Managing the Buccal Gap and Plate of Bone: Immediate Dental Implant Placement

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Managing the Buccal Gap and Plate of Bone: Immediate Dental Implant Placement

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LEARNING OBJECTIVES
After participating in this CE activity, the individual will learn:
• Available information in the literature regarding clinical management of the buccal gap.
• Practical guidelines for managing the buccal gap.

ABOUT THE AUTHORS

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INTRODUCTION
When a dental implant is placed into a fresh extraction socket, the space between the implant periphery and surrounding bone is called the gap or jumping distance.¹ The gap consists of 2 dimensions: horizontal defect width and vertical defect height (Figure 1). The term jumping distance refers to the ability of bone to bridge the horizontal gap and fill the void. A gap can occur on any aspect of an immediately placed implant: buccal, lingual, or proximally.

The main objective of immediate implant placement is to provide an osseointegrated fixture suitable for an aesthetic and functional restoration. Bone fill in the gap between the implant and the peripheral bone is important. The buccal aspect of an implant is of great concern, especially in the aesthetic zone, because the buccal bony plate is usually thin²,³ and its resorption can result in soft-tissue recession (Figure 2).⁴ Surgical management of the buccal gap to obtain an optimal result is controversial and confusing with respect to the best techniques to achieve the following: optimal bone fill in the gap, most coronal level of bone-to-implant contact (BIC), and the least amount of buccal bone loss and soft-tissue recession.

This article is a literature review which was undertaken to evaluate available information regarding clinical management of the buccal gap. Background information is presented, and data pertaining to gap management and limitations of our knowledge are discussed to develop practical guidelines for handling the buccal gap.
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**BACKGROUND INFORMATION**

Extrapolating Data from Animal Models to Humans—To attain histological evidence concerning the best methods to manage the buccal gap and adjacent bone, experimental studies were conducted in animal models. In this regard, Pearce et al\(^5\) concluded that dogs have the most similar bone structure to humans with respect to microstructure, macrostructure, bone composition, and bone remodeling. Nevertheless, there are differences in the size and shape of bones in canines and humans. Furthermore, a dog's bone has a higher mineral density and remodels faster than humans. It was concluded that dog models may be used in experimental investigations to assess aspects of wound healing; however, it is only an approximation of what occurs in humans.

Immediate Implant Survival Rates—The survival rates of immediately placed implants into fresh extraction sockets and healed ridges are similar (97.3% to 99%).\(^6,7\) This finding is also true with respect to immediate placement of implants into infected sites\(^8,9\) or locations with periapical lesions.\(^10\)

Typical Healing of an Extraction Socket—Sockets normally fill in with bone, but they are associated with a mean 1.24 mm vertical bone loss (range: 0.9 to 3.6 mm) and an average 3.79 mm horizontal bone reduction (range 2.46 to 4.56 mm) after 6 months.\(^11\) However, these means for bone loss represent data when teeth were extracted and flaps were usually elevated. Resolution of a socket is caused by a combination of bone fill and resorption of the bony crest adjacent to the socket.

Socket Healing After Immediate Implant Placement—Numerous investigations confirmed that immediate implant placement is associated with bone loss. This has been documented in experimental studies in dogs\(^12-15\) and human clinical trials.\(^16-19\) The amount of bone loss varies and is dependent on many factors (to be discussed). In general there is a decrease of vertical bone height and an even greater horizontal bone loss. The amount of alveolar bone resorption is larger on the buccal than the lingual aspect of an implant, because the buccal plate is typically thinner.\(^20,21\)

**DATA PERTAINING TO GAP FILL AND BUCCAL PLATE BONE LOSS: ANIMAL STUDIES AND HUMAN CLINICAL TRIALS**

Experimental Animal Studies (Usually Dogs)

Studies conducted in animals confirmed that immediately placed implants in fresh extraction sites integrated with the bone.\(^22-26\) Akimoto et al\(^27\) created defects 0.5 to 1.4 mm around machined implants and noted that all defects healed, regardless of size. However, the distance between the bone margin and where the BIC started was directly related to gap size. The larger the gap, the farther the first BIC was from the bone margin. Botticelli et al\(^1\) assessed the healing response around implants when created defects (sizes one to 1.25 mm) were treated with and without barriers and the implants were submerged. The defects healed with bone and the BIC against sandblasted, large-grit, acid-etched surfaced implants was similar to the control sites where an implant was placed into a healed ridge. They concluded that a defect > one mm may heal with a high degree of osseointegration. It was noted that previous assessments employed machined surfaced implants, whereas the latter study used rough surfaced implants.

In another dog study, Botticelli et al\(^28\) demonstrated that created defects ranging from 1.25 to 2.25 mm around an immediately placed implant spontaneously filled with new bone. They\(^29\) noted artificially created defects healed differently than natural gaps that occur after implant placement. It was concluded that created defects healed completely, whereas natural gaps partly repaired. Therefore, extrapolation of data with respect to healing at sites where defects were created versus natural gaps must be interpreted cautiously, because they may not represent the same healing response temporally or physically.

Araújo et al\(^12,20\) published a series of papers consistently demonstrating that in dogs, after immediate implants were inserted and the flaps were replaced, the gap (size was < 2 mm) between the implant and the bone filled in; however, the horizontal width and level of the vertical height of the buccal plate of bone were reduced. Of particular interest was a paper that assessed the impact of deproteinated bovine bone material (DBBM) collagen on the gap (one to 2 mm wide and 3 mm deep) around immediately placed implants.\(^30\) They noted bony plates of grafted sites were thicker and bone levels were more coronal than sites that were not grafted.

Recently, Caneva et al\(^15,31-33\) conducted a series of experimental studies in dogs to investigate techniques with respect to limiting the amount of buccal plate resorption that occurs when implants are installed immediately after an extraction. Their investigations provided the following results:
DBBM particles in conjunction with collagen barriers helped preserve the alveolar process, but mostly in a horizontal dimension, not vertically; a resorbable material without a membrane was not capable of completely maintaining the buccal crest of bone; implants should be placed lingually to the center of the socket and one mm deeper than the alveolar crest to limit exposure of buccal threads; wider implants, which were close to the buccal plate, caused greater bone loss buccally than narrower implants.

Favero et al, in a dog model, reported the following results: lingual placement of the implant reduced buccal bone resorption and recession, and use of collagen barriers with DBBM did not improve results when compared to no additional treatment. It was suggested the thickness of the buccal plate, which was approximately one mm, contributed to the finding that bone grafts and barriers provide no additional benefit with respect to inhibiting bone resorption.

**Human Investigations**

In 1998, Wilson et al supplied the first human histological documentation that osseointegration occurred between the newly formed bone in the gap and an immediately placed implant. Subsequently, Wilson et al assessed rough surface implants (N = 10) where the gap was covered with a connective tissue graft and the area was covered with a flap. Osseointegration, BIC, and bone fill were similar when gaps were < 1.5 mm and > 4 mm.

Paolantonio et al evaluated the healing response when implants were placed in healed bone and when they were placed in extraction sockets and the gap was ≤ 2 mm. No bone grafts or barriers were used before implants were submerged under the soft tissue. Biopsies revealed bone fill in the gap, and there was no difference between test and control sites.

Subsequently, Boticelli et al assessed 21 sites in 18 humans with respect to gap healing around rough surfaced dental implants that were not submerged. The flaps were placed next to the abutment portion of the implant exposed

| Table. Possible Therapies Available to Treat the Buccal Gap After Immediate Implant Placement: With and Without Flap Elevation |
|---|---|---|
| A. WITH FLAP ELEVATION | ADVANTAGE | DISADVANTAGE |
| 1. No additional treatment (no bone graft or barrier used) | | |
| (a) Flap placed over the defect | Covers defect | This may require flap advancement increased morbidity (edema and ecchymosis) |
| (b) Flap positioned at bone crest, leaving the gap exposed | Easier | Plaque and food may get trapped in void if coagulum is not retained |
| 2. Bone graft placed into the defect with or without growth factors | | |
| (a) Flap placed over the defect | Covers defect | This may require flap advancement increased morbidity (edema and ecchymosis) |
| (b) Flap positioned at bone crest, leaving the gap exposed | Easier | Plaque and food may get trapped in void if coagulum is not retained |
| 3. Barrier placed over defect | | |
| (a) Flap advancement is usually necessary to attain primary closure | Covers barrier | Increased morbidity (edema and ecchymosis) |
| (b) No flap advancement and use of nonresorbable or resorbable barrier or connective tissue graft | Easier | Nonresorbable barrier—exposure/infection |
| Resorbable barrier—fragments in mouth |
| 4. Barrier placed over bone graft | | |
| (a) Flap advancement is usually necessary to attain primary closure | Covers barrier | Increased morbidity (edema and ecchymosis) |
| Nonresorbable barrier—exposure/infection |
| (b) No flap advancement and use of nonresorbable or resorbable barrier or connective tissue graft | Easier | Nonresorbable—exposure/infection |
| Resorbable barrier—fragments in mouth |
| 5. Temporization of implant and abutment | | |
| Supports soft tissue | Additional work at time of surgery |
| B. NO FLAP ELEVATION (FLAPLESS IMPLANT INSERTION) | ADVANTAGE | DISADVANTAGE |
| 1. The gap is left open with no additional therapy | Easier | Plaque and food may get trapped in void if coagulum is not retained |
| 2. Bone is placed within the gap | | Bone particles may be displaced |
| 3. Temporization of implant and abutment with either of the above | Supports soft tissue | Additional work at time of surgery |
to the mouth. No bone or barriers were employed. Eight of 9, defects initially \( \geq 3 \) mm in width, were completely filled with bone. The vertical bone crest resorption amounted to 0.3 (buccal), 0.6 (lingual/palatal), 0.2 (mesial), and 0.5 (distal), and 56% of the horizontal width. No biopsies were done. There are 2 criticisms of the clinical study by Botticelli et al.\(^{16}\) It is possible that the BIC was more apical than other sites where implants were placed into healed ridges, and the clinical examination did not confirm that osseointegration occurred. However, as previously indicated in a histological assessment in dogs, Botticelli et al.\(^{38}\) found that defects lateral to rough surface implants regenerate with proper osseo integration, whereas smooth surfaced implants repaired with connective tissue between the bone and implants. It has been suggested that the rough surfaces provided a better surface for clot stability and maturation.\(^{39}\)

In a prospective study, Chen et al.\(^{4,40}\) also reported that the small defects with respect to height and width around nontextured implants could be eliminated without the use of a membrane and/or a bone graft. Similarly, Covani et al.\(^{41}\) confirmed that defects could be resolved in humans without barriers or bone graft materials if the defect was < 2 mm wide.

Recently, Tarnow and Chu\(^{42}\) provided histological evidence of defect fill and osseointegration in a gap adjacent to an immediate implant that was 4 mm wide. In this single case report, no flap was elevated, and the defect was allowed to heal by secondary intention without placement of a bone graft or a barrier. It was suggested that if the gap is allowed to heal by secondary intention (no coverage of the gap with a flap) then the gap size may not interfere with bone fill and osseointegration.

**TREATMENT OPTIONS WITH AND WITHOUT FLAP ELEVATION**

**Flap Elevation**

In conjunction with immediate implant placement, there is a diversity of available techniques to manage the buccal gap when a flap is elevated to place an implant.

Remarks in the Table pertain to situations where the bony plate is intact and does not require a regenerative procedure to treat a dehiscence or bone fenestration.

With respect to submerged versus nonsubmerged implant protocols after immediate implant placement, the data indicate that both techniques can be used successfully, depending on the situation and preference of the clinician.\(^{43,44}\) A submerged protocol usually requires flap advancement to attain primary closure over an immediate implant. If a nonsubmerged procedure is utilized, the flap is typically replaced adjacent to the healing abutment or temporary crown, or the gap can be left uncovered. If a permanent abutment is used, it will not have to be removed (avoids disrupting the junctional epithelium), and thereby may help reduce recession.\(^{45,46}\)

**Flapless**

If a flap is not elevated to place a dental implant, several therapeutic choices are available to deal with the gap (Table). However, despite a flapless approach, remodeling of the osseous crest occurs. Teeth derive their blood supply from 3 sources: periodontal ligament, periosteum, and the endosteal marrow spaces.\(^{47}\) Tooth extraction eliminates the blood supply to the bone from the periodontal ligament and results in horizontal and vertical bone loss.\(^{20,48}\)

In general, elevation of a flap without tooth extraction results in a mean bone loss of 0.5 mm.\(^{49,50}\) The amount of osseous resorption is usually greater over the buccal aspect of roots than interproximally, where the bone is thicker. Disturbance of the periosteum inhibits the blood supply to the bone and it takes several days before normal bone vascularization is resumed. Pertinently, several authors suggested that avoidance of flap elevation reduced bone loss and recession after tooth removal and immediate implant placement in humans\(^{51}\) and animal experimental studies.\(^{52-54}\) In contrast, other human\(^{55-57}\) and experimental studies\(^{58-60}\) determined that even with a flapless approach, the amount of bone loss was similar with and without flap elevation (Figures 3a to 3d). Recently, Grunder\(^{61}\) reported that with a flap approach, the amount of buccal soft-tissue recession was 1.06 mm. Despite these conflicting data, it is the authors’ opinion that if the tissues are left undisturbed (no flap elevation), there is a better chance to have less soft-tissue recession. This concept is also supported by the finding that even if there is bone loss, it does not necessarily result in alterations of the gingival contour as seen in periodontal patients.
OTHER FACTORS THAT CAN AFFECT HEALING OF THE GAP AND ADJACENT SOFT TISSUE

Size of Horizontal Bone Gap—The gap size is an important determinant with respect to predictability of spontaneous bone fill. The critical gap size that allows unaided healing has not been determined, because there are variables that can affect the result. However, in humans, gaps < 2 mm usually heal without allografts, xenografts, and barriers when implants are submerged\(^37,40,41,62,63\) or nonsubmerged (Figures 4a to 4f).\(^4,38\)

In dogs, investigators noted that bigger gaps have a greater potential for incomplete fill; therefore, they suggested biomaterial filler would be beneficial in large gaps.\(^18,27,64,65\) However, when evaluating the data in humans, different techniques resulted in bone fill without bone grafts in defects \(\geq 3\) mm.\(^16,35,36,42\) Tarnow and Chu\(^42\) reported bone fill in a gap that was 4 mm wide. The gap was not grafted and the defect was allowed to heal by secondary intention (no flap elevation or coverage of gap). In contrast, Botticelli et al\(^16\) did not graft, but replaced the flaps against healing abutments and 8 of 9 defects that were initially \(\geq 3\) mm filled with bone. Others noted bone fill in 4 mm gaps that were covered with a connective tissue graft and the flap.\(^35,36\) Thus, there appears to be a discrepancy with respect to how large a gap will heal spontaneously and under what conditions.

Biomaterials—Chen and Buser\(^66\) reviewed the literature regarding the effectiveness of placing biofillers in the gap. They concluded that most investigations employed combinations of a bone graft material and/or barrier membrane (expanded polytetrafluoroethylene-PTFE or collagen barrier) to enhance regeneration. The most commonly used biofiller was DBBM, which was employed alone and in conjunction with resorbable and nonresorbable barriers. Other graft materials used included autogenous bone, demineralized freeze-dried bone, and hydroxyapatite. All the techniques provided clinically acceptable defect resolution, and it was noted that augmentation procedures reduced horizontal bone resorption, but not crestal bone loss.

Recent studies in dogs focused on the use of DBBM. Araújo et al\(^30\) demonstrated that use of DBBM versus no biofiller resulted in the BIC being more coronal and the buccal plate thicker. After employing DBBM, Caneva et al\(^31\) also reported a more coronal level of BIC, and Chen et al\(^4\) noted a 25% reduction of horizontal bone loss. It appears that different materials can be used, but the one currently receiving the most attention is DBBM. A possible explanation for this is that in Europe, human allograft material is not allowed to be used in humans. Currently, there is no preponderance of data indicating that one type of graft material is superior to others.

Thickness of the Buccal Plate of Bone—Buccal plate thickness affects the degree of buccal plate resorption after immediate implant placement. In a dog model, it was...
determined that if the buccal plate was $> 1$ mm, there was less bone resorption compared to sites with a $\leq 1$ mm thick bony plate. In addition, Ferrus et al\textsuperscript{18} suggested that the wider the buccal bony plate, the greater the fill of the horizontal gap. In humans, Spray et al\textsuperscript{67} noted after tooth extraction that buccal plates $> 2$ mm thick did not usually resorb vertically, whereas socket walls $< 2$ mm wide demonstrated bone loss (Figure 5). It was advised by several authors that if the buccal bone thickness is not one to 2 mm, hard-tissue augmentation was recommended\textsuperscript{63,67,68} to maintain the level of the osseous crest.

**Buccolingual Position of Implants**—There are a few ways the spatial relationship between the implant and the buccal plate can be affected: positioning of the implant and selection of its diameter. Pertinently, the closer the implant is to the buccal plate, the greater the amount of bone resorption that occurs.\textsuperscript{15,34,69} Furthermore, use of large implants to fill the alveolus, which encroaches on the buccal plate, results in additional bone loss as opposed to retaining bone. Ultimately, room must be left to allow for the horizontal influence of the implant.\textsuperscript{70}
Concerning soft-tissue levels, implants placed buccally manifested 3 times more recession than lingually placed implants (1.8 versus 0.6 mm). However, lingual positioning of an implant needs to be taken into consideration with respect to prosthetic concerns.

**Number of Bony Walls**—With respect to defect morphology, the most favorable healing is in 3-walled defects, which is similar to the gap between the bone and the implant surface. If left undisturbed, the gap will fill in with a clot, and 3 walls provide better clot containment than defects with fewer walls.

**Implant Surfaces**—The stability of the clot will be impacted by the implant surface. Textured implant surfaces provide greater surface area and improved levels of osseointegration compared to machined surfaces. When placing immediate implants, healing is better with textured surfaces (eg, increased bone to implant contact) as opposed to smooth surfaces.

**Role of Adjacent Teeth**—In a dog model, Favero et al reported immediate implants placed in several adjacent sockets manifested more bone loss than implants which were inserted into a single socket adjacent to teeth. Apparently, the presence of adjacent teeth retarded bone loss with respect to the interproximal bone, and this finding is in agreement with other authors.

**Biotype**—If buccal bone does not resorb, soft tissue will not recede. In contrast, the crestal labial bone can resorb and the soft tissue may not recede. In this regard, numerous investigations assessed the effect of the biotype on recession, and the results have been conflicting. When a thick versus a thin biotype were compared after immediate implant placement, several authors reported increased recession when there was a thin biotype. Others noted there was no difference in the amount of recession. Lee et al reviewed the data on this subject and concluded that a thin biotype predisposes an individual to recession and loss of papillae.

**Temporization With and Without Bone Grafting**—Immediate insertion of implants with provisionalization may enhance soft-tissue contours. Tarnow and Chu et al also favored temporization in conjunction with a bone graft to fill the gap. In addition, it was suggested to add bone coronal to the osseous crest to help support the gingival contour. A clinical trial substantiating these findings was just completed and the technique is referred to as dual-zone socket management (personal communication with Dr. Tarnow, January 2013).

**DISCUSSION**

Management of the buccal gap and reducing buccal plate resorption are important considerations when contemplating immediate implant placement. Procedures to handle the gap when the buccal plate is intact have varied depending on whether the implant was placed with or without flap elevation. The 8 possibilities of therapy are listed in the Table. In addition to these methodologies, soft-tissue augmentation (eg, connective tissue graft) can be provided on the buccal aspect depending on the aesthetic demands of the case. In general, in the aesthetic zone it is preferable not to elevate a flap if the buccal plate is intact. Some techniques can be done alone (ie, adding a biomaterial) or in combination with other procedures (biomaterial filler plus a barrier). Studies have clarified that if the gap is < 2 mm, no additional therapy is needed to enhance gap fill; however, concomitant resorption of bone occurs and the magnitude of this alteration is related to buccal plate thickness, implant positioning, and whether a flap is elevated. Some authors suggest adding a biomaterial to inhibit horizontal bone resorption. It appears that a certain amount of crestal bone loss occurs after an extraction due to loss of blood supply when the periodontal ligament is eliminated. Differences in findings between studies with respect to gap fill can be attributed to different gap sizes, dissimilar thicknesses of the buccal plate and implant positioning, and various surgical modalities. Therefore, it is difficult to compare studies. This is further complicated by the fact that extrapolating data from dog models to humans can only be done conceptually without specificity regarding the magnitude of measurements.

Based upon the collective information in the literature, the next section provides conclusions and guidelines for immediate implant placement with respect to managing a buccal gap after immediate implant insertion when the buccal plate is present. If a buccal plate is dehisced, it is necessary to
address this issue with a bone regeneration procedure at the time of implant placement or subsequently in a delayed procedure.\textsuperscript{79,80}

**CONCLUSIONS AND GUIDELINES FOR TREATING THE BUCCAL GAP AFTER IMMEDIATE IMPLANT PLACEMENT**

1. Do not elevate a flap when placing an implant in the aesthetic zone, thereby reducing the risk of recession. If increased access for visualization is desired, raise only a lingual flap.

2. Gaps $<$ 2 mm wide will usually heal spontaneously without placing a biomaterial.\textsuperscript{66} If the gap is $>$ 2 mm, spontaneous bone regeneration is less predictable. If the gap is $<$ 2 mm, the gap can be left open and it will fill with a clot, or a biomaterial can be added to occlude the gap (Figures 6a to 6d). If a biomaterial is placed, some collagen material (eg, CollaCote [Zimmer Dental]) can be placed on top of the material to inhibit exfoliation of the material before a fibrin clot forms. If a flap is raised for implant placement and the gap is $<$ 2 mm, the flap can be replaced either over the gap\textsuperscript{28,30,37} or at the buccal crest of bone. If the flap covers the graft material, it will not exfoliate. Placement of a provisional crown on an interim or definitive abutment also can provide protection for the graft material. It has been suggested that it is better to leave the gap uncovered, thereby retarding the connective tissue and epithelium from interfering with initial population of the site with bone progenitor cells.\textsuperscript{77}

3. Bone fill can occur in defects $>$ 3 mm without placement of bone grafts or use of barriers.\textsuperscript{16,42} However, it appears that the greater the gap size the greater the potential for incomplete fill of the defect.

4. Gaps adjacent to nonsubmerged and submerged implants heal similarly.\textsuperscript{43}

5. Thin buccal bony plates resorb and result in loss of crestal bone height (approximately one mm) and horizontal bone width.\textsuperscript{4} Studies have shown that approximately 33\% of the patients manifested gingival recession on the buccal aspect (approximately one mm) after immediate implant placement.\textsuperscript{4,71} If the buccal wall is thick ($>$ one mm), there may be limited resorption. One mm recession was also noted when a connective tissue graft was placed.\textsuperscript{61}

6. If a biomaterial is inserted in a gap which is $<$ 2 mm, the data indicate that there will be crestal bone loss, but the horizontal width (contour) will be maintained better.\textsuperscript{4,12,31}

7. Numerous materials were investigated as fillers for the gap. However, deproteinized bovine bone has been used in the most studies.\textsuperscript{66}

8. The exact relationship between bone modeling and recession is unclear; however, with increased bone resorption, there is usually increased recession.\textsuperscript{4,66}

9. The implant should be placed 2 mm from the buccal plate to avoid encroaching on the buccal plate and thereby contributing to resorption.\textsuperscript{4}
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10. Oversized implants should be avoided, because they may encroach on the buccal plate.4,21

11. Place implants one mm subcrestally to account for crestal bone resorption.4,20 Crestal bone resorption can be decreased with platform switching.81,82

12. Biomaterials can be placed without a barrier, thereby avoiding flap elevation. However, if a defect is very large or if there is a bone dehiscence, it may be beneficial to use a barrier, and this would necessitate elevating a flap in order to achieve wound closure.

13. With a flapless approach, it was suggested that overfill of the gap with deproteinated bone helps support the soft tissue and reduces recession and bone loss when it is done in conjunction with an abutment and temporary crown.77 This statement is based upon an investigation that was just completed.

14. Only histological studies can confirm that osseointegration was achieved when the buccal gap fills with bone. However, a functional and stable implant over a period of time can be interpreted as a successful clinical outcome.

ADDENDUM
With respect to vertical bone loss when flap versus flapless procedures were compared, it was noted that there was conflicting information. However, with regard to horizontal bone loss, several recent articles have indicated that if a flap is not raised there is greater preservation of the horizontal bone width.83-85

REFERENCES
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POST EXAMINATION QUESTIONS

1. What is the jumping distance?
   a. Space located only on the buccal surfaces between the implant and the tooth.
   b. Space between the implant periphery and surrounding bone.
   c. Space located only on the lingual surfaces between the implant and the tooth.
   d. Space located only on the proximal surfaces between the implant and the tooth.

2. Which plate of bone is usually the thinnest around an immediate implant?
   a. Buccal.
   b. Lingual.
   c. Proximal.
   d. Both a and b.

3. After an extraction how much bone loss (mean) occurs on the buccal and lingual aspects of the extracted tooth after 6 months?
   a. 3.79 mm vertically and 1.24 mm horizontally.
   b. 1.79 mm vertically and 3.24 mm horizontally.
   c. 3.24 mm vertically and 1.79 mm horizontally.
   d. 1.24 mm vertically and 3.79 mm horizontally.

4. What is the major benefit of not elevating a buccal flap when placing an immediate implant?
   a. Helps preserve aesthetics.
   b. Does not reduce vascularity over the buccal plate.
   c. Probably reduces the amount of recession.
   d. All of the above.

5. After immediate implant placement, what size gaps will usually heal spontaneously if left untreated?
   a. 2 mm.
   b. 3 mm.
   c. 4 mm.
   d. 5 mm.

6. What does buccal plate thickness influence?
   a. Amount of keratinized tissue.
   b. Amount of recession.
   c. Amount of bone resorption.
   d. Both b and c.

7. How does implant position of an immediate implant in the maxilla affect the results?
   a. If too far lingual, it is prosthetically unacceptable.
   b. If too close to the buccal plate, it will induce bone resorption.
   c. If it is angled, it will fail.
   d. Both a and b.
8. What type of defect is a buccal gap if the socket walls are intact?
   a. One wall.
   b. Two walls.
   c. Three walls.
   d. Moat defect.

9. Is there a benefit to placing a bone graft in the gap if it is large?
   a. Usually no.
   b. Usually yes.
   c. Never.
   d. Only if it is < 2 mm.

10. Since there is usually some vertical bone loss associated with immediate implant placement, it is a good idea to place the implant platform where?
    a. At the crest of bone.
    b. One mm supracrestally.
    c. One mm subcrestally.
    d. It doesn't matter if the buccal plate is thin.

11. When comparing healing in the gap around submerged and nonsubmerged implants, which statement is true about submerged implants?
    a. They heal better than nonsubmerged implants.
    b. They heal worse than nonsubmerged implants.
    c. They heal the same as nonsubmerged implants.
    d. There is delayed healing.

12. Textured surfaced implants provide which advantages compared to smooth surfaced implants?
    a. Decreased surface area for more osseointegration.
    b. Increased bone to implant contact.
    c. Decreased clot retention.
    d. Decreased probing depths.

13. Some authors suggest overfilling the buccal gap with deproteinated bone in conjunction with an abutment and a temporary crown to achieve which outcome?
    a. Help support soft tissue.
    b. Reduce recession.
    c. Both a and b.
    d. Increased keratinized tissue.

14. When extrapolating data from a dog model to humans, which statement is true?
    a. It is only an approximation of what occurs in humans.
    b. It is exactly what happens in humans.
    c. Dogs' remodel overall healing is slower that humans.
    d. Dogs' bones are the same size as humans.

15. According to Botticelli et al, which statement is true about how artificially created defects (1.25 to 2.25 mm) heal in a dog model?
    a. The buccal aspect of created defects partially heal.
    b. The lingual aspect of created defects partially heal.
    c. Created defects heal partially.
    d. Created defects heal completely.

16. When can a clinician be sure complete osseointegration occurred along the entire implant surface?
    a. When the buccal gap fills with bone.
    b. Only histological assessment can confirm this finding.
    c. When there is a lack of mobility.
    d. When bone fills the buccal gap and there is a lack of mobility.
Managing the Buccal Gap and Plate of Bone: Immediate Dental Implant Placement

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ANSWER FORM: COURSE #: 159

Please check the correct box for each question below.

1.  a  b  c  d
2.  a  b  c  d
3.  a  b  c  d
4.  a  b  c  d
5.  a  b  c  d
6.  a  b  c  d
7.  a  b  c  d
8.  a  b  c  d
9.  a  b  c  d
10.  a  b  c  d
11.  a  b  c  d
12.  a  b  c  d
13.  a  b  c  d
14.  a  b  c  d
15.  a  b  c  d
16.  a  b  c  d

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Please complete the following activity evaluation questions.

Rating Scale: Excellent = 5 and Poor = 0

Course objectives were achieved. _______________________

Content was useful and benefited your clinical practice. _______________________

Review questions were clear and relevant to the editorial. _______________________

Illustrations and photographs were clear and relevant. _______________________

Written presentation was informative and concise. _______________________

How much time did you spend reading the activity and completing the test? _______________________

What aspect of this course was most helpful and why? _______________________

What topics interest you for future Dentistry Today CE courses? _______________________

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