Anterior Provisional Restorations Used to Determine Form, Function, and Esthetics for Complex Restorative Situations, Using All-Ceramic Restorative Systems

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ABSTRACT

A technique is proposed for the restoration of a large and visible maxillary anterior defect. The importance of proper diagnosis, treatment planning, and communication is emphasized. Irreversible treatment should only be rendered once patient approval has been obtained through objective evaluation with provisional restorations. The techniques presented in this article use a combination of ceramic systems currently available to satisfy functional demands while achieving acceptable esthetics. A controlled series of steps, where the provisional restorative components are being replaced by the definitive ones is planned. The only difference between the provisional and definitive restorative components is the material used. The definitive restorations consisted of an implant-supported zirconium oxide framework. Individual pressed porcelain restorations were luted to the framework and a natural tooth.

CLINICAL SIGNIFICANCE

Provisional restorations allow an objective form of communication. Vertical and horizontal transitional lines can be effectively masked with appropriate treatment planning and a skilled ceramist. Many traditional dental laboratory steps may be eliminated or simplified without compromising the definitive restorations.

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INTRODUCTION

The current availability of the vast number of choices for the restoration of anterior teeth is simply overwhelming. There is constant pressure for both the clinician and the dental technician to be at the forefront of these developments. Although this prospect may be enticing to some, it may also carry a large burden of risk.

As healthcare professionals, we are obliged to provide our patients

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Figure 1. Patient smile on presentation.

Figure 2. Intraoral anterior view on presentation. A large unilateral defect is present.

with restorations that serve many purposes. These need to be functional and esthetic at the same time. If attention is not afforded to the former, catastrophic consequences may ensue to the dismay of both the provider and the patient receiving the treatment. In short, a thorough diagnosis and treatment planning, coupled with an understanding of the limitations of dental materials, are mandatory.[1]

This article will describe techniques and novel approaches to the use of dental materials in order to remain faithful to the diagnostic arrangement. Only when the restoration has been tested for function and evaluated for esthetics may irreversible procedures be initiated.[2] The concept that is being proposed in this article allows for a controlled series of steps, where the provisional restorative components are replaced by the definitive ones. The only difference between the provisional and definitive restorative components is the material used. They are near identical in terms of form. Predictability in treatment outcome will be assured.

CLINICAL REPORT

A 39-year-old woman was referred to the University of Southern California Faculty Practice (Oral Health Center) for the replacement of the missing maxillary anterior teeth (Figure 1). The patient's chief complaint was the high level of embarrassment caused by her missing anterior teeth. The patient presented with two dental implants that were placed in the maxillary right canine and central incisor positions. A high-speed motor vehicle collision while riding a motorbike was the cause of the large anterior maxillary defect (Figure 2).

Because of the minimal residual vertical and horizontal height, high lip line,[3,4] and proximity to the maxillary midline, the patient was classified in the type IV category, according to the classification system for partially edentulous patients recommended by the American College of Prosthodontists.[5] In this classification system, a type IV category patient would be considered the most challenging to restore.

Evaluation of the dental casts of the patient's maxillary arch revealed unfavorable dental implant positions and angulations. Following a thorough interview to reveal the patient's esthetic desires, a diagnostic arrangement in wax was made (Figure 3).[2] The use of mounted diagnostic casts, diagnostic arrangements, and provisional restorations is well documented and ensures a predictable end result.[6,7]

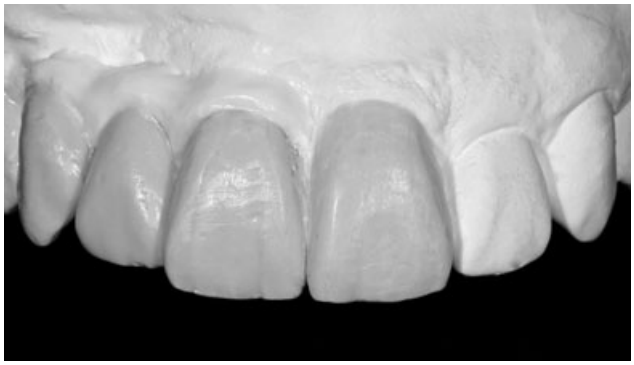

Figure 3. Diagnostic wax-up.

Figure 4. Duplicate of the Diagnostic wax-up in acrylic resin.

Approval by the patient is more likely to follow.

Diagnostic waxing was performed in two specific sequences (Figure 3). First, the teeth were waxed. This allowed objective evaluation of the missing soft tissues and evaluation of the harmony of the arrangement in line with patient expectations. Next, wax was applied to fill in the hard and soft tissue defect on the cast in order to evaluate potential dental materials and the design of the definitive restoration. Because of the unfavorable angulation of the dental implants and the volume of hard and soft tissue loss, a design that included a 3-unit screw-retained zirconium substructure was used.

Three individual all-ceramic restorations were planned for luting to the framework. In addition, a porcelain laminate veneer was planned to allow increasing the length of the maxillary central incisors to harmonize the smile in accordance with the patient expectations.[8]

The diagnostic arrangement in wax was duplicated completely in acrylic resin (Enamel plus, Micerium, Avegno, Italy) (Figure 4). The diagnostic arrangement on the definitive cast was duplicated with a light-bodied addition-reaction silicone material (Elite Double 22 Fast; Zhermack, Inc., Eatontown, NJ, USA). Temporary plastic implant cylinders (Brånemark System; Nobel Biocare USA, Yorba Linda, CA, USA) were placed on a duplicate of the definitive cast and the wax pattern was replaced with acrylic resin (Figure 4). The acrylic resin was milled with a handpiece in order to create the 3-unit screw-retained substructure (Figure 5). Three acrylic resin splinted units were fabricated indirectly to fit on the substructure. A pencil was used to delineate the outline of the acrylic resin crowns from the future simulated gingival areas (Figure 6). A pink composite resin material (Enamel HFO; Micerium), along with staining, was used to mimic the simulated gingival areas (Figures 7–9). The provisional implant supported restorations and an indirect acrylic resin mock-up for the maxillary left central incisor were fabricated on the cast (Figure 10). Even prior to delivery, the acrylic resin provisional restorations can serve a diagnostic purpose. It was apparent that the maxillary left central incisor would require some tooth preparation on the mesial aspect in order to mask the vertical transition-line between tooth and ceramic (Figure 10). The incisal edge of this tooth would also require shortening in order to achieve a more balanced level of translucency with the contra-lateral tooth. Figure 11 demonstrates meticulous care given to the form and appearance of the lingual aspect of the prosthesis. The diagnostic mock-up on the cast also

Figure 5. Milled acrylic resin provisional screw-retained substructure.

Figure 6. Delineation of acrylic resin crowns outline from the future simulated gingival areas.

Figure 7. Initial application of simulated gingival areas on substructure.

Figure 8. Completion of simulated gingival areas on substructure.

Figure 9. The Intaglio surface of the implant-supported provisional substructure.

Figure 10. Anterior-lateral view of the provisional restorations. The indirect mock-up on the cast confirms the need for tooth reduction on the mesial of the natural tooth.

Figure 11. Lingual view of the provisional restorations.

Figure 12. Harmonized smile following delivery of provisional restorations at 4 weeks.

provided an objective tool and a means for communication between the dental technician and clinician. It is apparent that, unless a tooth preparation was created that wrapped around the mesial aspect of the tooth and was extended apically and lingually to a significant degree, esthetic complications would most likely follow. Adequate extensions of the preparations in this area would have also allowed the dental laboratory technician to create appropriate emergence profile (Figure 10).

Figures 9 and 10 show internal characterization achieved with the cut-back technique from the buccal and lingual views. Proper planning allowed adequate contours to facilitate oral hygiene procedures (Figure 9).[9,10] The indirect mock-up was delivered by spot etching enamel (Ultra-Etch; Ultradent, Provo, UT, USA) on the facial aspect of the tooth and a composite resin luting material (Venus Flow; Heraeus Kulzer, Armonk, NY, USA).[6] The screw-retained substructure was delivered, followed by the 3 units of provisional restorations that were cemented with a translucent temporary material (TempBond Clear; Kerr Corp., Orange, CA, USA). Although the patient seemed extremely satisfied with the outcome (Figure 12) of the indirect mock-up on the prepared tooth and dental implants, she was encouraged to remain in provisional restorations for a few weeks to obtain input from close family and friends.[2] This time period allowed for the evaluation of function and form in addition to esthetics.[2,6,7] The patient was instructed on the maintenance of interproximal gingival health and the intaglio surface of the implant-supported prosthesis with the aid of dental floss (SuperFloss; Oral-B, Boston, MA, USA). At the next appointment, the patient remained satisfied with the restorations and was willing to proceed to the "next step." Some minor modifications that could easily be incorporated into the definitive restorations were requested. The patient preferred slightly narrower and brighter maxillary incisors. Even if the patient had decided against the treatment, none of the clinical steps mentioned was irreversible and could be easily removed without harm to the patient.

A pick-up final impression of the maxillary arch was made.[11] It included the porcelain laminate veneer preparation of the left central incisor and two customized (Pattern Resin; GC America, Alsip, IL, USA) and intraorally connected (Venus Flow; Heraeus Kulzer, Armonk, NY, USA) impression

Figure 13. Acrylic resin framework used as a reference for copy milling.

Figure 14. Zirconium oxide framework on the definitive cast. A lingual silicone index was used to confirm appropriate controlled cut-back. The copy milling technique allowed retainers to be designed with adequate resistance and retention form. Rounded internal line angles were used to avoid initiation of cracks through ceramic. A clearly defined shoulder finish line was prepared for all three retainers. Minor difference in contour between the acrylic resin in Figure 12 and zirconium oxide frameworks are because of the limitations imposed by each material. According to the manufacturer, zirconium oxide may not be less than 0.3 mm in thickness.

copings (Brånemark System; Nobel Biocare USA). The diagnostic information from the provisional restoration allowed the fabrication of the screw-retained zirconium oxide framework (Procera; Brånemark System) by the copy milling technique.[12] An acrylic resin framework (Figure 13) that closely resembled the provisional framework (Figure 5) was used as a reference for copy milling. It was sent to the manufacturer (Brånemark System; Nobel Biocare USA) with the definitive cast in order to manufacture the definitive framework (Figure 14).

A silicone index (Platinum 85; Zhermack, Inc.) of the diagnostic arrangement was used to fabricate three individual acrylic resin restorations (Enamel Plus; Micerium) on the zirconium oxide framework. The thickness of the restorations was measured and thin areas were thickened with wax (Figure 15). The three individual acrylic resin restorations were sprued (Wax wire; Kewax, Myerstown, PA, USA) (Figure 15) in preparation for investment (HS Investment; Microstar, Lawrenceville, GA, USA). The acrylic resin was burnt out and a castable ceramic was pressed (HT high temperature; Swiss NF Metals, Inc, Toronto, ON, Canada) using the lost wax process (Figure 16).[13–16] The advantages of using acrylic resin restorations include the ease of application and the ability to try the restorations intraorally. The all-ceramic restorations were placed on the framework with no need for adjustment (Figure 17). They were cut-back (Figure 18) and prepared for the internal effects and layered with traditional feldspathic ceramic (Creation; Klema, Meiningen, Austria). The dental technician was more likely

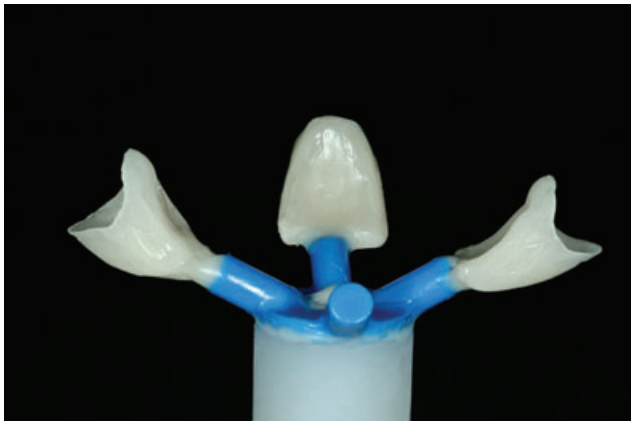

Figure 15. Sprued individual acrylic resin restorations.

Figure 16. Castable ceramic restorations were identical in form to the sprued individual acrylic resin restorations in Figure 15.

Figure 17. Two of the all-ceramic restorations on the framework.

Figure 18. Cut-back and staining of the maxillary central incisors.

to match the base shade of the central incisors if cast concurrently (Figure 19). It was considered prudent to use different internal effects for applying ceramic to these teeth because of the variation in thickness between restorations and core structures with different colors. Because of the high level of translucency of cast ceramic restorations, the "stump shade" (Vitapan Classical shade guide; Vident, Brea, CA, USA) was recorded and its influence was factored in.[17] The Geller model was used to verify contour and position of the restorations (Figure 20). Simulated gingival areas were created with feldspathic ceramic (Gingival kit paste; Vita VM13, Vident) on the definitive cast and with the individual ceramic restorations on the framework (Figure 21). After thorough clinical evaluation, the bonded restorations were luted (Enamel HFO; Micerium) under rubber dam isolation. The detailed luting procedures have been previously described and are beyond the scope

Figure 19. The central incisors were sintered and polished together. The other two restorations shown were cast but not cut back. This served as an accurate reference.

Figure 20. Final finishing of all-ceramic restorations together.

Figure 21. The ceramic application for the simulated gingival areas.

Figure 22. Anterior intraoral view of the definitive restorations at 14 months.

of this article.[18,19] The patient was instructed on maintenance of interproximal gingival health with the aid of dental floss (Super Floss; Oral-B). Figures 22 and 23 show the definitive restoration after 14 months. No clinical complications were observed at the 14-month follow-up examination, and the patient remained satisfied with the function and esthetics of the restorations.

DISCUSSION

Provisional restorations serve as an excellent tool in evaluating the patient's esthetic needs.[2,6,7] Some patients command a high level of restorative dentistry to achieve esthetics and function. Elective restorative dentistry should not be undertaken without a clear understanding of the patient's desires and the limitations of restorative therapy. The final result should be visualized and realized before an irreversible procedure is performed.

Castable ceramics also offer some benefits. They have a more

Figure 23. Harmonious patient smile after delivery.

organized crystalline structure than traditional layered feldspathic porcelain.[14] Additionally, full-coverage restorations in the anterior region made with these materials have shown excellent success rates.[15,16] Acceptable esthetic results can be achieved in a consistent and timely manner with superior marginal adaptation.

When any "esthetic" restorative procedure is performed, the treatment should be carefully planned and sequenced prior to the start of treatment. No irreversible treatment should be performed without a diagnostic provisional phase. One must also be wary of living up to patient expectations and deliver definitive restorations that function and are at least as esthetically pleasing as the provisional.

CONCLUSION

In the opinion of the authors, there are many techniques that are valid for the restoration of balance and harmony to the anterior dentition. Only with a thorough evaluation of the patient on presentation and with meticulous attention to detail during treatment can successful outcomes be predictably achieved. An in-depth understanding of the materials and techniques used will likely result in the predictable production of esthetic, functional, and long-lasting restorations.

Achieving a desirable outcome in a severely compromised situation is extremely rewarding. The patients' quality of life can truly be enhanced.

DISCLOSURE

The authors do not have any financial interest in the companies whose materials are included in this article.

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