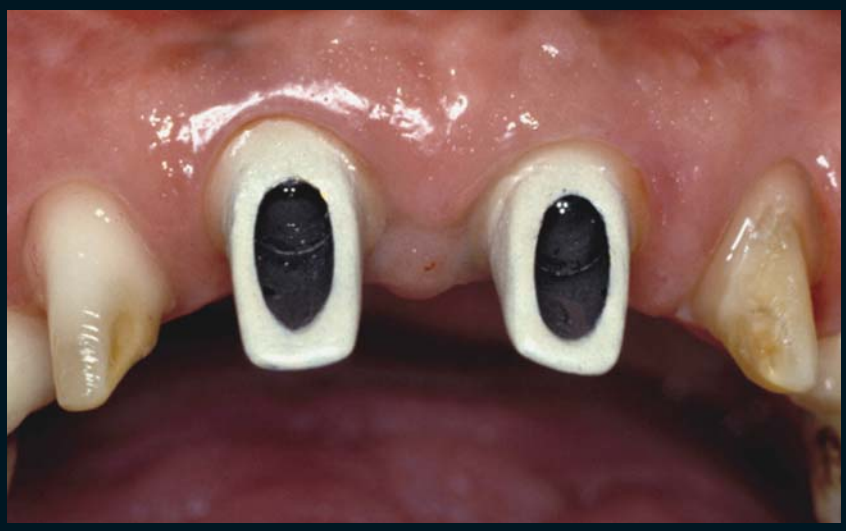
CONTEMPORARY IMPLANT CONCEPTS IN AESTHETIC DENTISTRY — PART 3: ADJACENT IMMEDIATE IMPLANTS IN THE AESTHETIC ZONE

Tidu Mankoo, BDS*



This series of articles has discussed contemporary concepts in the treatment planning of dental implants in edentulous ridges and immediate single-tooth implants in the aesthetic zone. This presentation broadens the discussion to include the wider application of immediate implants, highlighting the surgical and restorative considerations affecting their immediate placement and provisionalization. It highlights the application of immediate implants in both single- and multiple-unit applications and provides detailed demonstrations of the involved implant and restorative components required by such procedures.

Learning Objectives:

This article discusses immediate placement of adjacent implants to restore multiple teeth. Upon reading this article, the reader should:

- Understand the role of immediate implant placement and loading for multiple-unit restorations.
- Be aware of the protocol associated with immediate implant placement in adjacent regions for optimal tissue maintenance.

Key Words: implant, immediate, provisionalization

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The primary utilization of immediate implants and immediate loading or provisionalization techniques has been in immediate single-tooth replacement and immediate loading of implants placed in edentulous full arches — particularly in the mandible.[1-4] Little data and few guidelines are available when dealing with adjacent immediate implants in partially edentulous cases or in multiple immediate implants, particularly concerning the aesthetic implications in relation to the gingival tissues. Clinicians are interested in establishing whether the advantages observed in single-tooth applications are also feasible for adjacent implants, and there remains a desire to better understand the limitations of the technique. Consequently, this presentation will highlight the application of immediate implant techniques for adjacent multiple teeth in the anterior maxilla.

The appeal of the immediate implant concept is the placement of implants at the time of tooth removal in a flapless approach, thereby avoiding extensive surgical intervention and complicated augmentation techniques required to rebuild resorbed or previously edentulous ridges. A key aesthetic concern is to maintain the gingival architecture and gingival harmony, especially the interdental papillae.[5] In the author's clinical experience with immediate adjacent implant placement, the interimplant bone and soft tissue architecture are maintained more effectively than in adjacent implant treatment into healed edentulous ridges. The aspects of the interimplant distance has been suggested as critical for maintaining sufficient space for the horizontal component of the biologic width.[6] Thus, it may be desirable to place narrower implants than would first seem obvious in order to achieve a 3-mm distance.

The relationship between the interproximal bone peak and interdental papilla may not be merely a one-way relationship.[7,8] The gingiva not only depends on the bone, but the bone may also be influenced by the gingiva. Perhaps the network of collagen fibers around the tooth serve a role in maintaining bone height.[9] This idea arises from the clinical evidence seen in the author's practice, whereby two- to three-year radiographic and clinical records demonstrate markedly different results

Figure 1. Case 1. Preoperative appearance demonstrates failed restorations. Scarring was also evident from previous endodontic surgery. Gingival recession was apparent in the anterior region, and a flattened midline papilla resulted from inadequate tooth support.

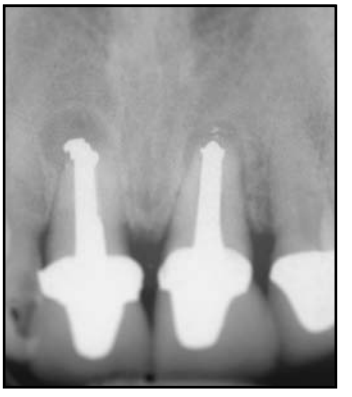

Figure 2. Preoperative radiograph exhibits well-defined periapical lesions and abundant bone apical to and surrounding the roots.

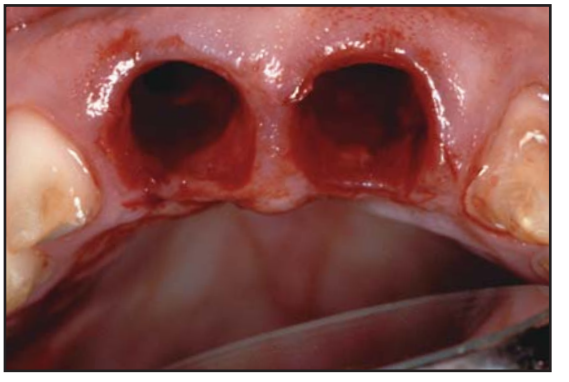

Figure 3. Tooth extraction was performed with minimal trauma to the surrounding gingival tissues.

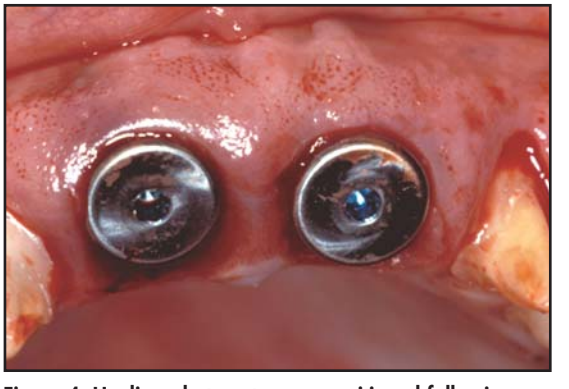

Figure 4. Healing abutments were positioned following immediate implant placement. Note that while the abutments filled the sockets, they were slightly narrower than the sockets themselves.

than those of implants placed conventionally into healed edentulous ridges. Perhaps the vertical alveologingival and interpapillary fibers help to maintain the bone peaks when immediate support is provided to the interdental tissue around immediate implants by either healing abutments or provisional restorations. Thus, the support to the gingival tissues provided by an immediate implant and healing abutment or provisional restoration may help to maintain the interproximal bone and papilla height. While additional study is needed to further qualify this, clinical results to date are encouraging.

From an aesthetic perspective, the principle objective of the immediate implant technique is to maintain the soft tissue architecture of the original teeth. Maintenance of the interdental soft tissue architecture and papillae appears to be enhanced with an immediate approach (as compared to a conventional delayed approach), where fixed partial dentures (FPDs) are used to maintain the sufficient interimplant distance and a more natural soft tissue response. For multiple implants, this presents a challenge. With multiple immediate implant placement using a one-stage flapless approach, however, the papillae are found to be demonstrably more stable. This, again, may be attributed to the support of the interdental tissue by the healing abutment or provisional restoration.

Recent implant designs (eg, NobelPerfect, Nobel Biocare, Yorba Linda, CA) may enhance the achievement of the peri-implant tissue complex. The biologic width around implants is 1.5 mm to 2 mm when sulcus depth is not included.[10,11] Bearing in mind that biologic width studies typically obtain measurements at the midbuccal point in posterior edentulous ridges where there is minimal gingival scallop, one has to take into account that in the anterior region, the interproximal or interimplant gingival scallop implies an increase of sulcus depth and junctional epithelium attachment. In essence, the scalloped implant-abutment interface may improve (ie, reduce) sulcus depth in the interproximal areas and increase proximal bone height, improving the maintenance of bone and soft tissue architecture.[12] This requires clinical study and confirmation but appear to be consistent with this author's experiences.

Figure 5. The provisional FPDs were modified chairside and adapted to fit the healing abutments.

Figure 6. Aesthetic healing and tissue maintenance were evident 1 week postoperatively.

Figure 7. Since this case was treated prior to the availability of ceramic abutments, metal-ceramic abutments with porcelain shoulder margins were utilized.

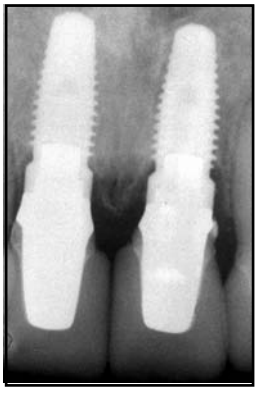

Figure 8. Radiograph of maxillary central incisor implants 1 month after case was completed.

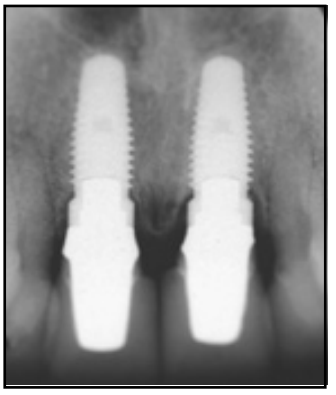

Figure 9. Postoperative radiograph following 3 years of function demonstrates the creation of biologic width from the implant abutment connection. The interproximal bone peak was completely maintained and stable.

Figure 10. Postoperative appearance 3 years following treatment demonstrates slight recession on the maxillary right central incisor and proper maintenance of gingival architecture and interdental papillae.

Case Presentations

Case 1

A 51-year-old female patient presented for aesthetic restoration that would be accomplished via a combination of crowns, veneers, and dental implants. The maxillary central incisors had a poor prognosis after previous endodontic treatments (Figures 1 and 2). The maxillary central incisor tooth form was excessively triangular and short, and loss of the midline papilla height was noted. Since closure of the "black triangle" would have made the teeth too wide and square, a longer and more slender tooth form was planned. This would be achieved predominantly by increasing the length of the teeth and the occlusovertical dimension. By adjusting the transgingival contours of the implant abutments and the emergence profile of the definitive crowns, the central incisors could also be lengthened gingivally.

The maxillary central incisors were extracted (Figure 3), and two tapered implants (Replace Select, Nobel Biocare, Yorba Linda, CA; Frialit-2, Dentsply Friadent, CO) were immediately placed in the extraction sockets.[13,14] The implants were placed 3 mm from the gingival margins with approximately 1.5 mm of space between the fixture heads and labial bone crests, allowing for the horizontal component of the biologic width. Healing abutments were placed to support the tissues and to essentially fill the sockets openings (Figure 4).

The maxillary anterior teeth had already been prepared from canine to canine and provisionalized in six splinted provisional crowns. The splint was then converted to a provisional FPD with hollow pontics that were modified and relined to fit onto the healing abutments. Its margins were refined with flowable composite resin (eg, Tetric Flow, Ivoclar Vivadent, Amherst, NY; Kerr Revolution, Kerr Dental, Orange, CA) to support the interproximal gingival tissues. After finishing and polishing, the provisional FPD was recemented into place (Figure 5).

Figure 11. Case 2. Preoperative view demonstrates advanced periodontal breakdown. Note the diastema between the central incisors. While deep pocketing was evident, gingival levels weremaintained.

After one week, rapid healing with minimal swelling or pain had occurred, and excellent maintenance of the soft tissue architecture was achieved (Figure 6). The tooth form was judged to be too squared and the central too short gingivally.

Four months postsurgery, the teeth were restored with custom metal-ceramic abutments. The abutments were tried in to ensure correct tissue support and positioning of the margins, and they were torqued to recommended levels (Figure 7). All-ceramic crowns (eg, Procera, Nobel Biocare, Yorba Linda, CA; IPS Empress, Ivoclar Vivadent, Amherst, NY) were delivered for the maxillary anterior teeth and cemented with glass-ionomer cement (Fuji 1, GC America, Alsip, IL).

The maintenance of the gingival architecture was evident three years postoperatively (Figure 8). Special note was taken of the complete maintenance of the interproximal bone (Figures 9 and 10), even though remodelling of the adjacent bone to create the biologic width and "steady state" seen around the implants was

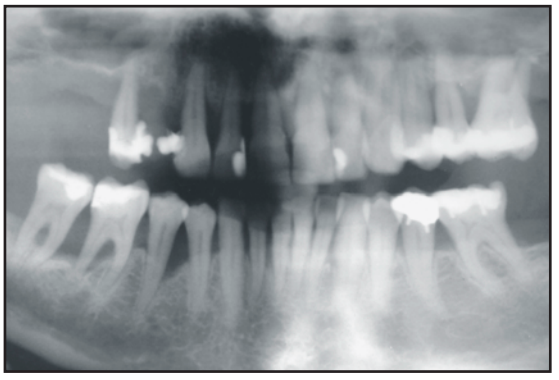

Figure 12. Preoperative radiograph exhibits the presence of extensive bone loss.

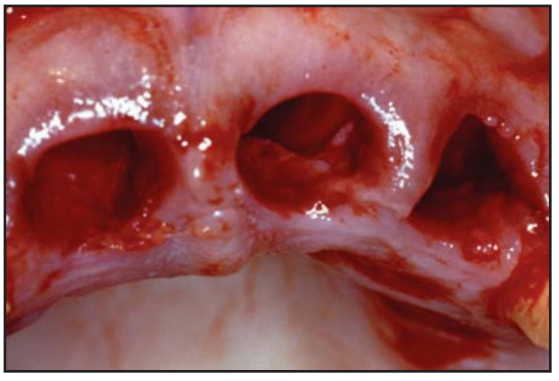

Figure 13. Clinical appearance of the maxillary extraction sockets prior to debridement and immediate implant placement in the anterior region.

visible. At that time, the bone level between the implants matched that on the mesial aspects of the lateral incisors. This result was significantly different from that typically seen in conventional delayed implant placement, where the bone peak tends to be relatively flat.

Case 2

A 40-year-old female patient who presented with advanced periodontal disease requested an aesthetic restoration of her mouth (Figure 11). The patient was a smoker and had previously received porcelain veneers for the maxillary anterior teeth. She had already suffered some tooth loss, and all of the remaining maxillary teeth were mobile and showed advanced bone loss (Figure 12). The maxillary posterior teeth were all hopeless, and the mandibular right posterior teeth were also severely affected. On examination, it was believed that the maxillary canines and right lateral incisor were treatable and could be maintained. The bone loss on the canines was felt to have component of occlusal trauma. In the mandible, the right second premolar and both molars were deemed hopeless, and the molars were immediately extracted along with the maxillary right second premolar and left first premolars.

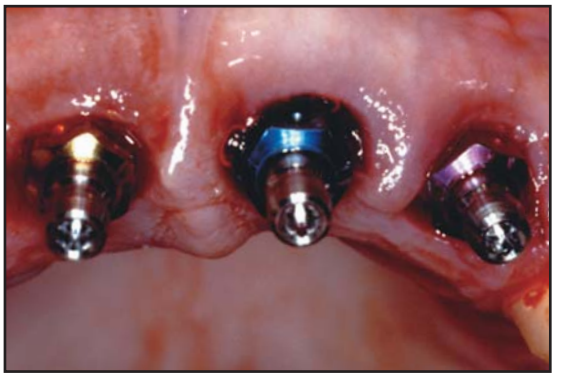

Figure 14. The implants were positioned to ensure placement 3 mm from the desired gingival margin. Potential recession was anticipated due to the existing bone levels.

The Interdental Papillae

The primary aesthetic complication was the tissue height in the maxillary anterior region, where deep pocketing, mobility, and bone loss indicated a poor prognosis. Stabilizing the disease, maintaining the teeth, and achieving good aesthetic outcome would be quite difficult; moreover, the teeth would likely be severely compromised even if these goals were achieved. Secondly, the difficulties surrounding extraction (ie, delayed implant placement in a conventional protocol) would inevitably cause the loss of the scalloping and tissue height through ridge resorption as well as the loss of any interdental papillae, thus rendering the ridge flat. The hope of achieving the scalloping necessary to maintain papilla height would thus be lost.

The immediate approach was selected for the anterior maxillary teeth in order to maintain the gingival form. Nevertheless, some recession of the labial gingivae was expected, as labial bone levels were approximately 5 mm from the gingival margins. The immediate implants would thus be placed at the level of the labial bone, deeper than normal. On a positive note, the labial gingivae would remodel to create a margin 3 mm coronal to the head of the implants.[6,15] The interdental papillae, however, would be maintained through immediate postextraction support provided by the one-stage immediate implant approach. This 3-mm level was a key treatment planning parameter in the anterior maxilla. Ideally, the immediate support provided to the papillae would help maintain and perhaps make

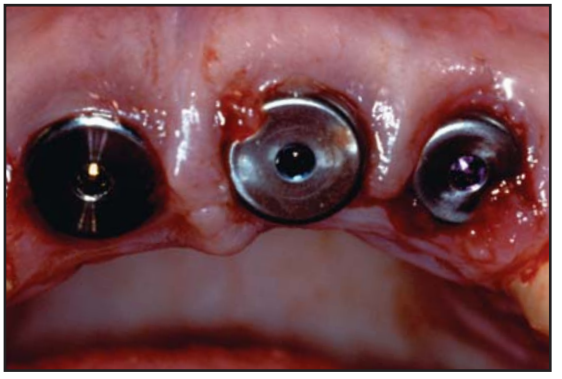

Figure 15. The healing abutments were positioned and a slight undercontour was developed to allow the pontics to be relined and create the definitive tissue support.

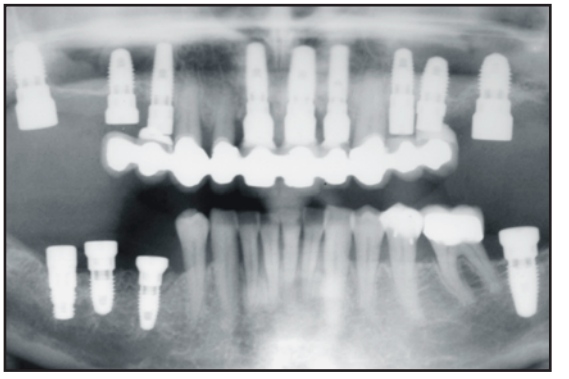

Figure 17. Radiographic appearance of the provisional restoration with hollow pontics relined onto the healing abutments. Tooth #7 was not yet treated.

Figure 16. Appearance of provisional restoration at suture removal 1 week following implant placement. Adequate tissue healing was evident without trauma.

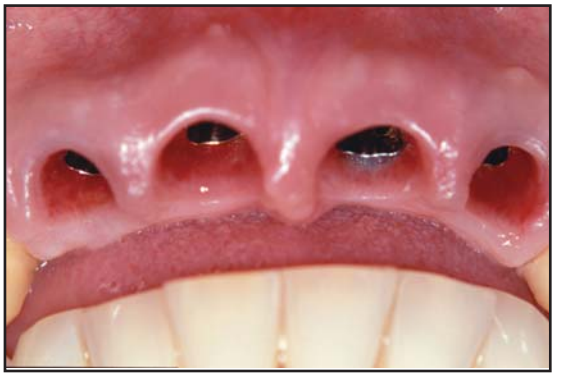

Figure 18. Clinical appearance of the gingival architecture and fixture heads prior to final abutment placement. Note the maintenance of aesthetic tissue scallop and interproximal papillae.

the gingival scalloping more pronounce, thereby allowing for a more aesthetic result.

Case Management

Three months after periodontal therapy, the maxillary canine teeth and right lateral incisor were prepared, and impressions were made for a laboratory-fabricated metal-acrylic provisional FPD to extend from second premolar to second premolar. Hollow pontics were designed for the central incisors, the left lateral incisor, and the premolars. The prosthesis would be retained by the canines and right lateral incisor and simply rest on the healing abutments. The metal framework was kept away from the gingival aspect of the pontic areas to allow for easy adjustment of these areas. An acrylic duplicate of the FPD was also fabricated to act as a surgical guide for implant placement.

Two weeks later, the teeth were extracted according to the immediate implant protocol (Figure 13). Implants were immediately placed into the sites of the central incisors, left lateral incisor, and left second premolar. Conventional implant placement was completed for the right first and second premolar and second molar. The distal dentition were treated with combined localized sinus lifts using osteotomes for the surgery. An immediate implant was placed in the left second premolar position, again with an osteotome technique to raise the sinus floor. No graft was placed at this time. The left molar was extracted, and this — and the first premolar site — were allowed to remodel for a few months prior to conventional implant placement.

The implants were placed slightly deeper than normal to allow for a 3-mm distance from the fixture heads to the final anticipated gingival margins (Figure 14), and healing abutments were connected (Figure 15). The prosthesis was adapted and relined to fit onto the healing abutments and provisionally cemented. In the author's experience, the use of microsurgical instruments and magnification (eg, ×4.8 loupes, Orascoptic, Kerr/Sybron, Orange, CA) for all procedures, along with 6-0 monofilament polypropylene sutures, helps to minimize surgi-

Figure 19. The definitive metal-ceramic abutments were fabricated with porcelain shoulder margins, fitted, and sealed with a provisional cement.

Figure 21. Postoperative appearance demonstrates maintenance of interdental architecture and enhanced aesthetics 3 years following treatment.

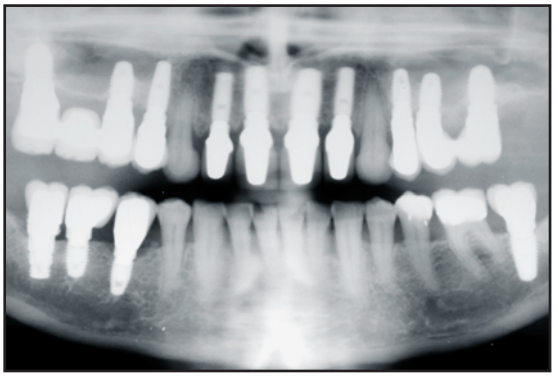

Figure 20. Postoperative radiograph exhibits healthy bone levels. The implants placed in the posterior maxilla demonstrate the success of the osteotome sinus lift procedure.

Figure 22. Postoperative retracted view demonstrates the development of gingival harmony and aesthetics.

cal trauma and improve postsurgical healing (Figure 16).

After three months, the right lateral incisor was also extracted and replaced with an implant. The canines had responded well to periodontal therapy and were stable; radiographs confirmed resolution of the angular bone defects. This was due in part to periodontal therapy, but also because of the eradication of the occlusal trauma. Additional implants were placed at the maxillary left first premolar and molar using combined conventional osteotome preparation and osteotome sinus floor elevation. In the mandible, implants were placed in the left second molar, right first, and second molar sites, and an immediate implant was placed on the extraction site of the right second premolar (Figure 17).

In the prosthetic phase, the mandible was completed to the desired vertical dimension. Silicone bite registration, healing abutment size, and impressions of the provisional prosthesis were all provided with a facebow registration and a waxup to the laboratory. These data allowed the technician to fabricate custom abutments and to mill prefabricated abutments according to the proper tooth positions. The anterior abutments were tried in and adjusted as necessary to produce the correct transgingival contours. The metal framework was tried in posteriorly, sectioned, and rejoined with pattern resin to ensure fit; pattern resin was again used to verify the occlusal registration.

Bisque bake try-in was then performed, final adjustments were made, and the restorations were completed (Figure 18). Once the abutments were torqued into place (Figure 19), all-ceramic crowns (Procera, Nobel Biocare, Yorba Linda, CA; IPS Empress, Ivoclar Vivadent, Amherst, NY) were cemented into place on the maxillary anterior implants and canines with a glass-ionomer cement (Fuji 1, GC America, Alsip, IL). Metal-ceramic crowns and FPDs were used in the posterior on milled prefabricated abutments or custom titanium abutments as appropriate.

At three-year follow-up, the maintenance of the interdental papillae and gingival architecture were evident (Figures 20 through 22). The papillae between the implants were at the same level as that of the papillae between the implants and natural canines. This is in stark

contrast to results achievable in conventional delayed implant therapy where the papillae between implants are always at a more apical level than between natural teeth or teeth and implants.

Discussion

Immediate Provisionalization

Hollow pontics can also be applied to more extensive cases. In such applications, the implants should be stable with adequate primary fixation. When teeth will be retained, they may be utilized as provisional FPD abutments either by means of crown retainers or adhesive-style retainers, which may allow for easier removal and recementation of the provisional bridgework than do Maryland-style wings. In either case, the hollow pontics can be adapted to fit onto the healing abutments in the technique described above. It is possible to complete provisional FPDs directly on the implants, significantly simplifying the clinical process and reducing time at the surgical visit. In addition, the need for extended laboratory time and further implant components is avoided. Using this hollow pontic technique permits vertical loading forces only on the implants and minimizes undesirable lateral forces during the early phase of osseointegration.

The protocol requires the clinician to keep the healing abutments just above tissue level so the hollow pontics simply rest on them. As previously described, the pontics are relined onto the abutments with a self-curing temporary cement, and then refined with flowable composite in order to produce the correct form and tissue support. The FPD is then luted to the abutment teeth and onto the healing abutment with provisional cement to maintain some inherent resilience, and may further cushion forces applied to the implants. Obviously, implant stability, bone quality, type, and stability of natural tooth abutments/retainers, the number and distribution of the implants and the occlusion are all key considerations that influence the suitability of cases for this protocol.

This approach can be used for single teeth with an adhesive bridge composed of metal acrylic/composite or fiber-reinforced acrylic/composite. Although the single tooth is perhaps not the best indication for this technique, it may be more useful for multiple implants, particularly where some of the adjacent teeth will be crowned and utilized as supportive abutments. Advantages of the technique include its relative simplicity, the ease of fabrication prior to implant placement, and the ease with which modifications and refinements can be performed chairside to create the necessary tissue support and tooth form using composite and/or flowable composite.

Conclusion

The achievement and maintenance of aesthetic gingival architecture around multiple adjacent implants remains a challenge, particularly for the interdental or interimplant papilla. Results witnessed by the author suggest that the immediate implant protocol for adjacent implants, combined with a one-stage technique, is effective in producing successful maintenance of gingival architecture and aesthetics — in particular the interimplant papilla.

Acknowledgment

The author mentions his gratitude to Eva Forst and Nikki Cox for their invaluable contributions in the laboratory and technical aspects of the cases presented.

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Continuing Education (CE) Exercise No. X

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 "Contemporary Implant Concepts in Aesthetic Dentistry — Part 3: Adjacent Immediate implants in the Aesthetic Zone," by Tidu Mankoo, BDS. This article is on Pages XXX-XXX.

1. Immediate implant placement has primarily been performed in:
a. Partially edentulous cases.
b. Multiple immediate implants.
c. Compromised gingival regions.
d. Immediate single-tooth replacement cases.

2. Immediate implant placement:
a. Can be performed at the time of tooth extraction.
b. Facilitates maintenance of the gingival architecture and harmony.
c. Is generally performed using a flapless approach that eliminates the need for extensive surgical intervention.
d. All of the above.

3. When the sulcus is not included, the biologic width around implants should be maintained at:
a. 1 mm to 1.5 mm.
b. 1.5 mm to 2 mm.
c. 2.5 mm to 3 mm.
d. 3.5 mm to 4 mm.

4. In the anterior region, the scalloped implant-abutment interface may:
a. Improve the sulcus depth in the interproximal regions.
b. Reduce the sulcus depth in the interproximal regions.
c. Both a and b are correct.
d. Neither a nor b are correct.

5. The maintenance of bone and soft tissue architecture may be improved by:
a. A reduction in sulcus depth in the interproximal regions.
b. An increase in proximal bone height.
c. A scalloped implant-abutment interface.
d. All of the above.

6. Which of the following factors will influence the suitability of cases for the use of hollow pontics?
a. Implant stability.
b. Bone quality and type.
c. Stability of the natural tooth abutments.
d. All of the above.

7. According to the literature, interimplant distance is:
a. Critical to the maintenance of sufficient space for the horizontal aspect of the biologic width.
b. Critical to the maintenance of sufficient space for the vertical aspect of the biologic width in the anterior region.
c. Influential in the determination of an appropriately-sized implant length.
d. None of the above.

8. According to this article, when placing immediately loaded implants in the anterior region, it is critical to understand that:
a. The existing bone structures are reliant upon the condition of the soft tissues.
b. The network of collagen fibers surrounding the tooth may facilitate maintenance of bone height.
c. The vertical alveologingival and interpapillary fibers may assist in the maintenance of bone peaks when immediate support is provided interproximally.
d. All of the above.

9. Biologic width studies generally obtain measurements at the:
a. Mid-lingual point in anterior ridges where there is optimal gingival scallop.
b. Mid-facial point in anterior ridges where optimal gingival scallop is observed.
c. Mid-facial point in posterior edentulous ridges where there is minimal gingival scallop.
d. Mid-buccal point in posterior edentulous ridges where there is minimal gingival scallop.

10. Augmentation procedures are:
a. Required to rebuild resorbed ridges during immediate implant placement.
b. Unnecessary due to efficient maintenance of soft tissue architecture following immediate implant placement.
c. Essential to the development of sufficient bond support when placing immediate implants in previously edentulous ridges.
d. All of the above.