

Tooth Replacement in the Esthetic Zone

Synergy and Success for Accreditation Case Type III

Mohan Bhuvaneshwaran, MDS, AAACD

Key Words: implant esthetics, soft tissue grafting, anterior implant restoration, abutment solutions, subgingival contouring, Accreditation Case Type III



Figure 1: Preoperative; full-face smile view.

Introduction

The field of cosmetic dentistry has gained new dimensions from numerous advances in the fields of materials science and soft tissue techniques. Undetectable replacement of a missing anterior tooth has become more predictable; however, such procedures remain a challenge in day-to-day dental practice.

One of the clinical options for the replacement of a missing tooth involves the use of a dental implant. With the expanded knowledge we have gained about bone and soft tissue reactions to tooth extraction and implant placement, we can now fabricate implant-retained restorations with an outcome that is beautiful and natural in appearance. A successful outcome depends upon a number of factors, including implant position, gingival biotype, restoration emergence, and communication with the ceramist and specialists.

// A successful outcome depends upon a number of factors, including implant position, gingival biotype, restoration emergence, and communication with the ceramist and specialists. //



Figure 2: Preoperative frontal 1:2 view, showing the unesthetic acrylic bridge.



Figure 3: Preoperative 1:1 view, clearly showing that the acrylic bridge has impinged on the gingival tissues, resulting in an unhealthy site in relation to #8 and #9.

Patient History

A 20-year-old female was referred to us by her general dentist due to a missing upper anterior tooth. Her history revealed trauma to her maxillary central incisors 10 years earlier during a school sporting event. Both #8 and #9 had been treated with a light-cured composite to restore the significant fractures, after endodontic treatment. Five years later, because there were frequent failures with composite, temporary acrylic crowns were placed. Subsequently, the patient experienced moderate discomfort in this area. Tooth #8 was deemed non-restorable and was extracted, while #9 was retreated endodontically. An acrylic cantilever bridge was then placed by her general dentist.

She was in excellent health, with an unremarkable medical history and good preventive dental care. Her oral hygiene was good and the soft tissue was in good shape. Clinical and radiographic examinations were within normal limits and there were no temporomandibular joint (TMJ) abnormalities. For many years, the patient had been unhappy about her appearance; her dream was to have a beautiful smile (Fig 1).

Diagnosis and Treatment Planning

A thorough clinical examination including study models, photographs, and radiographs was completed. For precise implant planning, a CT scan was also done to evaluate the bone morphology of the edentulous area. The examination revealed a poor acrylic temporary cantilever bridge replacing tooth #8 (Fig 2). The bridge was totally out of contour, impinging on the tissues, and was highly unesthetic. The soft tissue surrounding the bridge was highly inflamed (Fig 3). There was an obvious extraction site defect in the region of #8 and radiographic examination revealed that the endodontic treatment of #9 was without any periapical pathology (Fig 4). The patient's other teeth were all in good condition.

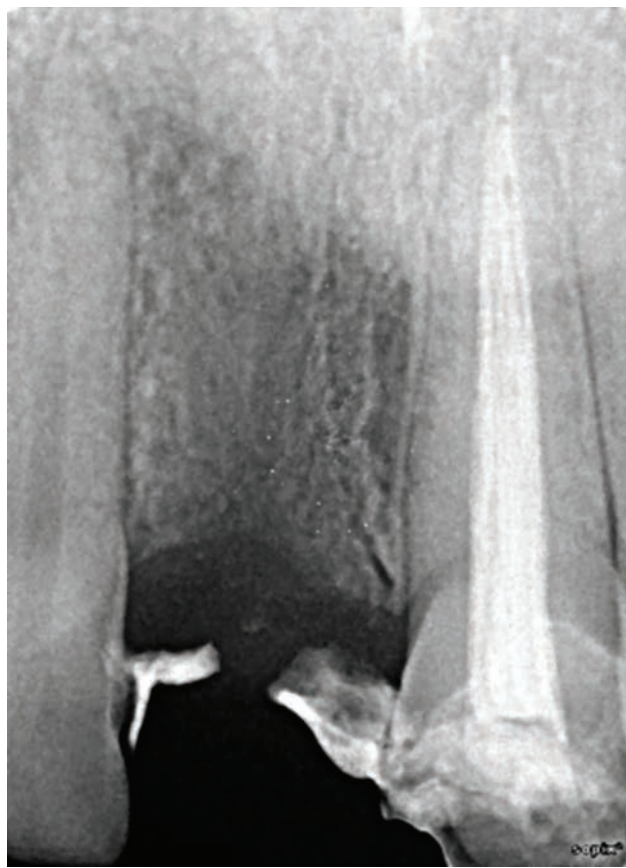


Figure 4: Preoperative radiograph shows the extracted site and the satisfactory endodontic treatment in #9.

Treatment options for this patient included a traditional fixed bridge or an implant crown for replacement of #8. Considering the age and overall status of the patient, it was decided to place an implant. Implants are a conservative treatment modality for a missing anterior tooth and the level of esthetics achieved can be exceptionally good.¹

Biological Considerations

Clinical and radiographic examinations and a scan report revealed acceptable bone quality for implant placement. The site required only soft tissue augmentation (Fig 5). It was also noted that there was loss of keratinized attached gingiva in the region of #8.

Esthetic Considerations

The challenge was to achieve a symmetrical smile with reference to hard and soft tissues. All-ceramic crowns would be sufficient, but the main issue was to mirror #8 with #9 both anatomically and at the gingival interface. This required careful implant placement, provisionalization, abutment selection, customizing of the abutment, and final crown placement.

Functional Considerations

The patient did not have any occlusal discrepancy or TMJ problems. Hence, a carefully designed restoration in harmony with the existing dentition was enough to address functional considerations. A good diagnostic wax-up was done on a semi-adjustable articulator, and a provisional template and surgical stent were fabricated. The same wax-up also served as a guide for the permanent restorations.

After correlating the data, a precise treatment plan was formulated with the help of additional key team members, including the oral surgeon, periodontist, and ceramist. The esthetic importance of achieving a correct emergence profile was discussed with the surgeon and the periodontist. The surgeon's plan ensured that the implant was placed correctly, bearing in mind the incisal edge position of the final restoration and the bone morphology.² Correct placement and angulation of the implant are important in achieving good soft tissue architecture.³ The grafting procedure was planned after the implant placement to take into consideration the final soft tissue morphology after wound contraction.⁴ The tissue was harvested from the palatal mucosa instead of using Alloderm, since the former generally yields predictable results.⁵ Considering the esthetic requirements of the case, the technician preferred a glass ceramic instead of oxide ceramic. Glass ceramic can provide a better esthetic outcome.⁶



Figure 5: Note defect and loss of attached keratinized tissue.

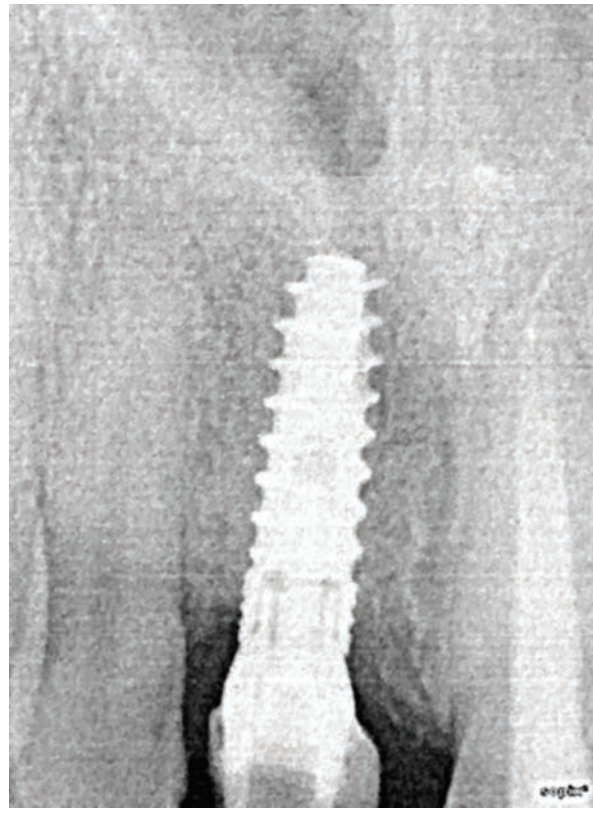


Figure 6: Radiograph three months after implant placement.

The treatment time required to achieve an excellent result was discussed, as soft tissue management can require significant time.^{7,8}

Treatment Plan Sequence

The treatment plan sequence was as follows:

1. placement of temporary crown in #9
2. placement of a two-stage implant for #8
3. placement of temporary abutment and provisional crown for #8
4. connective tissue grafting for soft tissue augmentation in the region of #8
5. provisionalization of #8 and #9
6. functional and esthetic evaluation of provisionals
7. fabrication of customized abutments and permanent crowns using lithium disilicate glass ceramic (IPS e.max, Ivoclar Vivadent; Amherst, NY)
8. observation and follow up.

Description of Treatment

Surgical Procedure

The temporary acrylic bridge was removed, a new temporary crown was placed in #9, and the tissue was allowed to heal in the region of #8. Our surgical treatment was simple, predictable, and respected the biology of hard and soft tissues. The surgeon's goal was to create an ideal prosthodontic environment,⁹ allowing the dental technician to create an implant restoration with ideal soft tissue support and long-term stability. The surgeon used the template from the diagnostic wax-up as a surgical stent for the placement of a 3.7 mm x 14 mm implant (Hexacone, IHDE Dental; Uetliberg, Switzerland). After achieving complete local anesthesia, the implant was placed, an esthetic healing cap was placed, and the soft tissue was sutured. The surgical guide helped the surgeon to determine the angulation of the implant.¹⁰ Instructions for home care were given and the patient was discharged after postoperative radiographs were taken. The primary stability of the implant was satisfactory and the radiograph revealed correct placement.

Tissue Grafting

The patient was recalled one week later for suture removal and the healing was found to be acceptable. A temporary partial denture was fabricated without impinging on the soft tissue and the patient was examined monthly for three months.

Clinical and radiographic examinations during the follow-up appointments verified satisfactory healing. After three months, laser gingivectomy was done to

expose the implant, and a temporary abutment and provisional were placed for #8 (Fig 6). After two weeks, soft tissue grafting was completed using the connective tissue from the palate, which served as the donor site (Figs 7 & 8). Vicryl 5-0 suture (Ethicon; Blue Ash, OH) was placed to secure the graft in position. Care was taken to maximize soft tissue thickness around the implant (Fig 9); this allowed ideal gingival contour, to achieve the required emergence profile.¹¹

Ten days later, sutures were removed and the bone levels of the teeth adjacent to the implant were evaluated (Fig 10). The bony crest was sounded using a periodontal probe to ensure that the proximal contacts of the provisional were within 4 to 5 mm of the interdental bone of the adjacent natural tooth (this will minimize the occurrence of black triangles). The provisional crown of #8 was removed and reshaped using flowable composite in order to train the peri-implant soft tissue for a proper emergence profile. The gingival third of the crown was well polished to avoid any irritation to the soft tissue. In subsequent appointments, small amounts of composite were added in the gingival third to establish the required emergence profile (Figs 11a & 11b). This tissue training was repeated every two weeks to achieve the desired contours.^{12,13} During the entire procedure of soft tissue grafting, it was always kept in mind to match #8 and #9 with regard to the symmetry of hard and soft tissues. Once the ideal contours were developed with provisional crowns, the tissue was allowed to mature for six weeks. During the healing phase, the soft tissue responded very well to treatment and a good keratinized mucosa formed in the region of #8 (Fig 12).

// Implants are a conservative treatment modality for a missing anterior tooth and the level of esthetics achieved can be exceptionally good. //

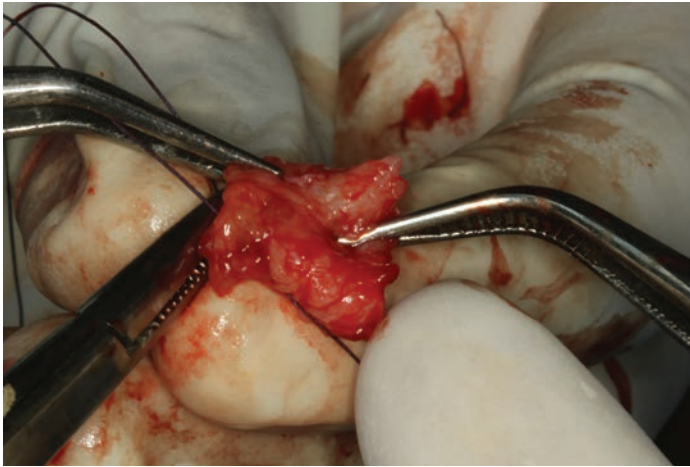


Figure 7: The connective tissue graft was taken from the palatal region.

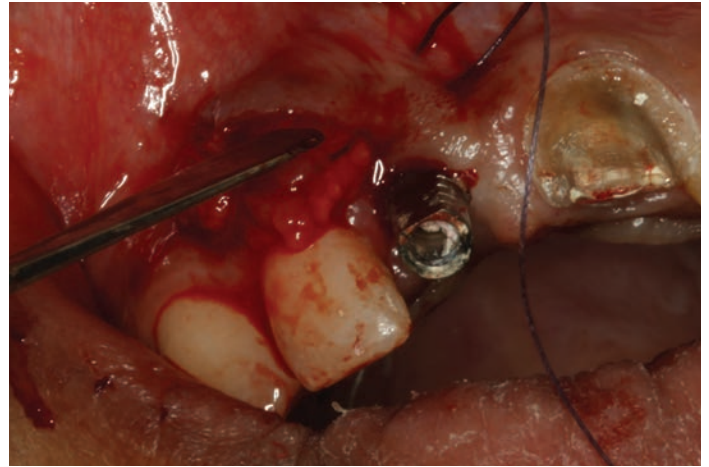


Figure 8: The connective tissue graft was tucked into an envelope, to preserve the papilla and any related wound contraction.



Figure 9: Note the significant bulk of soft tissue that was gained after the initial grafting procedure.



Figure 10: The postoperative period was uneventful. This image shows the maturation of the tissues.



Figure 11a: Labial view of the provisional was contoured to obtain the emergence profile.



Figure 11b: Mesial view of the provisional.



Figure 12: An ideal soft tissue profile was obtained. Note the soft tissue bulk and the healthy site for prosthetic rehabilitation.



Figure 13: Custom abutment during the try-in stage.

Prosthetic Management and Crown Fabrication

After complete evaluation and discussion with the technician, it was decided that the NiTi abutment would be milled and used as a base for the final abutment. Lithium disilicate glass (IPS e.max) was selected to customize the abutment to the tissue contours using computer-aided design/computer-aided manufacturing (CAD/CAM) technology, making it easy to replicate the tissue contours that were achieved.¹⁴ The provisionals were removed, the temporary abutment of #8 was replaced with the custom titanium abutment, and #9 was carefully prepared for an all-ceramic crown. An open tray impression was made using an addition silicone impression material (Virtual, Ivoclar Vivadent). The opposing arch impression and bite registration were made. An impression of the gingival third of the provisional of #8 was also sent to the laboratory to transfer the exact replica of the soft tissue contour that was achieved. The abutment was

milled to achieve the required contour and then customized using lithium disilicate (IPS e. max), which was cemented onto the titanium abutment using Mutilink Hybrid Abutment (Ivoclar Vivadent) (Fig 13).

The crowns for both #8 and #9 were fabricated using IPS e.max pressable glass ceramic, replicating the diagnostic wax-up in the permanent restorations. The laboratory sent the custom abutment and crowns in the pre-glaze stage for clinical evaluation. The custom abutment was placed and required no further adjustment, as the expected soft tissue contour was achieved. The crowns were placed using the try-in cement and evaluated esthetically and functionally. The shade match to the natural dentition was excellent, as were all contours and contacts. Radiographs were used for seating verification. When the patient and all the team members were happy with the results, the crowns were returned to the laboratory for final finishing.

Delivery

On delivery day, the provisionals were removed, the implant was rinsed with chlorhexidine gluconate (0.2%), and the custom abutment was torqued into place (20 Ncm). Radiographs were taken to verify seating of the abutment. The screw access hole of abutment was then sealed and the abutment and tooth were cleaned thoroughly before cementing the crowns with Mutilink Speed (Ivoclar Vivadent). The crowns were held firmly in place and light-curing (Bluephase G2, Ivoclar Vivadent) was done using a quarter-cure technique. This facilitated the easy removal of the cement. The restorations were then carefully examined under magnification and radiographed to ensure there was no excess cement. Finally, the occlusion of crowns was verified and was found to be in proper alignment with rest of the dentition. The patient was examined after one week, at which time the restorations had completely blended with the existing dentition (Figs 14 & 15). Postoperative photographs and radiographs were taken during this visit (Fig 16). The emergence profile proved to be in the zone of excellence (Fig 17).

Summary

Replacement of missing teeth in the esthetic zone with an implant-supported restoration provides patients with a conservative treatment modality. In this case, an interdisciplinary approach to treatment was the key to success. Needless to say, an excellent treatment plan is essential for a predictable outcome. Improving the perio-prosthetic interface with connective tissue grafting is one of the most efficient surgical treatments for obtaining long-term stability, as seen in this type of esthetic case.

This case was managed via a multidisciplinary team effort that proved to be successful for the patient and all who were clinically involved (Fig 18).¹⁵ The patient was extremely satisfied with the treatment outcome (Figs 18-20).



Figure 14: Note the blending of the ceramics with the existing dentition.



Figure 15: The ideal soft tissue contour and the beautiful restorations that were achieved through a multidisciplinary team effort.

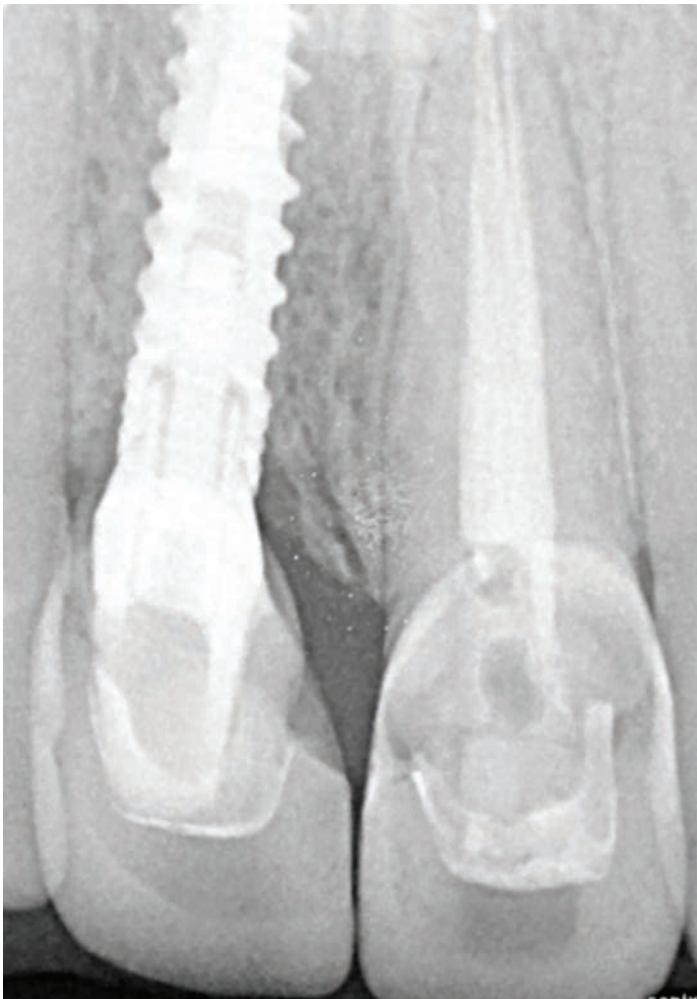


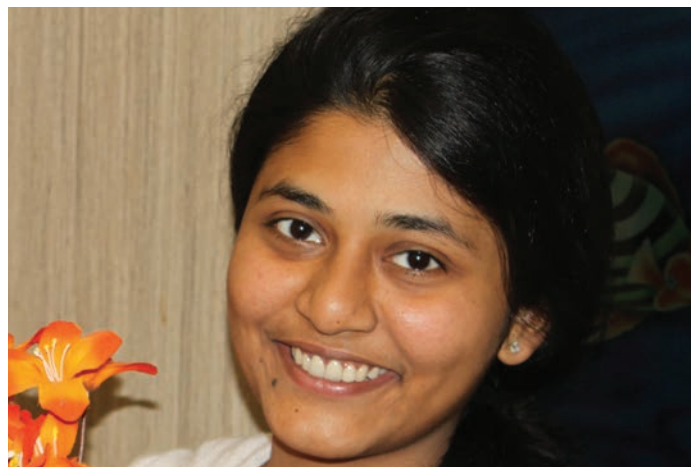
Figure 16: Postoperative radiograph showing perfect fit of the restorations with no excess cement.



Figure 17: The right lateral view showing good emergence profile.



Figure 18: Postoperative full smile.



Figures 19 & 20: The happy patient.

Acknowledgments

The author thanks his team members: oral and maxillofacial surgeon P. Suresh Kumar, periodontist P.M. Archana, and N. Dhanasekar, CDT, all of Tamil Nadu, India, for their tireless efforts leading to the success of this case. The author also extends his gratitude to his mentor, Rebecca Pitts, DMD, FAACD, for her continuous support and encouragement to pursue Accreditation.

References

1. Fradeani M. Esthetic rehabilitation in fixed prosthodontics. Vol. 1: esthetic analysis—a systematic approach to prosthetic treatment. Hanover Park (IL): Quintessence Pub.; 2004.
2. Kojs JC. Predictable single-tooth peri implant esthetics, five diagnostic keys. *Compend Contin Educ Dent*. 2004 Nov;25(11):895-6, 898.
3. Spear FM. Maintenance of the interdental papilla following anterior tooth removal. *Pract Periodontics Aesthet Dent*. 1999 Jan-Feb;11(1):21-8.
4. Sclar A. Soft tissue and esthetic considerations in implant therapy. Hanover Park (IL): Quintessence Pub.; 2003. p. 243-61.
5. Wie PC, Laurell L, Eivelis G, Lingen, Maddalozzo D. Acellular dermal matrix allografts to achieve increased attached gingiva. Part 1. A clinical study. *J Periodontol*. 2000 Aug;71(8):1297-305.
6. Shenoy A, Shenoy N. Dental ceramics: an update. *J Conserv Dent*. 2010 Oct;13(4):195-203.
7. Fagan MC, Owens H, Smaha J, Kao RT. Simultaneous hard and soft tissue augmentation for implants in the esthetic zone: report of 37 consecutive cases. *J Periodontol*. 2008 Sep;79(9):1782-8.
8. Chen ST, Wilson TG, Hammerle CF. Immediate or early placement of implants following tooth extraction: review of biologic basis, clinical procedures, and outcomes. *Int J Oral Maxillofac Implants*. 2004;19 Suppl:12-25.
9. Chiche GJ, Pinault A. Esthetics of anterior fixed prosthodontics. Hanover Park (IL): Quintessence Pub.; 1996.
10. Buser D, Martin W, Belser UC. Optimizing esthetics for implant restorations in the anterior maxilla: anatomic and surgical considerations. *Int J Oral Maxillofac Implants*. 2004;19 Suppl:43-61.
11. Funato A, Ishikawa T. 4D implant therapy: esthetic considerations for soft tissue management. Hanover Park (IL): Quintessence Pub.; 2011.
12. Murphy KG. 10 key steps in immediate implant placement: delivering a screw-retained provisional. *J Cosmetic Dent*. 2012 Summer;28(2):74-82.
13. Nealon FH. Acrylic restorations by operative nonpressure procedure. *J Prosthet Dent*. 1952 Jul;2(4):513-27.
14. Culp L, McLaren EA. Lithium disilicate: the restorative material of multiple options. *Compend Contin Educ Dent*. 2010 Nov-Dec;31(9):716-25.
15. Spear FM, Mathews DP, Kokichi VG. Interdisciplinary management of single-tooth implants. *Semin Ortho*. 1997 Mar;3(1):45-72. **JCD**



Dr. Bhuvanewaran is associate dean, professor, and head of the Department of Conservative Dentistry, SRM Kattankulathur Dental College, Chennai, Tamil Nadu, India. He also is an instructor at the Center for Advanced Dental Education and Training in Tamil Nadu, where he maintains a practice specializing in restorative dentistry.

Disclosure: The author did not report any disclosures.

Examiners' Commentary

Synergy and Success

Clinical Case Type III: Tooth Replacement (Implant)

James H. Peyton, DDS, FAACD

// Careful attention to the gingival profile and soft tissue contours are of the utmost importance. //

The examiners' main comments were as follows:

- Criterion #53: *Is the color (hue, value, chroma) selection appropriate/natural, not monochromatic?* The restored teeth #8 and #9 were lower in value.
- Criteria #64/#84/#87: These criteria are related to a wide contact area. The incisal embrasure was underdeveloped and the distal line angle was underdeveloped.

Accreditation Case Type III can be very difficult to blend seamlessly with the surrounding dentition. Careful attention to the gingival profile and soft tissue contours is of the utmost importance. The restoration needs to be made to mimic the adjacent teeth. This all calls for a tremendous team effort! The cosmetic dentist must properly treatment plan the case in conjunction with the implant surgeon/periodontist, laboratory technician, and the patient. A result such as that obtained by Dr. Bhuvanewaran could have been achieved only by selecting a first-rate team.

There was a significant esthetic improvement in this case. The soft tissue was healthy and the extraction site was handled very well. However, even though all five examiners passed the case, it was not perfect. The examiners' comments were almost the same, and the scores they awarded were identical.

It is important to note that sometimes a fault can be categorized as belonging to several different criteria. However, in each instance here, the examiners did not "double dip" and just deducted for one fault that related to the similar issue. Overall, Dr. Bhuvanewaran obtained an excellent result and his case was deemed worthy of Accreditation. **JCD**

Dr. Peyton is an AACD Accredited Fellow and has been an AACD Accreditation Examiner since 2000. A part-time instructor at the UCLA School of Dentistry, he practices in Bakersfield, California.

Disclosure: The author did not report any disclosures.

