Immediate implantation with provisionalization: From literature to clinical implications

Bernard Touati,[1] Gerard Guez[2]

Abstract

Numerous studies have confirmed the predictability of dental implants used for the replacement of a single missing tooth. Successful application of this surgical protocol is still technique sensitive and should be executed only by experienced restorative teams. Factors such as implant stability, implant design, immediate loading, provisionalization, and various others have a direct influence on the result of thisprocedure. This article reviews current literature on immediate implant placementand provides clinical guidelines aimed at improving the use of this technique in daily restorative practice.

Key Words: implant, immediate provisionalization, soft tissues, osseointegration, aesthetics

Introduction

The immediate replacement of a single tooth with an implant is no longer considered an experimental technique. The literature bears witness to numerous reports and clinical studies demonstrating that this technique has been mastered in cases where its indications are properly assessed and its execution is perfectly accomplished. Interest in this technique can be attributed to the following benefits:

- Preservation of tissue and optimization of the soft tissue contour.
- Simplification of treatment and reduction of sequences.
- Improved psychological advantages.
- Enhanced patient comfort and aesthetics.

Nevertheless, this surgical-prosthetic procedure remains technique sensitive and should be implemented only by a well-trained surgical/restorative team. By reviewing literature concerning the essential parameters that are currently under discussion, the authors shall highlight the clinical and practical conclusions involved in optimizing this technique for use in daily practice.

[1] *Dr Bernard Touati, DDS, DSO s in private practice, Paris, France*

[2] *Dr Gerard Guez, DDS, is in private practice, Paris, France*

Loading and Osseointegration

The remarkable success rates reported by longitudinal studies involving one-stage implants (ie, implantation accomplished via one surgical procedure) have eliminated one of the basic tenets of the original Brånemark technique: the covering of the implants, supposedly protecting them against early loads liable to ruin their osseointegration. Clinical studies have demonstrated that these same one-stage implants, when situated in the symphyseal sectors and covered by complete rebased dentures (ie, exerting pressures), had success rates comparable to those of two-stage implants. Clinicians thus recognized that immediate implant loading — when properly implemented in bone of good quality and sufficient implant stability was achieved — did not compromise osseointegration (Figures 1 through 10).

It appears that it is not early loading that creates the effect of fibrous encapsulation, but rather a certain degree of micromovements at the bone/implant interface[1] resulting from inadequate primary stability. Various experimental studies indicate that the range of tolerance of these micromovements is approximately 50 µm to 150 µm for rough surfaces[2-4] and about 100 µm for smooth machined surfaces.[5] Thus, the implant surface is not an indifferent factor in the process of bone healing. Rough surfaces appear to tolerate greater

Figure 1. Case 1. Preoperative view of a fractured maxillary lateral incisor in need of extraction.

Figure 2. Flapless extraction was carefully performed with an osteotome.

Figure 3. Osteotomy was performed without damaging the periodontal tissues.

micromovements and therefore could be placed under load at an earlier time.[1,6]

In light of these data and numerous clinical studies (Glantz, Randow, Chiapasco, Balshi-Wolfinger, Tarnow), immediate or early loading can be legitimately considered for cases with dense bone and when the implants are splinted. For its part, the "pseudoloading" of a single-tooth restoration in the aesthetic zone essentially requires perfect primary stability and complete occlusal arch support[7], which, in the absence of splinting, alone guarantees limited micromovements within the limits of tolerance.

The Factors of Primary Stability

Microscopic study of the bone/implant interface reveals that this coadaptation does not result from a "chemical bond."[8,9] The stability of an implant depends almost exclusively on the mechanical interlocking between the mineralized bone and the roughness of the implant surface. The obtaining and the optimizing of this interlocking involves a certain number of factors that include the bone factor, the implant design, and the surgical protocol.

The Bone Factor

Chemical studies have clearly shown the relationship between primary stability and bone density, as evaluated by the drilling torques.[10] In dense bone, the process of osseointegration does not modify implant stability, since primary stability was very good during stage I surgery.[10] Since osseointegration is no longer a prerequisite for the prosthetic phase, early loading may be justified in these cases, thus reducing the length of treatment.

Alternately, the stability of implants placed in bone of less density is inadequate, and it will be necessary to lengthen the period of healing beyond the norm. Osseointegration and subsequent loading increase this secondary stability, eventually raising it to a quality comparable to that of dense bone.[10] It is thus essential tobe able to identify, during preimplant study and surgery, the qualitative bone factors (eg, height, volume, density, thickness of the cortical plates) by tomodensitometric radiological examination (ie, CT scans). It is similarly imperative for clinicians to understand the values of the implant insertion torque, in order to determine the need for osseointegration and the ideal duration for it.

Figure 4. Fixture was positioned with an implant carrier in the ideal three-dimensional position.

Figure 5. The neck of the implant (Replace, Nobel Biocare, Yorba Linda, CA) was located 3 mm below the free gingival margin.

Figure 6. The machined abutment (Esthetic Abutment, Nobel Biocare, Yorba Linda, CA) was adjusted chairside according to the patient's occlusion to allow clearance for the restoration.

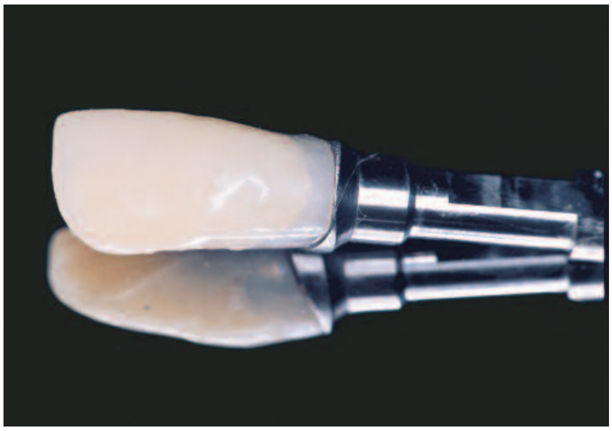

Figure 7. The provisional restoration was rebased on the abutment, which was placed on the implant analog. The margins were refined with flowable composite resin.

The Implant Design

Since primary stability depends directly on the contact surface between the implant and the bone, various morphological features have been recommended. These include the taper or "anatomical shape" of the implant body, so as to compress bone of lesser density (Replace, MkIII, MkIV, Nobel Biocare, Yorba Linda, CA; Frialit-2, Friatec, Irvine, CA) and optimize the stresses transmitted to the bone tissue. Lateral compression exceeding the tolerance limits might, however, produce a negative tissue response in the form of necrosis and bone resorption. The double spiral has also been recommended as a means of increasing the bone/implant contact surface. The length of the implant should likewise be sufficient to ensure a maximum bone anchoring and guarantee a favorable crown/implant ratio, preventing the system from creating a mobilizing lever arm effect.

The Surgical Protocol

In order to improve the implant stability when installing the implant, various techniques have been proposed, particularly in bone of lesser density that often occurs in the premaxilla. One involves the "undercalibration" of the implant site via insertion of a self-tapping implant[10]; a second uses the osteotome technique,[11] either by itself or as a supplement to conventional drilling, to compact cancellous bone and improve its density.

The use of root form implants (eg, Replace, Nobel Biocare, Yorba Linda, CA; Frialit-2, Friatec, Irvine, CA) is based on the same principle, that is, with the objective of laterally compacting the cancellous bone. It has been shown that the primary stability increases in proportion to the insertion torque[5,12], thus enhancing the implant's resistance to micromovements. For an early loading, minimum insertion torques of 35 Ncm through 50 Ncm have been proposed.[12,13]

Objective Evaluation of Implant Stability

This evaluation has long been considered subjective, since it is not based on quantitative methods: dental radiographs, percussion, resistance to screwing. Based on the studies of

Figure 8. Immediate postoperative result following extraction and placement. The emergence profile gently supported the interdental papillae.

Figure 9. Eight-day postoperative result demonstrated proper tissue healing during provisionalization.

Meredith on the resonance frequency analysis (RFA), clinicians now have an objective and quantitative method for assessing the stability and the osseointegration of implants.[14] This process measures stability by the application of microscopic flexural stress (most often functional clinical stresses undergone by implants).

The system consists of an autoclavable transducer that is secured to the implant or to the abutment, a frequency analyzer, a computer, and proprietary software. After stimulating the transducer, the resonance frequency of the system is recorded. This value is influenced by the characteristics of the implant, the bone volume, the bone quality, and - in particular - by the degree of rigidity at the bone/implant interface. The RFA will be able to evaluate the stability after installation of the implant as well as following osseointegration; it also monitors the decrease in rigidity at the bone/implant interface over time, thus allowing one to anticipate a possible implant failure even prior to its radiographic manifestation.[14] This is a determining factor in clinical evaluation and the decision-making process, indicating, for example, whether the implant can be early loaded or whether it should be submerged and undergo a longer period of healing. In the Osstell system, resonance frequency values have been translated into an index known as the Implant Stability Quotient (ISQ), which is easy to use in clinical practice and numbered from 0 to 100 (Table).

Clinical Considerations

Guidelines For Immediate Implantation

It is clear that immediate implantation can no longer be considered as an experimental technique. Numerous studies show medium- and long-term survival rates comparable to those for conventional techniques involving delayed implantation.[15-19] The clinical parameters (eg, appearance of tissues surrounding the implant, bleeding, probing) and histological parameters also demonstrate an identical appearance to those of delayed implants.[20,21] One of the principal advantages of the immediate technique is the prevention of postextraction bone resorption. According to Carlsson[22], this bone loss may affect approximately 23% of the anterior alveolar crest during the six months following extraction. The literature highlights additional clinical parameters required to optimize the potential for success:

Table

Clinical Translation of ISQ Values*

ISQ	Clinical Translation
< 50	Insufficient Stability
50 to 60	Good Stability
> 60	Excellent Stability

*For Replace (Nobel Biocare, Yorba Linda, CA) implants.

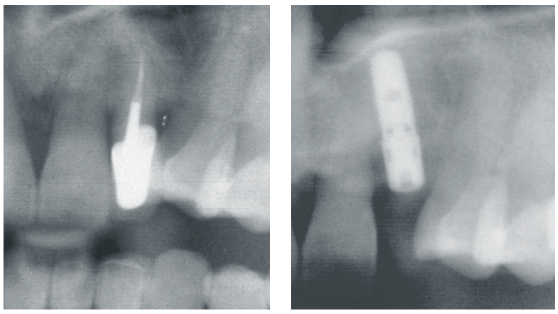

Figure 10A. Preoperative radiographic evaluation demonstrates the position of the fractured lateral incisor requiring extraction.
10B. Immediate postoperative radiograph demonstrates implant placement (Replace Select, Nobel Biocare, Yorba Linda, CA).

Figure 11. Case 2. Preoperative view following trauma and fracture of the incisor's root. Coronal fractures were also evident on the adjacent teeth, and the teeth were splinted together.

Figure 12. Flapless surgery was conducted, the implant was positioned, and chairside adjustment and connection of the sandblasted abutment was performed.

- Infection, possibly affecting the root being extracted, would represent a contraindication to the technique[14,22], as it is most often accompanied by apical or lateral bone loss that might impair primary stabilization and healing. It is important to evaluate the presence of this by clinical (eg, pain upon percussion, presence of exudate, fistula) and radiographic criteria. Chronic infection or granuloma without major bone loss might be acceptable in limited cases.
- The depth of osteotomy: It seems logical to insert an implant of sufficient length to ensure the best possible quality of anchoring. In any case, there seems to be a consensus in having the drilling limit at a minimum distance of 3 mm to 5 mm beyond the apical limit of the extracted tooth root in order to ensure sufficient primary stability.[15] There appears to be a consensus for an implant length of 12 mm to 13 mm for the maxillary incisors, for example.
- The gap that may remain between the cervical portion of the implant and the surrounding alveolar rim does not appear to require systematic filling, provided it does not exceed a value of approximately 1 mm.[23,24] In this regard, the use of a wide implant (at least in its crown portion) is desirable.[25] The selection of an overly wide implant may, however, eventually result in resorption of the interdental crestal bone with aesthetic repercussions. The minimum space between an implant and a natural tooth should remain 1.5 mm to 2 mm (Figures 11 through 18).
- The surgical technique: Raising a surgical flap compromises the bone vascularization and may result in marginal bone loss[26] and soft tissue recession with collapse of the interdental papillae, particularly in the presence of thin, scalloped gingiva.[27] Gomez-Roman demonstrated that a narrow mucoperiosteal flap preserving the papillae would produce considerably less significant crestal bone loss than a broad flap involving the entire papilla.[19] Thus, placement of an implant without flap elevation would minimize tissue loss. The lack of visibility of the bone site should, however, be compensated for through preoperative planning and CT scans. The success of this flapless technique depends on the clinicians' adherence to a particular protocol[25,28]:
- Alveolar crest with minimum thickness of 6 mm.
- Prudent extraction.
- Use of a surgical guide to compensate for the lack of vision.
- Drilling of the implant site guided by surgeon's finger, which is placed on the buccal gingival wall to prevent possible perforation.
- Use of the palatal wall as a drilling guide.
- Possible use of an osteotome to compact the maxillary bone.[11]
- The integrity of the vestibular bone wall should be constantly checked with a probe during the surgery.

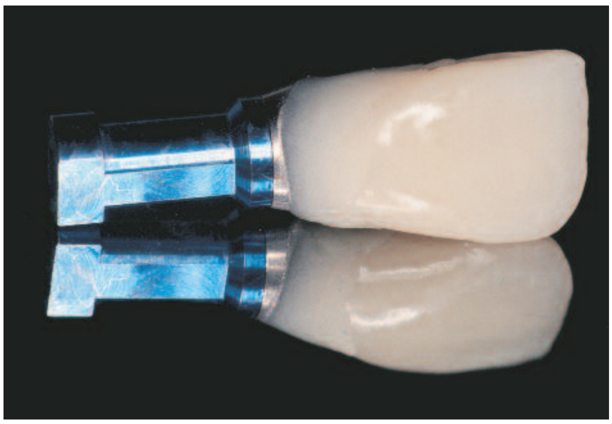

Figure 13. Margins were refined on the analog in order to allow optimal precision and emergence profile.

Figure 14. The emergence profile was completed. The provisional restoration was sandblasted and covered with a light-cured varnish (Palaseal, Heraeus Kulzer, Armonk, NY).

Figure 15. Facial view immediately following flapless surgery and implant placement.

Figure 16. One-week postoperative view of the provisional restoration with optimal tissue healing. The length of the provisional restoration was slightly reduced to protect the implant during incisal guidance.

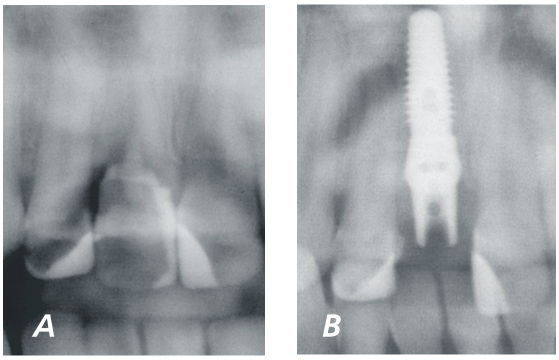

Figure 17A. Preoperative radiograph demonstrates the extent of anterior root fracture.
17B. Postoperative evaluation prior to placement of the definitive crown restoration demonstrated functional implant integration.

Stability of the Peri-Implant Tissues — Provisionalization

The soft peri-implant tissues are subject to recession of approximately 0.6 mm to 1 mm.[29,30] This presumably generally occurs during the first three months postsurgery.[30] It therefore seems appropriate for the clinician to observe a temporization period of at least six months before proceeding with the final prosthetic restoration.[29] This period of provisionalization also enables management of the emergence profile and preservation of the papillae.[31] Standard implants should result in three times less crestal resorption than do wide implants.[32]

In a study of single-tooth restorations,[29] the one-year measurement of the distance between the most apical portion of the contact surfaces and the bone level yielded mean values of less than 5 mm for natural teeth and 8 mm to 9 mm for the implants. It is the level of this interdental crestal bone that is crucial to the preservation of the papillae. The "microgap" corresponding to the prosthetic joint (ie, cervical limit of the abutment) should be located at a minimum distance of 2 mm from the bone crest to allow the "biologic width" to be established.[33]

Immediate Replacement

Research on the preservation of the tissue architecture, the reduction of surgical sequences, the augmentation of patient comfort during provisionalization, and greater aesthetic requirements[31] have led many practitioners to consider immediate replacement of the missing or freshly extracted tooth. Studies and clinical reports alike demonstrate the increasing interest of dental professionals in this technique for the aesthetic zone.[34-37] These various studies allow the authors to develop and to present a set of criteria for evaluation and implementation that should be rigorously followed to optimize the chances for success of the technique.

One point of discussion concerns the decision to treat healed sites or fresh sockets. In a retrospective study of five years (with

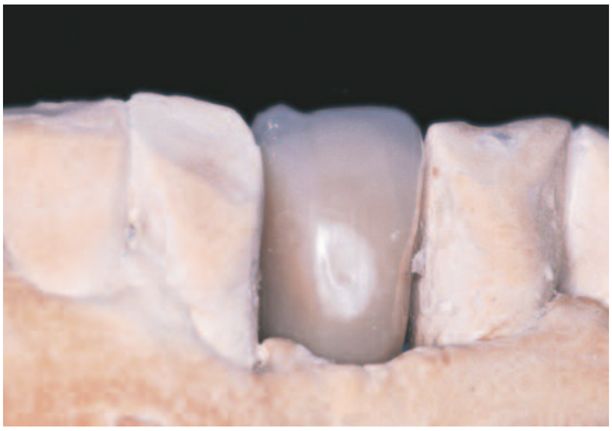

Figure 18. Case 3. The provisional restoration was splinted to the adjacent teeth for maximum immobilization and to limit micromovements.

Figure 19. The adjacent teeth were used to stabilize each side of the restoration during immediate provisionalization.

Figure 20. Polyethylene fibers (Connect, Kerr/Sybron, Orange, CA) were used to reinforce the composite splint.

Figure 21. Note the appearance of the provisional restoration, which served as a prototype for the definitive restoration.

Figure 22. Buccal view of the immediately provisionalized and splinted restoration placed after stage I surgery.

Figure 23. Occlusal view of the splint, which served to reduce micromovements and limit the stresses imposed on the immediate restoration.

an average real clinical perspective of 24 to 30 months) involving 233 implants, an overall success rate of 95.5% was presented.[35] All failures involved extractions with immediate implant placement and were attributed to either infection of the extraction site or insufficient primary stability. The authors confirmed that predictability of the treatment was greater in healed sites versus fresh sockets, as did Malo et al who also found that failure was due primarily to the infection of the

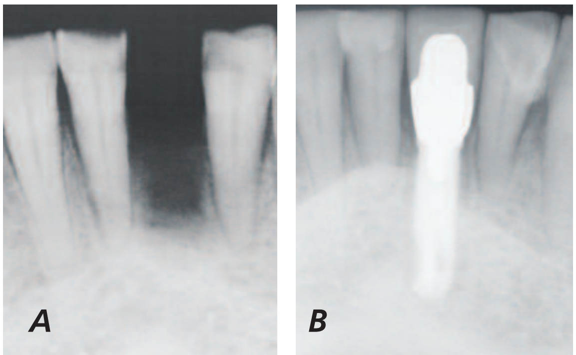

Figure 24A. Preoperative radiograph of the mandibular dentition following extraction of tooth #24 (31).
24B. Postoperative radiograph demonstrates natural implant integration following placement of the definitive restoration.

extracted teeth.[37] Although the occlusal contacts had been eliminated, Malo et al also observed several crown fractures, which indicated that there are certain constraints on these restorations during provisionalization and that primary stability was critical to success.

Choquet et al used a specific surgical technique in which all the implant sites (n = 37) were systematically prepared with the combination of 2-mm pilot drills and Summers osteotomes.[38] All the implants were inserted with a minimum torque of 40 Ncm. The results of this prospective study at one year revealed two early failures in premolar sites, probably due to the use of implants with inappropriate morphology for the site (MkIII in a bone of low density and MkIV in a dense bone) (Figures 19 through 24).

Hui et al present a preliminary report (13 to 15 months) of a prospective study involving 24 single-tooth implants.[13] No implant was lost during this period. No implant underwent marginal bone loss greater than 0.6 mm. It was not possible to find any difference between the healed sites and the immediate implantations. All the implants were installed by finding a bicortical anchoring with a minimum controlled insertion torque value (40 Ncm to 50 Ncm) to ensure an optimal primary stability. The authors concluded that absolute control of the primary stability was imperative to the success of the procedure.

Clinical Implications

It follows from this analysis that objective control of implant stability (eg, via RFA), in combination with the application of a controlled insertion torque, is essential for confirming the possibility of immediate replacement as early as the installation of the implant. Furthermore, it seems advisable that, whenever technically possible, the implant should be splinted with the adjacent natural teeth in order to limit micromovement at the bone/implant interface. The connection to two or three adjacent teeth on each side of the implant, with fibers and composite, for example, significantly reduces the physiological lateral mobility of a periodontally healthy natural tooth, which lies in the range of 56 µm to 108 µm. The containment, besides its effect of distributing the stresses among all the solidified elements, has the advantage of changing the orientation of the stresses. The direction of a lateral constraint gradually approaches that of the major axis of the teeth when its surface of application becomes more extensive.

Conclusion

In a previous article on the immediate replacement of a single tooth, the authors wrote: "Since the maintenance of the existing anatomical structures is easier than their re-creation, it has even been advocated to perform provisionalization with a pseudoloaded prosthesis immediately following stage I surgery in immediate tooth replacement although this procedures is still experimental."[31] Immediate replacement, while no longer experimental, nevertheless remains challenging and requires careful case selection (ie, preimplant identification of unfavorable factors), a rigorous observance of the criteria for success, flawless technical execution, serious collaboration with the patient, and strict professional maintenance.

Long-term multicenter prospective studies would be useful in confirming the reliability of the technique, identifying factors to optimize it, and to define its limitations. The evolution toward the combination of immediate implantation and early loading techniques, however, appears to represent the most adequate solution for solving concerns inherent in single-tooth replacement for the aesthetic zone. Progress in the areas of implant design (ie, scalloped neck), surgical technique, and strict control of the implant stability will help further increase the reliability of this technique.

Reprinted with permission from Practical Procedures & Aesthetic Dentistry.

*Touati B, Guez G. Immediate implantation with provisionalization: from literature to clinical implications. Pract Proced Aesthet Dent 2002;**14(9)**:699-707*

References

1. Szmukler-Moncler S, Piattelli A, Favero GA, Dubruille JH. Considerations preliminary to the application of early and immediate loading protocols in dental implantology. Clin Oral Impl Res 2000;11(1):12-25.
2. Cameron CE. The cracked tooth syndrome: Additional findings. J Am Dent Assoc 1976;93(5):971-975.
3. Soballe K. Hydroxyapatite ceramic coating for bone implant fixation. Mechanical and histological studies in dogs. Acta Orthop Scand Suppl 1993;255:1-58.
4. Vaillancourt H, Pilliar RM, McCammond D. Finite element analysis of crestal bone loss around porous-coated dental implants. J Appl Biomater 1995;6(4):267-282.
5. Brunski JB. Biomechanical factors affecting the bone-dental implant surface. Clin Mater 1992;10(3):153-201.
6. Taborelli M, Jobin M, Francois P, et al. Influence of surface treatments developed for oral implants on the physical and biological properties of titanium. (I) Surface characterization. Clin

Oral Impl Res 1997;8(3):208-216.
7. Ericsson I, Nilson H, Lindh T, et al. Immediate functional loading of Brånemark single tooth implants. An 18 months' clinical pilot follow-up study. Clin Oral Impl Res 2000;11(1):26-33.
8. Sennerby L, Thomsen P, Ericson LE. A morphometric and biomechanic comparison of titanium implants inserted in rabbit cortical and cancellous bone. Int J Oral Maxillofac Impl 1992; 7(1):62-71.
9. Albrektsson T, Eriksson AR, Friberg B, et al. Histologic investigations on 33 retrieved Nobelpharma implants. Clin Mater 1993; 12(1):1-9.
10. Friberg B, Sennerby L. Grondahl K, et al. On cutting torque measurements during implant placement: A 3-year clinical prospective study. Clin Impl Dent Relat Res 1999;1(2):75-83.
11. Summers RB. A new concept in maxillary implant surgery: The osteotome technique. Compendium 1994;15(2):152,154-156.
12. Brunski JB. Avoid pitfalls of overloading and micromotion of intraosseous implants. Dent Impl Update 1993;4(10):77-81.
13. Hui E, Chow J, Li D, et al. Immediate provisional for single-tooth implant replacement with Brånemark system: Preliminary report. Clin Implant Dent Relat Res 2001;3(2):79-86.
14. Meredith N, Shagaldi F, Alleyne D, et al. The application of resonance frequency measurements to study the stability of titanium implants during healing in the rabbit tibia. Clin Oral Impl Res 1997;8(3):234-243.
15. Schwartz-Arad D, Chaushu G. Placement of implants into fresh extraction sites: 4 to 7 years retrospective evaluation of 95 immediate implants. J Periodontol 1997;68(11):1110-1116.
16. Schwartz-Arad D, Doley E. The challenge of endosseous implants placed in the posterior partially edentulous maxilla: A clinical report. Int J Oral Maxillofac Impl 2000;15(2):261-264.
17. Polizzi G, Grunder U, Goene R, et al. Immediate and delayed implant placement into extraction sockets: A 5-year report. Clin Impl Dent Relat Res 2000;2(2):93-99.
18.Huys LW. Replacement therapy and the immediate post-extraction dental implant. Impl Dent 2001;10(2):93-102.
19. Gomez-Roman G, Kruppenbacher M, Weber H, Schulte W. Immediate postextraction implant placement with root-analog stepped implants: Surgical procedure and statistical outcome after 6 years. Int J Oral Maxillofac Impl 2001;16(4):503-513.
20. Bragger U, Hammerle CH, Lang NP. Immediate transmucosal implants using the principle of guided tissue regeneration (II). A cross-sectional study comparing the clinical outcome 1 year after immediate to standard implant placement. Clin Oral Impl Res 1996;7(3):268-276.
21. Barzilay I, Graser GN, Iranpour B, et al. Immediate implantation of pure titanium implants into extraction sockets of Macaca fascicularis. Part II: Histologic observations. Int J Oral Maxillofac Impl 1996;11(4):489-497.
22. Carlsson GE, Bergman B, Hedegard B. Changes in contour of the maxillary alveolar process under immediate dentures. A longitudinal clinical and x-ray cephalometric study covering 5 years. Acta Odontol Scan 1967;25(1):45-75.
23. Park KB, Han TJ, Kenney B. Immediate implant placement with immediate provisional crown placement. Three case reports. Pract Proced Aesthet Dent 2002;14(2):147-154.
24. Wilsson-Rahmberg M, Olovson SG, Forshult E. Method for long-term cerebrospinal fluid collection in the conscious dog. J Invest Surg 1998;11(3):207-214.
25. Schwartz-Arad D, Chaushu G. Immediate implant placement: A procedure without incisions. J Periodontol 1998;69(7):743-750.
26. Bragger U, Hafeli U, Huber B, et al. Evaluation of postsurgical crestal bone levels adjacent to non-submerged dental implants. Clin Oral Impl Res 1998;9(4):218-224.
27. Becker W, Becker BE, Israelson H, et al. One-step surgical placement of Brånemark implants: A prospective multicenter clinical study. Int J Oral Maxillofac Impl 1997;12(4):454-462.
28. Proussaefs P, Kan J, Lozada J, et al. Effects of immediate loading with threaded hydroxyapatite-coated root-form implants on single premolar replacements: A preliminary report. Int J Oral Maxillofac Impl 2002;17(4):567-572.
29. Grunder U. Stability of the mucosal topography around single-tooth implants and adjacent teeth: 1-year results. Int J Periodont Rest Dent 2002;20(1):11-17.
30. Small PN, Tarnow DP. Gingival recession around implants: A 1-year prospective study. Int J Oral Maxillofac Impl 2000;15(4): 527-532.
31. Touati B, Guez G, Saadoun A. Aesthetic soft tissue integration and optimized emergence profile: Provisionalization and customized impression coping. Pract Periodont Aesthet Dent 1999;11(3):305-314.
32. Small PN, Tarnow DP, Cho SC. Gingival recession around wide-diameter versus standard-diameter implants: A 3- to 5-year longitudinal prospective study. Pract Proced Aesthet Dent 2001; 13(2):143-146.
33. Kinsel RP, Lamb RE, Moneim A. Development of gingival esthetics in the edentulous patient with immediately loaded, single-stage, implant-supported fixed prostheses: A clinical report. Int J Oral Maxillofac Impl 2000;15(5):711-721.
34. Wöhrle PS. Single-tooth replacement in the aesthetic zone with immediate provisionalization: Fourteen consecutive case reports. Pract Periodont Aesthet Dent 1998;10(9):1107-1114.
35. Ericsson I, Nilson H, Lindh T, et al. Immediate functional loading of Brånemark single tooth implants. An 18 months' clinical pilot follow-up study. Clin Oral Impl Res 2000;11(1):26-33.
36. Kan JY, Rungcharassaeng K. Immediate placement and provisionalization of maxillary anterior single implants: A surgical and prosthodontic rationale. Pract Periodont Aesthet Dent 2000;12(9):817-824.
37. Malo P, Rangert B, Dvarsater L. Immediate function of Brånemark implants in the esthetic zone: A retrospective clinical study with 6 months to 4 years of follow-up. Clin Impl Relat Res 2000; 2(3):138-146.
38. Choquet V, Hermans M, Adriaenssens P, et al. Clinical and radiographic evaluation of the papilla level adjacent to single-tooth dental implants. A retrospective study in the maxillary anterior region. J Periodontol 2001; 72(10):1364-1371.