Implant Replacement of the Maxillary Central Incisor Utilizing a Modified Ceramic Abutment (Thommen SPI ART) and Ceramic Restoration

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ABSTRACT

The prosthetic restoration of a missing anterior tooth with a dental implant is a challenge. Treatment coordination with a multidisciplinary team is critical in the successful outcome of this type of patient treatment. Newer surgical treatment modalities in the management of hard and soft tissues are becoming common, with very good predictability and long-term stability. Additionally, the use of advanced dental technology and materials such as sintered zirconium allows the restorative practitioner the opportunity to fabricate an esthetic, precise-fitting, biocompatible, and strong definitive prosthesis for the patient, with good longevity.

CLINICAL SIGNIFICANCE

The use of an all-ceramic abutment and restoration is described, along with the "soft tissue sculpting" procedure through the use of a custom provisional restoration. The relative ease and convenience of the procedure is also illustrated.

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INTRODUCTION

The utilization of dental implants to replace single or multiple missing teeth or entire edentulous arches has become common in today's prosthodontic and surgical practices around the world.[1–4] Relatively recent advances in implant dentistry allow practitioners the option to consider the extraction of a nonrestorable tooth and the immediate placement of the implant, along with immediate provisionalization. These improvements in technique have led to more predictable development of acceptable emergence profiles, which is of obvious primary importance in the esthetic zone.[5–7] Development of an appropriate emergence profile by the restorative doctor, and also the laboratory technician, is paramount in the maintenance of long-term, periodontally sound oral health by supporting the soft tissues in an optimal position and contour. In addition to optimal periodontal health, a predictable long-term esthetic outcome is more easily achieved.

Today's implant systems present very good long-term success levels as well as several advantages over the traditional fixed and removable treatment alternatives in many cases. Additionally, single-implant restorations are not without challenge in the esthetic zone. Achievement and maintenance of proper gingival architecture caused by the

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changes that take place in the alveolar bone following tooth extraction and the resultant apical migration of the patient's gingival tissues are a serious concern.

Recent development of new dental materials have allowed the restorative doctor and dental technician to facilitate the maintenance of these conditions to improve the long-term esthetics for the patient. Most recently, the use of ceramic or zirconia abutments for implant systems have helped improve their esthetic capabilities. The zirconia abutment has physical properties that, when properly utilized, can withstand routine occlusal forces in the anterior portion of the mouth.[8] The zirconia abutment can lead to a more natural-appearing implant restoration, with no metal showing through or darkening of the soft tissue, and can adequately support and retain an all-ceramic crown.

Although ceramic materials are very strong in compressive strength, they have a tendency to become weak in tensile strength. In some patients, these types of forces are exerted during chewing and parafunction. Also, because of the extreme hardness of the ceramic materials utilized for these abutments, great care must be exercised during their preparation in the laboratory so as not to develop Griffith's flaws or stress cracks in the material that could lead to catastrophic failure under minimal occlusal forces. The screw-retention access hole in the ceramic abutments is a concern because if the external walls are prepared beyond the manufacturer's minimum specifications, catastrophic failure under function can be expected.

Another observed advantage of the all-ceramic abutments and restorations are that they seem to be very kind to the periodontium and promote good tissue health, even in the case of suboptimal oral hygiene, compared with traditional ceramometal restorations.[9]

This article will review a technique for the utilization of a zirconia ceramic abutment, in addition to provisionalization, to develop soft tissue contours in an 18-year-old male patient.

PATIENT TREATMENT

The maxillary left central incisor had experienced trauma several years before, had been treated endodontically, and has now exhibited nonrestorable internal root resorption (Figure 1). The patient presented with suboptimal oral hygiene, which was addressed with oral hygiene instructions and oral and written information on the need to improve hygiene and the potentially deleterious effects that this

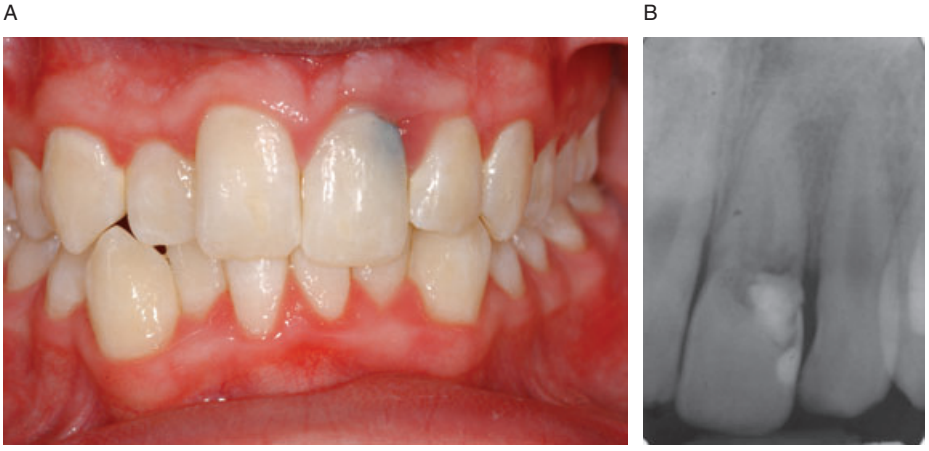

Figure 1. A, *Patient's condition at initial appointment.* B, *Initial periapical radiograph of the tooth with internal resorption.*

may have on the long-term outcome of the restoration/implant complex. The tooth was atraumatically extracted, and a 5.0-mm-diameter Swiss Precision Implant (SPI), Element type implant was placed (Thommen Medical, Cleveland, OH, USA), utilizing a surgical guide. A healing cap was placed and the soft tissue allowed to mature for 6 weeks. During the healing period, the patient wore a provisional removable partial denture.

At the 6-week healing period, the final impression was made at the implant level. Following the final impression at the implant level, an EASY abutment (Thommen Medical) was placed to facilitate the fabrication of the provisional for further soft tissue contouring (Figure 2). A PMMA provisional component made for the EASY abutment (Thommen Medical) was utilized as the substructure to maintain marginal integrity and adaptation to the abutment. A thermoplastic matrix made from the patient's diagnostic casts preextraction was utilized to form the provisional restoration utilizing a PMMA material (Figures 3–7). The

Figure 2. Healing at 6 weeks, and the EASY abutment in place to retain provisional restoration.

Figure 3. Thermoplastic matrix made from the diagnostic cast before the tooth was extracted.

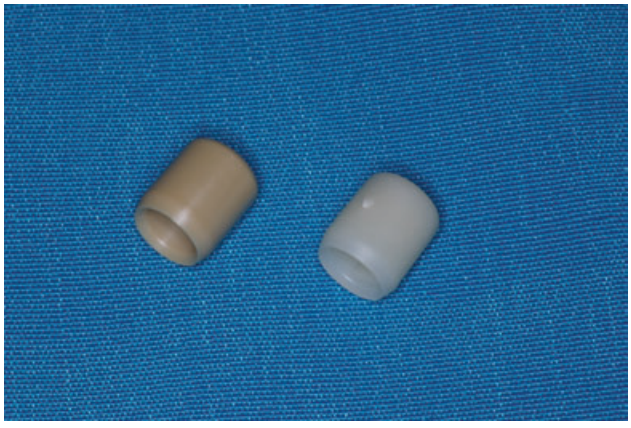

Figure 4. Provisional components made from PEEK plastic (tan), primarily for use in the posterior area, and PMMA (white) for the fabrication of custom acrylic resin provisionals.

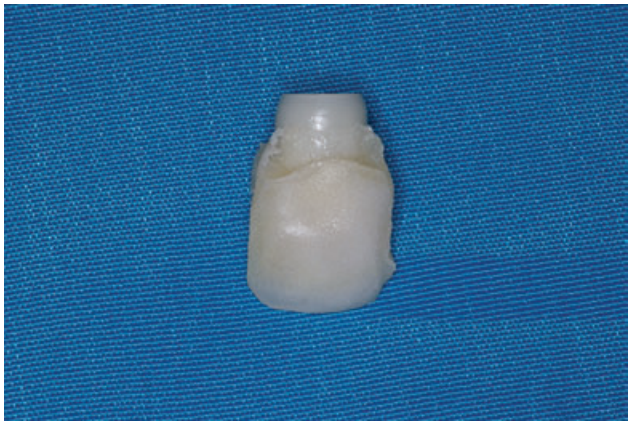

Figure 5. Initial appearance of the provisional following removal from the mouth.

optimal emergence profile was achieved by the further addition of PMMA following the removal of the provisional from the patient's mouth, smoothed, polished, and cemented with a provisional cement (Figure 8).

The laboratory analog was attached to the impression coping and the master cast poured in high-strength, low-expansion die stone. It was determined, utilizing the thermoplastic matrix on the master cast, that the zirconia ART EASY abutment (Thommen Medical) would require some modification/reduction to obtain optimal room for the final all-ceramic cemented restoration.

Marking the ART abutment on the master cast, the areas of reduction were identified and very carefully reduced using abrasive rotary instruments in the laboratory, with very light pressure and copious amounts of irrigation so as to not build up heat and create microfractures in the ceramic material (Figures 9–12). Also, very close

Figure 6. Optimal emergence profile of the provisional restoration developed by the addition of PMMA, finishing, and polishing before cementation.

Figure 7. Lateral view of the completed provisional restoration.

Figure 8. Appearance of the provisional restoration at cementation.

Figure 9. ART ceramic abutment marked for modification to place the restoration margin slightly below the patient's marginal gingival.

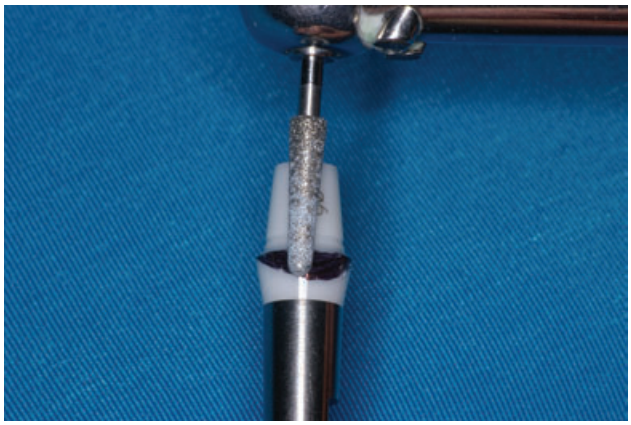

Figure 10. Reduction of the ART abutment with abrasive rotary instruments in the laboratory.

Figure 11. Facial view of the finished preparation of the ART abutment.

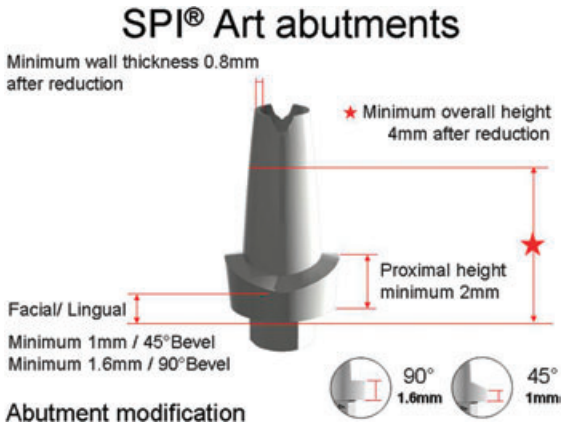

Figure 12. Diagram of the minimum reduction specifications for the ART abutment.

Figure 13. Completed all-ceramic crown.

attention was given to the manufacturer's directions on minimal wall thickness to ensure optimal abutment strength properties by not overpreparing the abutment.

The laboratory can now fabricate the definitive restoration of the chosen materials and return the final restoration and abutment to the prosthodontist/restorative doctor for delivery (Figures 13 and 14). The definitive zirconia abutment and all-ceramic restoration are tried in, adjusted if necessary, and repolished. The author places a small amount of PVS material in the abutment access following tightening to the recommended torque before cementation to allow future access to the retaining screw if necessary. The restoration can then be cemented with the practitioner's cement of choice (Figures 15–17). Note the better periodontal health around the ceramic abutment and restoration compared with the other areas of the patient's mouth. Even though the patient's oral hygiene was less than optimal, there was less bleeding, plaque, and inflammation around the restoration than his natural teeth. This

Figure 14. Delivery of the ART abutment, with the appropriate torque applied to the retaining screw (25 Ncm).

Figure 15. Delivery of the abutment and restoration.

Figure 16. Patient's smile following the delivery of the restoration and minor reshaping on the natural central incisal edge to improve esthetic contours.

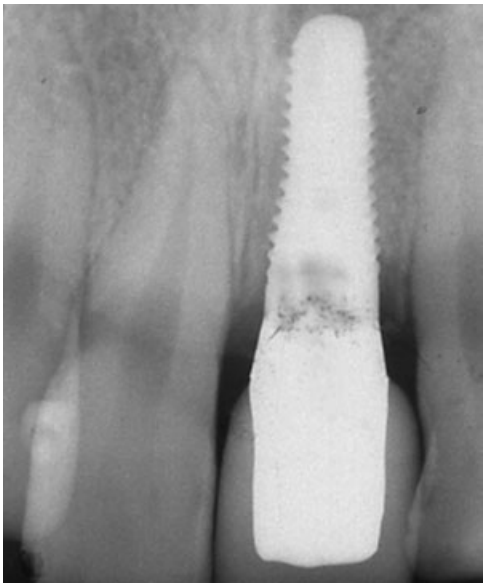

Figure 17. Radiograph of the completed restoration.

clinical observation has been made by other authors without definitive explanation.[9]

CONCLUSION

More predictable esthetics and stable periodontal health are now achievable with newer techniques and materials utilized in traditional and implant dentistry. The response of the soft tissue to a particular dental material is an important factor in selecting the material to be used for fabrication of a prosthesis. Microorganisms that tend to adhere to dental materials can impact the soft tissue response to that material. It appears that some of the all-ceramic materials may have a tendency to collect fewer microorganisms than

some of the traditionally utilized materials.[8]

As we treat more and younger patients with dental implants, as a profession, we must ensure that the restorations will have long life and cause minimal problems when replacement is required. The ultimate clinical longevity of single-tooth implants is thought to be many years; however, the clinical life span of some of the newer restorative materials, especially when utilized with dental implants, has yet to be definitively determined. The current results are promising for helping our patients participate in the decision of materials utilized in the delivery of their dental care with great confidence.

The use of dental implants and zirconia restorative components is becoming more commonplace and predictable with increased research, and numbers of patients successfully treated with this type of restoration may become routine in today's practice.

DISCLOSURE AND ACKNOWLEDGMENTS

Dr. Schneider occasionally lectures for Thommen Medical, for which he receives honoraria.

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