# IMPLANT AESTHETIC SCORE FOR EVALUATING THE OUTCOME: IMMEDIATE LOADING IN THE AESTHETIC ZONE

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***Implant restorations delivered according to the Brånemark protocol have proven to be highly predictable. To shorten the length of treatment associated with the Brånemark protocol, as well as to preserve soft and hard tissues, newer protocols have focused on reducing or even eliminating the time between tooth extraction and implant placement and between implant placement and prosthetic restoration delivery. The authors present a case in which control of postextraction implant placement, optimal implant positioning, and immediate loading contributed to clinical success.***

**Learning Objectives:**
This article describes a new protocol that shortens the time from tooth extraction through prosthetic restoration delivery. Upon reading this article, the reader should be able to:

- Recognize the factors that contribute to clinical success.
- Identify the variables that must be considered when selecting patients for immediate placement or loading procedures.

*Key Words: implant, anterior, immediate loading, aesthetics, soft tissue*

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Endosseous implant-supported restorations delivered in accordance with the traditional Brånemark protocol have proven to be highly predictable.[1] This protocol requires a 12-month healing period following tooth extraction, with an additional undisturbed healing period of 6 months following implant placement. Both were long considered to be a prerequisite for the osseointegration of dental implants in the maxilla.

The application of these time intervals to treatment plans for maxillary anterior cases presents patients with aesthetic and functional limitations as well as emotional considerations. At the same time, clinicians must contend with the effects of resorption of the alveolar process.[2-8] In order to shorten the overall duration of treatment and preserve both soft and hard tissues, newer protocols have focused on reducing or even eliminating the time that elapses between tooth extraction and implant placement and between implant placement and prosthetic restoration delivery. There are many variables that must be considered when selecting patients for immediate placement or loading procedures.

In this presentation, the authors report on a case in which careful control of the following factors contributed to clinical success:

- Postextraction implant placement;
- Ideal implant positioning; and
- Immediate loading.

Placing implants into fresh anterior extraction sockets in the maxilla prevents bone resorption, which normally occurs after tooth extraction and often prohibits the surgeon from placing implants in an optimal position. Proper maintenance of the crestal anatomy tends to maintain those parameters that are recognized as essential for aesthetic treatment. While ideal positioning may involve the creation of a gap between the socket and the implant, immediate implantation has been shown to have a favorable outcome even without the use of barrier membranes or other regenerative materials as long as the bone-to-implant gap does not exceed 1.5 mm.[7,9-14]

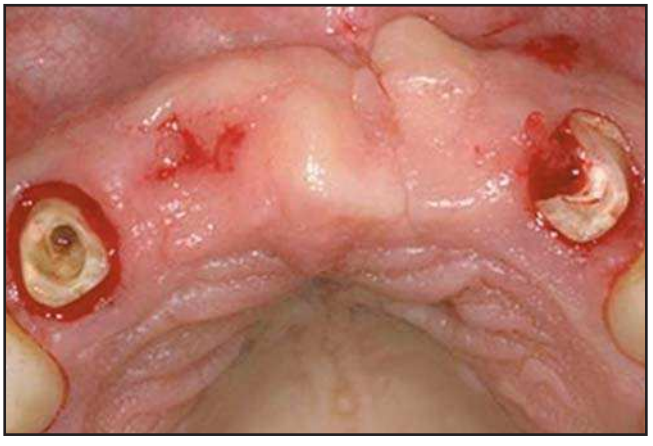


**Figure 1. Preoperative occlusal view of patient's maxillary anterior following the removal of the failing fixed partial denture (FPD). The patient requested rehabilitation of the loose FPD.**

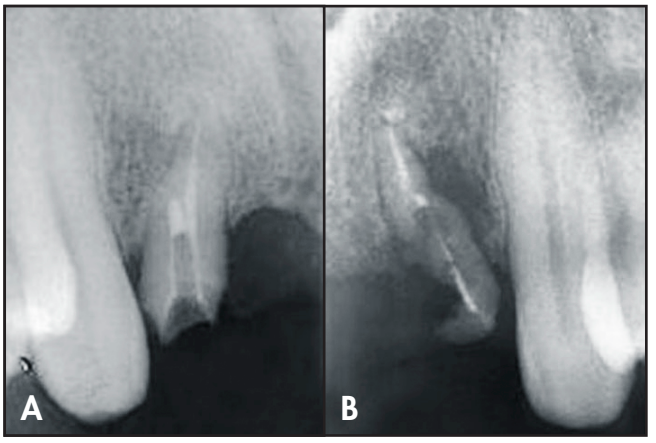



**Figure 2A. Radiographic appearance of tooth #7(12) with vertical root fracture. 2B. Preoperative radiograph of endodontic failure of tooth #10(22).**

**Figure 3. Four implants were placed in the correct faciolingual position. The 1.5-mm gap between the implants and the cortical plate will be filled with autogenous bone.**

## Case Presentation

A 35-year-old male patient presented with a failing maxillary anterior fixed prosthesis supported by two nonrestorable lateral incisors (Figure 1). The fixed partial

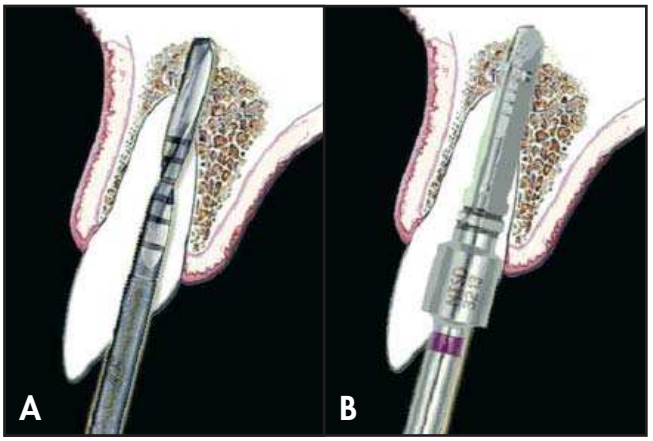



**Figure 4A. The drill is positioned against the palatal wall of the socket. 4B. Alignment of the drill with the cingulum facilitated proper implant placement in the anterior site.**

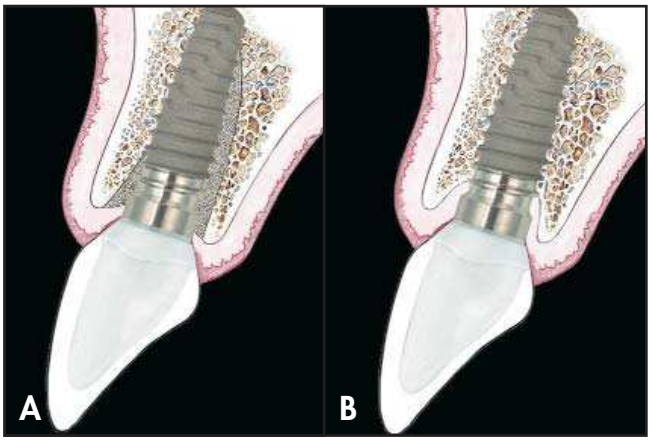



**Figure 5A. When properly positioned, the implant will be well-integrated within the socket. 5B. The soft tissue stability is promoted by the thick cortical bone.**

denture (FPD) had become loose, and the patient was asking for it to be rehabilitated. The patient's medical history was noncontributory. A review of his dental history indicated that the two central incisors had been previously avulsed due to trauma. Tooth #7(12) was nonrestorable due to vertical root fracture, while #10(22) had suffered a major endodontic failure (Figure 2). No clinical evidence of bruxism or clenching was detected.

A clinical evaluation including periodontal screening was also conducted. The patient presented a thick and flat periodontal biotype, and no signs of periodontitis were evident. Intraoral radiographs and a CT scan were taken in order to better evaluate the volume of the edentulous ridge, revealing an adequate amount of type II bone. Impressions were made, and a waxup was obtained for fabrication of a surgical template and a provisional removable restoration. The original prosthesis was provisionally recemented, and the patient was scheduled for a further discussion of possible treatment plans.

The treatment plan called for placement of four implants, with immediate loading of the two central implants and delayed loading of the two lateral implants. This provided transitional implants in the event that the immediate loading prevented the two central implants from osseointegrating. In such an event, it would still be possible to complete the restoration using the two lateral implants for support. On the other hand, if all four implants integrated, an acceptable interimplant distance would still exist.

After the clinician discussed the treatment alternatives (eg, an FPD, delayed implant treatment with an interim provisional partial removable prosthesis) with the patient, the patient provided informed consent for the immediate loading procedure.

## Surgical Phase

After atraumatic extraction of the two lateral incisors, a full-thickness crestal flap was elevated. A surgical guide was positioned, and four tapered implants (ie, 4.0 mm × 11.5 mm, Osseotite NT, Implant Innovations Inc, Palm Beach Gardens, FL) were placed in the extraction sockets and central incisor sites. Tapered implants were chosen because of the ease with which primary stability can be achieved (Figure 3).[15]

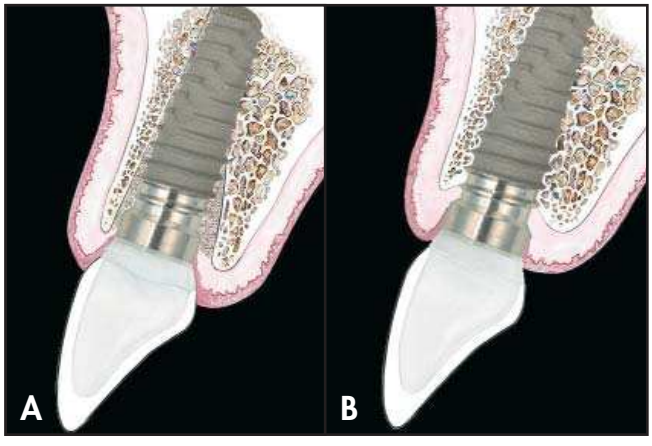



**Figure 6A. If the implant is too far facially, stress upon the thin cortical bone may result. 6B. The thin cortical plate may resorb under loading and cause soft tissue recession.**

In addition to the implant design, another factor in the achievement of primary stability in the extraction sockets was the design of the osteotomies. Rather than following the long axis of each extraction socket, the bur was positioned against the palatal wall of the socket and aligned with the cingulum of the future restoration. Following these directions, the initial osteotomy started 5 mm to 7 mm more apically from the soft tissue contour on the palatal side.

The implants were then placed into the bone on the palatal wall of the extraction sites (Figure 4). The resulting small gap between the implants and the labial plate was filled with autogenous bone collected from the flutes of the shaping drills. This graft helped to establish a thicker, more stable wall, thus increasing resistance to bone resorption (Figure 5). Under loading, when the bone recedes to the first thread, if thick cortical bone has been established, the vestibular part of the bony wall will not be affected by the bone resorption.[16] This leads to soft tissue stability. The need for bone grafting is related to the need to preserve the buccal/palatal dimension.

If the implant is placed too far facially, stress upon the thin cortical bone may result. The thin cortical plate may resorb under loading, causing soft tissue recession and resulting aesthetic problems due to the longer crown and margin exposure (Figure 6).

Transfer assemblies were connected to the two central implants, and cover screws were placed on the two lateral implants. The flap was temporarily closed with silk sutures, and an impression of the two central implants was made. The sutures were then removed around the central implants, and minor bone grafting was performed to cover a bone dehiscence on the buccal plate at tooth #8(11). A resorbable membrane (ie, Ossix, 3i, Palm Beach Gardens, FL) was positioned on that implant. To cover the expanded buccal contours, a connective tissue graft harvested from the palatal area was also used.

Wide healing abutments (7.5 mm in diameter, 4 mm in height) were placed on the two central implants to prevent a collapse of the soft tissue until the placement of the temporary prosthesis 24 hours later. The healing abutments were tightened to only 10 Ncm to avoid applying any further torque to the implants.

The day after surgery, the healing abutments were removed, and a provisional restoration with metal reinforcement was screwed directly to the two central implants (Figure 7). The two lateral implants were not loaded but

**Figure 7. Facial view of the provisional crowns screwed directly to the implant platform in positions #8(11) and #9(21), with two cantilevered lateral incisors.**

**Figure 8. Uncovering of the two lateral incisors was accomplished using a tissue punch. A gingivoplasty was performed to smooth the tissue contours.**

**Figure 9. Provisional restorations were subsequently cemented to the zirconia posts (ie, ZiReal, Implant Innovations, Inc, Palm Beach Gardens, FL).**

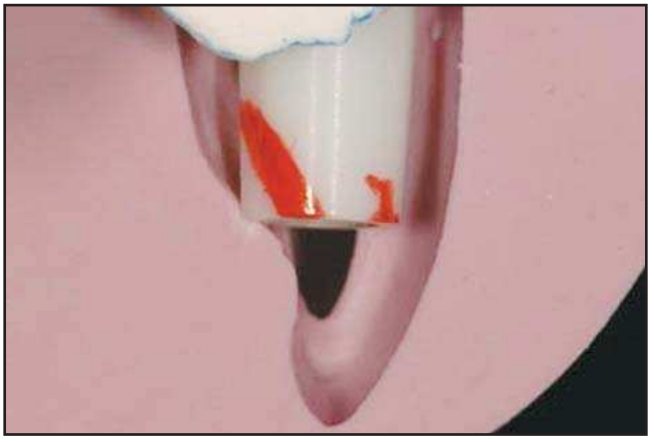


**Figure 10. Master cast of the unprepared zirconia abutment. When implant positioning is correct, only minor modifications are needed to prepare the post.**

**Figure 11. View of the ceramic buildup completed for the four aesthetic restorations (ie, IPS Empress, Ivoclar Vivadent, Amherst, NY). Note the natural appearance.**

**Figure 12. Facial view of the definitive implant restorations that were fabricated and cemented into place. Note the proper tissue integration and aesthetics.**

were rather cantilevered in the provisional restoration. The absence of centric and eccentric contacts was determined by the interposition of 200 μm articulating paper.

The patient was instructed not to chew on the provisional crowns for at least 8 weeks. Six months following implant placement, second-stage surgery on the two lateral implants was performed using a flapless procedure. Using gingivoplasty burs, the soft tissue contours were also refined (Figure 8). The implant-stability quotient was then measured by resonance frequency analysis, which showed secondary osseointegration of all four implants. After an additional 8 weeks, an impression of the four implants was made.

## Laboratory Procedures

After tissue healing, definition of the final aesthetic outline began with the preparation of a second set of provisional crowns. The first provisional crowns were examined in order to decide what changes were required to optimize the aesthetic outcome. After final impression making, a master cast was created for use in fabricating both the second provisional restoration (Figure 9) and the definitive all-ceramic crowns.

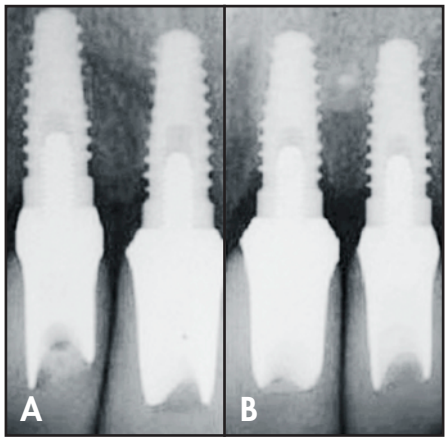
The master cast was mounted in the correct jaw relationship, and the diagnostic cast of the first provisional restoration was used as a reference point for the fabrication of the second provisional restoration. Teeth were waxed up (Figures 10 and 11), and a natural aesthetic appearance was achieved.

Zirconia posts (ie, ZiReal, 3i, Palm Beach Gardens, FL) were then secured with screws tightened to 32 Ncm, and the provisional restoration was cemented. It was left in place for 6 months to achieve soft tissue maturation. The definitive restoration, consisting of four all-ceramic crowns (ie, IPS Empress 2, Ivoclar Vivadent, Amherst, NY), was then fabricated and cemented in place (Figures 12 through 16).

## Discussion

An Ossix membrane was used to cover the defect on the implant at tooth #8 because of the nature of the defect. It was not merely a gap, but a dehiscence which caused the exposure of the implant buccal side for 6 mm.

The decision to place four implants was driven by the need to combine immediate implant placement with immediate loading. A traditional (ie, delayed loading) protocol was followed for the two implants that were




**Figures 13A and B. Periapical radiograph recorded at final seating of the implants at teeth #7 through #10 demonstrates integration in the anterior maxilla.**

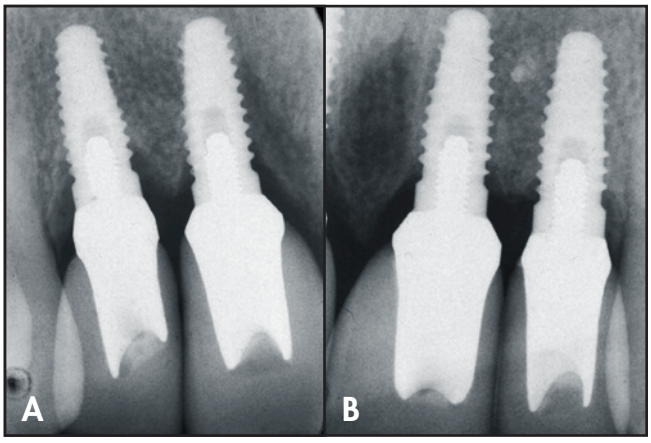



**Figure 15A. Teeth #7 and #8 at 2 years postoperatively. 15B. Two-year follow-up radiograph shows stable bone levels around implant at sites #9 and #10.**

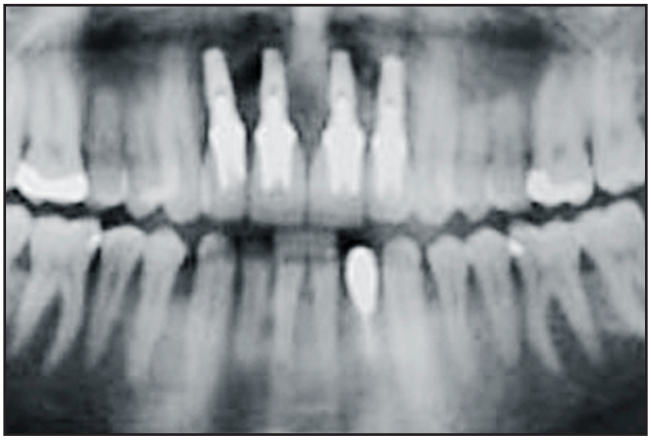


**Figure 14. Orthopantomograph of the implant restorations (teeth #7 through #10) exhibits their position within the maxillary arch. Note the proper and stable postion.**


**Figure 16. Frontal view with aesthetic score (Table). Changes in the gingival level are measured from the reference line to the apex of each papilla at selected time intervals.**

placed into fresh extraction sockets, while an immediate loading protocol was applied to the two implants placed into healed bone.

Preoperative measurements have shown that it was possible to replace the four missing dentition with four implants, since the alveolar bone and subsequently the prosthetic space was sufficient (intercuspid approximately 33 mm) to allow an optimal interimplant distance. An interimplant distance of 3 mm has been considered to be ideal because it prevents resorption cones around adjacent implants from fusing together.[17] As a result, this may possibly cause the loss of the interimplant bone peak. According to the authors' clinical experience, a 5 mm interimplant distance in the anterior zone should be regarded as even safer than 3 mm. Another challenge that needed to be addressed in this case was the creation of aesthetically acceptable interproximal papillae. While the height of the papilla between natural teeth and implants will largely depend on the position of the interproximal bony crest adjacent to the natural teeth, it has been demonstrated that the ideal condition for creating a pseudo interimplant papilla is achieved when the distance between the bone crest and the contact point is approximately 3.4 mm.[18,19]

Considering the aesthetic importance of an implant-supported restoration in the anterior area, clinicians should not merely consider the implant survival as the only success parameter, but also address the different aspects of the aesthetic result and long-term stability of the soft tissues.[20]

## Table

***Implant Aesthetic Score***

**A. Presence and stability of the mesiodistal papilla**
0 = Papilla
1 = Does not fill the entire space but is aesthetically acceptable in harmony with adjacent teeth
2 = Total fill

To follow up the dimensional stability of the papilla, the vertical distance from the apex of the mesiodistal papilla to the imaginary line connecting the CEJ of the two adjacent teeth and the height of the mesiodistal papilla should be periodically measured with reference to this line.

**B. Ridge stability buccopalatally**
0 = Width maintained
1 = Width with ridge loss

Ridge stability is measured in mm of buccal resorption in respect to adjacent natural teeth from the baseline (ie, crown delivery) to follow-up recall 6 months, 1 year, and then 1 year annually. Study models fabricated at final crown delivery may facilitate evaluation of buccal resorption over time.

**C. Texture of the peri-implant soft tissue**
0 = Complete loss of texture
1 = Does not look like healthy tissue, but some texture still maintained
2 = Looks like healthy gingival tissue around the natural teeth

**D. Color of the peri-implant soft tissue**
0 = Completely different color from healthy tissue
1 = Does not look like healthy tissue but still aesthetically acceptable
2 = Looks like healthy gingival tissue around the natural teeth

**E. Gingival contour**
0 = Evident asymmetry from the accepted parameters of scalloping
1 = Signs of asymmetry but aesthetically acceptable
2 = Harmonious gingival contour

***Perfect outcome = 9***
***Acceptable outcome = 4 to 8***
***Compromised outcome = 0 to 3***

In this particular case, an overall satisfactory result was achieved due to the following conditions, which were investigated before treatment: a thick periodontal biotype, the absence of vertical bone resorption in the area to be treated, the presence of proximal bony peaks at the adjacent teeth, and a linear distance from canine to canine that allowed for a correct interimplant distance. Moreover, by using an immediate loading approach, the provisional restoration was more stable as compared to a removable partial denture that might cause uncontrolled loading on the implants.

To evaluate the aesthetic outcome in an objective way, an implant aesthetic score (IES) was proposed (Table). The reference line (Figure 16) connects the zenith of the CEJs of the teeth adjacent to the implant restoration. For the clinical case described in this paper, the assessment for the aesthetic score was:

A: 2
B: 1
C: 1
D: 1
E: 2
Total score: *7*

## Conclusion

Recently, newer protocols have focused on reducing treatment times. In this case, it was possible to combine immediate implantation and immediate nonocclusal loading by selectively applying the protocols for both approaches. The two implants that were immediately loaded were not placed in fresh extraction sockets and were considered as possibly transitional. In case of failure, the prosthodontist could have used the other two implants to complete the restoration.

A further step in achieving aesthetic results in the anterior region may be loading of immediately placed implants. This step calls for further investigation, however, since the determinants of both functional and aesthetic success are multiple. A thorough understanding not only of the processes underlying osseointegration, but also of the principles of tissue management is required.

## Acknowledgment

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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 exercise are based on the article, "Implant Aesthetic Score for Evaluating the Outcome: Immediate Loading in the Aesthetic Zone," by Tiziano Testori, MD, DDS, Francesca Bianchi, DDS, Massimo Del Fabbro, BSc, PhD, Matteo Capelli, DDS, Francesco Zuffetti, MD, DDS, Ignazio Berlucchi, DDS, Silvio Taschieri, DDS, Luca Francetti, MD, DDS, Roberto Ludovico Weinstein, MD, DDS. This article is on pages 000-000.***

**1. Advantages of immediate implant placement in the anterior include:**
a. Resorption of the alveolar process.
b. Resorption of soft tissues.
c. All of the above.
d. None of the above.

**2. When placing implants in the aesthetic zone, osteotomies should be obtained by placing the bur:**
a. Along the long axis of the natural tooth.
b. Against the buccal wall of the socket.
c. Against the palatal wall of the socket.
d. Misaligned with the cingulum of the future restoration.

**3. The gap which may result from the proper placement of implants in the aesthetic zone:**
a. Needs the placement of a membrane when exceeding 0.5 mm.
b. Needs the placement of a membrane when exceeding 1 mm.
c. Does not need the placement of a membrane when not exceeding 0.5 mm.
d. Does not need the placement of a membrane when not exceeding 1.5 mm.

**4. Grafts used to fill minor gaps resulting from the correct placement of postextraction implants:**
a. Maintain buccal bony volume.
b. Decrease soft tissue stability.
c. Improve primary stability.
d. Decrease primary stability.

**5. Stress caused by loading upon a thin cortical bone may result in:**
a. Loss of primary stability.
b. Enhanced aesthetics.
c. Bone resorption.
d. Prosthetic crown shortening.

**6. The minimum interimplant distance to prevent the loss of the bone peak is:**
a. 1.5 mm.
b. 2.5 mm.
c. 3 mm.
d. 4 mm.

**7. The mean expected papilla height between two implants is around:**
a. 2.4 mm.
b. 3.4 mm.
c. 4.4 mm.
d. 5.4 mm.

**8. Implant Esthetic Score (IES) includes the evaluation of:**
a. Presence and stability of the mesial and distal papillae and gingival contour.
b. Texture and color of the peri-implant soft tissue.
c. Ridge stability.
d. All of the above.

**9. According to the suggested protocol in the aesthetic zone for multiple implants, buccal resorption is evaluated over time by means of:**
a. Radiographic assessment.
b. Probing.
c. Photographic assessment.
d. Study casts.

**10. The following condition is considered favorable for a satisfactory outcome of an implant-supported restoration in the aesthetic area:**
a. Thick and flat periodontal biotype with rectangular teeth.
b. Thin and scalloped periodontal biotype with triangular teeth.
c. Absence of bony peaks at the adjacent teeth.
d. Presence of vertical bone resorption.