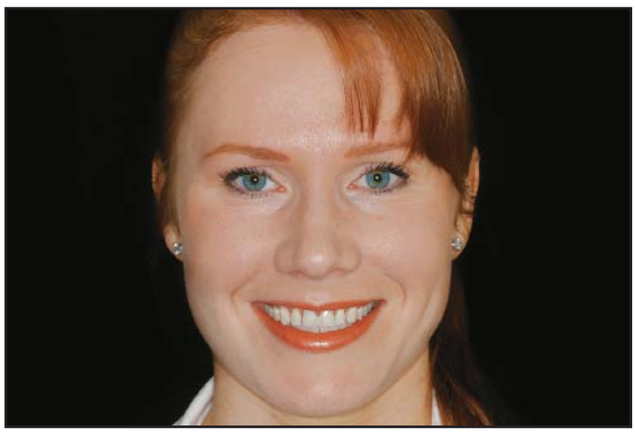

Figure 5. Mid-treatment reassessment image taken after crown lengthening. Patient declines orthodontic treatment or further perioplastic surgery.

magazine pictures of smiles that they like and to bring in family pictures of themselves in youth leads to discussion between the dentist and patient about face shapes, lip drapes, Angle's classifications, arch shapes, and other factors that affect how teeth appear in a smile.[4-6] This gives the patient a means to communicate desires and build understanding. During the time the patient is involved in learning about aesthetics and discovering what she or he wants to achieve, the clinician is learning more about the patient and the patient's case, and the patient's ownership and engagement in the project is growing.

Once the patient's and dental team's vision is clear, a waxup of the treatment plan should be created. This waxup serves as the first rendering of the final product. All too often, the definitive restoration serves as the only rendering, particularly for implant restorations. This limits the feedback that a waxup and provisional restorations can provide the clinician and patient.

Oftentimes, patients do not know what results can be achieved and, even if they do, they cannot envision what the dentistry will look like in their own smiles. Many practitioners have the ability to create digital images of potential outcomes.[7] These images are helpful but can easily give patients unrealistic expectations due to the fact that transforming real teeth is far more difficult than doing it digitally. Applying composite mockups to the teeth also gives the patient an impression of how it could look, but this misses all the other learning that provisional restorations provide.[8] Provisionals help patients to both see and feel the planned dentistry in order to judge it. Wearing provisional restorations serves to develop their understanding of what is possible aesthetically and offers patients the opportunity for involvement in making modifications as the dentist tests how their dentistry will function, look, and feel.

Tooth Reduction Guides and Provisional Restorations

From the aesthetic perspective, the waxup is more than a means to solve the technical issues and a guide for the laboratory to complete the project. The waxup is used in creating reduction guides for tooth preparation.[9-11] Since the waxup is a rendering of the clinician's understanding of what the patient wants aesthetically, it serves as the template for the provisional restorations—the second rendering of the final product. The waxup can be used to fabricate the provisional restorations whether the clinician plans to make the provisional restorations directly or indirectly.

Figure 6. The diagnostic waxup demonstrates the clinician's interpretation of the patient's aesthetic expectations and the plan to resolve her occlusal and restorative issues.

4020_200604PPAD_Fondriest.qxd 5/4/06 1:09 PM Page 220

The waxup may be created by the clinician, laboratory technician, or a professional waxup artist. While a technician who specializes in waxing may be more likely to create a beautiful wax rendering, the clinician stands to gain significant learning moments by performing the waxup by his or her self. For example, the dentist will get a better feel for just how much reduction needs to be done to move teeth into preferred orientations/positions, as well as for tissue/ridge contours and scallop heights.[10,11] Cusp/fossae/ridge blade placement and functional issues also will become apparent to the clinician during the waxing process. This useful information can be used by the clinician to better restore the dentition and provide aesthetics that are more in line with the vision outlined by the clinician and the patient.

Once the waxup is completed, reduction guides are prepared, and the patient is scheduled for preparation and provisionalization (Figures 6 through 8). Many patients require other preliminary treatments, and the actual sequencing varies with each patient.

Provisional Adjustments

No matter how well the contours, axial inclinations, and incisal edge positions are planned with preoperative photographs and waxups, one does not know how they will appear or how they will interact with the tissue to create scallop forms and interdental papillae until a provisional restoration is seated.[11,12] Only with the provisional restorations seated can one determine how far from the margin the interproximal contacts should be placed and if the patient can clean with the new tooth contours.[12,13]

This also is the first time the patient sees and feels a model of the definitive restorations intraorally. A dialogue can develop between clinician and patient about the aesthetic interpretations the dentist made from previous conversations. The patient is able to see how the amended length, occlusal plane, and incisal embrasures of the teeth appear behind the lips. It is rare that a patient does not have some modification in mind. Often these modifications are subtle, easy to perform, and pertain to embrasure shapes or occlusion. Sometimes the patient's goal cannot be achieved. In such cases, the clinician has the opportunity to explain why it cannot be achieved *before* it is sent to the laboratory instead of after the fact.

Phonetic Concerns

Whenever arch forms or the relationships between the lingual aspects of the maxillary incisors to the incisal edges of the mandibular incisors are modified, the patient's ability to enunciate may change.[14,15] Most difficulties are

Figure 7. A reduction guide made from an impression of the waxup ensures appropriate tooth reduction and fabrication of aesthetic restorations of uniform thickness.

Figure 8. Facial view of the anterior dentition following tooth preparation for porcelain laminate veneers.

Figure 9. Provisional restorations are then placed for 1 to 6 months to permit evaluation and adaptation to the modified aesthetics, phonetics, and function.

4020_200604PPAD_Fondriest.qxd 5/4/06 1:09 PM Page 221

Figure 10. Facial view depicts crossover wear facet on the distal aspect of the mandibular right canine preoperatively.

Figure 11. Postoperative view of canine with a wear facet and crossover guidance pathway that is identical to the wear facet in the patient-accepted provisional.

Figure 12. Wear facets form on provisional restorations and can provide clues about how to design the contours and edges of the definitive restorations.

temporary because patients can adapt to changes. Lisping of the "S" can be a more difficult dilemma because this frequently will not improve with time. The S sound is usually formed by forcing air between the maxillary and mandibular incisors that are co-apted to within 1 mm to 2 mm of each other as the S sound is formed. The mandible moves anteriorly to different degrees depending on the Angle classification but, without the ability to limit the airflow between the anterior maxillary and mandibular teeth, a lisp will occur.

Wearing provisional restorations allows for patient adaptation to changes in the phonetic interplay between the teeth and any occlusal changes that have been created by the prosthetic reorientation of teeth prior to the delivery of the definitive restorations (Figure 9). If the patient cannot adapt to the changes the practitioner has created, it is beneficial to know this and make the needed changes prior to sending the case to the laboratory.

Aesthetic Concerns

Sometimes patients are startled by the changes that can be made by dental care. Provisional restorations allow a temporary, intermediate placement in order to accustom the patient to the changes. Occasionally a patient will express difficulty in adapting to the new look and express a desire for less significant change. If the practitioner gives the patient time to "live" in the provisional restorations prior to making final impressions, the patient has the opportunity to adjust and to consider his or her decisions, often accepting the changes without additional modification.

In the author's office, patient-requested modifications to the original provisional restorations are accomplished in front of the patient. This allows patients to appreciate the skill it takes to manifest their wishes in the provisional restorations. Making these modifications also solidifies the partnership between clinician and patient, creating dual ownership and responsibility for the project. Willingness on behalf of the practitioner and the technician to follow the patient's wishes is a key factor in the ideal clinician/technician/patient relationship. Giving the patient permission and time to consider the modifications made to the provisional restorations can result in the patient asking to restore the original contours and can lead to increased respect for the practitioner's judgment.

Occlusal Concerns

The subtleties of mandibular guidance may go undetected by the practitioner. As the mandible moves into excursive positions, the edges of the mandibular anterior teeth move against the guide planes of the maxillary teeth.

4020_200604PPAD_Fondriest.qxd 5/4/06 1:09 PM Page 222

Figure 13. Postoperative image. The patient knows how the definitive restorations will appear and function before they are placed.

Figure 15. Left lateral view of the definitive feldspathic veneers at 2 months postoperation.

Figure 14. One week postoperative view demonstrates the significant aesthetic enhancement and harmony achieved with this provisionalization protocol.

Figure 16. Two-month postoperative view of definitive restorations and the patient's smile.

In extended movements, the incisal edges of the mandibular anterior teeth function against the edges of the maxillary anterior teeth. Wear occurs in natural teeth on these edges, which creates flat facets rubbing against flat facets. In nature, these opposing facets will be parallel in three dimensions. When reconstructing anterior teeth in porcelain, it is rare to find technicians and practitioners planning these functional surfaces in the definitive restorations (Figures 10 and 11). Especially rare is the planning for the functional edges of the incisors passed crossover the canines.

Due to the hard and brittle nature of porcelain, as the patient rubs his/her edges together subsequent to prosthetic delivery, tooth wear, porcelain fracture, or debonding can result rather than what occurs in nature, which is the slow milling in of these edges. Accordingly, most practitioners demand less abrasive porcelains or more effective bonding agents to retain the porcelain. Successful, long-lasting restorations benefit from planning for these functional positions and not violating the patient's guidance patterns.

When forces are introduced into a system, there will always be some type of response (eg, tooth wear, breakage, mobility, movement, sensitivity, muscle soreness, joint breakdown).[16-19] The natural response will be proportional to the forces generated by the patient. More force is required to push something over a steep hill than a shallow gradient. It is important, when restoring teeth, not to increase the gradients or guidance, or the forces in the system will increase as well as the likelihood of the above natural responses. Porcelain fracture is a very common manifestation of this response when restorations are squared out in the smile design process. The porcelain is being placed in the way of normal border movements of their patients' occlusal function. More durable restorations and resins only serve to shift the eventual natural response from the restoration to something else.

The same issues apply to posterior restorative dentistry. After designing the cusp fossae relationships and guide pathways on the posterior occlusal surfaces of

4020_200604PPAD_Fondriest.qxd 5/4/06 1:09 PM Page 223

the provisional restorations, the clinician should consider confirming that the developing wear facets are small and round instead of large scuffs, streaks, or comets.[20,21]

Modern practitioners construct provisional restorations from different materials with varying degrees of surface hardness. Acrylic (ie, methyl methacrylate) is an excellent material to use for the first set of provisional restorations due to its superior marginal fit, unsurpassed aesthetics, non-brittle nature, and its ability to wear. This ability to slowly wear becomes extremely diagnostic because wear facets appear within days of delivery (Figure 12).

Wear facets will be shiny when lighted, and they allow the practitioner to see the individualized guide pathways that each patient habitually takes. Some facets will be very subtle even after months of wear. Others will be heavy and destructive to the provisional restoration. Sometimes a multiunit splinted provisional restoration will repeatedly de-cement or fracture on one side or even on one tooth. Does the patient have a history of bruxism or of being hard on her or his teeth? The clinician should look at the non-restored teeth in the mouth and confirm whether they have heavy wear or mobility? If not, then it is probably an occlusal design that requires re-examination. This is strong evidence that the envelope of function has either been steepened in that area or the excursive transitions are bumpy. Occlusal rehabilitation should seek to recreate the patient's original envelope of function or to create one just a little shallower.

Laboratory Concerns

When the provisional restorations have passed all the tests for aesthetics, function, phonetics, and maintenance, it is time to document them and send the case to the laboratory. If all criteria have been satisfied during provisionalization, then the laboratory only has to duplicate the buccal, incisal, and lingual contours of the provisional restorations to achieve an aesthetic—and comfortable—result (Figures 13 through 16).[10,22] The clinician will help the technician achieve improved results by providing a critique of the provisionals from the perspective of the dentist and the patient.

Conclusion

Laboratories are often requested to deliver imperceptible restorations that aesthetically and occlusally blend into the dentition without receiving the information required to provide these characteristics. Typically, there is little planning for provisional restorations by the clinician prior to treatment; these provisionals are usually similar in shape and occlusion to the original teeth. By spending more time in the provisional stage, the clinician enjoys the opportunity to build a better relationship with the patient, to differentiate the practice, to demonstrate restorative skills, and to learn what is ideal for the patient occlusally and phonetically. The practitioner can address and confirm the patient's aesthetic agenda, which increases patient satisfaction with the results.

References

1. Spear FM. Forming an interdisciplinary team: A key element in practicing with confidence and efficiency. J Am Dent Assoc 2005;136(10):1463-1464.
2. Terry DA, McGuire M. The perio-aesthetic-restorative approach for anterior reconstruction—Part I: Evaluation and periodontal surgery. Pract Proced Aesthet Dent 2002;14(4):283-291.
3. Fondriest J. The new-patient interview. Dentistry Today 2005; 24(10):142-145.
4. Flores-Mir C, Silva E, Barriga MI, et al. Lay person's perception of smile aesthetics in dental and facial views. J Orthod 2004; 31(3):204-209.
5. Rifkin R. Facial analysis: A comprehensive approach to treatment planning in aesthetic dentistry. Pract Periodont Aesthet Dent 2000;12(9):865-871.
6. Kokich VO Jr, Kiyak HA, Shapiro PA. Comparing the perception of dentists and lay people to altered dental esthetics. J Esthet Dent 1999;11(6):311-324.
7. Brooks LE. Smile-imaging: The key to more predictable dental esthetics. J Esthet Dent 1990;2(1):6-9.
8. Donovan TE, Cho GC. Diagnostic provisional restorations in restorative dentistry: The blueprint for success. J Can Dent Assoc 1999;65(5):272-275.
9. Brunton PA, Aminian A, Wilson NH. Tooth preparation techniques for porcelain laminate veneers. Br Dent J 2000;189(5): 260-262.
10. Magne P, Magne M, Belser U. The diagnostic template: A key element to the comprehensive esthetic treatment concept. Int J Periodont Rest Dent. 1996;16(6):560-569.
11. Gurel G. The Science and Art of Porcelain Laminate Veneers. Berlin: Quintessence; 2003:237-286.
12. Bichacho N, Touati B. The Art of The Smile. London: Quintessence; 2005:7-24.
13. Tarnow DP, Magner AW, Fletcher P. The effect of the distance from the contact point to the crest of bone on the presence or absence of the interproximal dental papilla. J Periodontol 1992;63(12):995-996.
14. Pound E. Let /S/ be your guide. J Prosthet Dent 1977;38(5): 482-489.
15. Pound E. Controlling anomalies of vertical dimension and speech. J Prosthet Dent 1976;36(2):124-135.
16. Dawson PE. Evaluation, Diagnosis, and Treatment of Occlusal Problems. 2nd ed. St. Louis: Mosby; 1989.
17. Okeson JP. Occlusion and functional disorders of the masticatory system. Dent Clin North Am 1995;39(2):285-300.
18. Becker IM. Occlusion as a causative factor in TMD. Scientific basis to occlusal therapy. N Y State Dent J 1995;61(9):54-57.
19. Nowlin TP, Nowlin JH. Examination and occlusal analysis of the masticatory system. Dent Clin North Am 1995;39(2):379-401.
20. Kirveskari P, Alanen P, Jamsa T. Association between craniomandibular disorders and occlusal interferences in children. J Prosthet Dent 1992;67(5):692-696.
21. Christensen LV, Rassouli NM. Experimental occlusal interferences. Part I. A review. J Oral Rehabil 1995;22(7):515-520.
22. Alpert RL. A method to record optimum anterior guidance for restorative dental treatment. J Prosthet Dent 1996;76(5): 546-549.

4020_200604PPAD_Fondriest.qxd 5/4/06 1:09 PM Page 224

CONTINUING EDUCATION (CE) EXERCISE NO. 8

8 CE CONTINUING EDUCATION

To submit your CE Exercise answers, please use the answer sheet found within the CE Editorial Section of this issue and complete as follows: 1) Identify the article; 2) Place an X in the appropriate box for each question of each exercise; 3) Clip answer sheet from the page and mail it to the CE Department at Montage Media Corporation. For further instructions, please refer to the CE Editorial Section.

The 10 multiple-choice questions for this Continuing Education (CE) exercise are based on the article "Using provisional restorations to improve results in complex aesthetic restorative cases," by James F. Fondriest, DDS. This article is on Pages 217-223.

1. For which of the following are laboratory putty impressions of the waxup used?
a. A guide for axial tooth reduction.
b. A guide for incisal tooth reduction.
c. A template for provisional construction.
d. All of the above

2. Which of the following is true regarding acrylic-based provisionals?
a. They have the same hardness as composite-based provisionals.
b. They are more likely to fracture than composite-based provisionals.
c. Have no more diagnostic ability for aesthetics and occlusion than composite-based provisionals.
d. None of the above.

3. Wearing provisionals for extended periods allows for which of the following?
a. Tissue development.
b. Evaluation of aesthetics.
c. Evaluation of occlusion.
d. All of the above.

4. In a Class I jaw relationship, the mandibular incisors often are in contact with which teeth in extended right and left excursive movements?
a. They contact the maxillary cuspids.
b. They contact the maxillary incisors.
c. The mandibular incisors do not normally contact anything in right and left movements because the molars prevent it.
d. None of the above.

5. What concerns may arise when dental care is provided?
a. Improper occlusion.
b. Changes in enunciation.
c. Difficulty accepting the dramatic aesthetic change.
d. All of the above.

6. When creating anterior restorations, what is the best way to design the incisal edges?
a. Keep them as rounded as they were when the teeth originally erupted.
b. Make them flat and parallel in three dimensions to the occlusal plane.
c. Make them flat and parallel in three dimensions to the wear facet on the opposing teeth.
d. Make them flat and parallel in three dimensions to the eminence.

7. Which of the following is the first step after discussing goals?
a. Creating a waxup.
b. Creating provisional restorations.
c. Lingual beveling to mask polymerization.
d. None of the above.

8. If your provisionals continually fracture or de-cement, it is most commonly caused by which of the following?
a. Luting cement failure.
b. Excessive preparation.
c. Inappropriate occlusal design.
d. Inadequate material strength of provisionals.

9. The concept of ownership in this article has which of the following effects?
a. It incorporates a larger team of specialists.
b. It places responsibility for treatments rendered.
c. It increases active participation in treatment planning.
d. It alleviates the responsibility of the patient and specialists.

10. Which of the following was NOT a tool used to formulate a treatment plan in this case?
a. Radiographs.
b. Family history.
c. Patient's expectations.
d. Diagnostic photographs.