Case Report

Rehabilitating the Failing Dentition: Full-Arch Immediate Placement, Immediate Load Therapy

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ABSTRACT: *Implants have become an important component of the dental armamentarium. Implants have customarily been installed and remained unloaded for a period of time in order to promote bone attachment to the surface. Multiple surgeries and provisionals were required, resulting in additional treatment time and costs. More recently, however, full-arch immediate placement, immediate load therapy has presented a new alternative. Eliminating the problems associated with serial extractions and full dentures, immediate loading also has the added benefit of allowing the patient to go from a failing dentition to a repaired one within 48 hours. The purpose of this article is to establish a rationale and protocol for rehabilitating the failing dentition utilizing an immediate load approach.*

The predictability of dental implants has been well-documented with long-term studies in refereed journals.[1,2] Recent consensus conferences have validated their use in many clinical settings.[3,4] Implants have become an important tool in clinicians' armamentarium. They are used to replace a single tooth, a segment of an arch, as anchors for an overdenture, in orthodontics, or to restore a full arch with a fixed prosthesis.

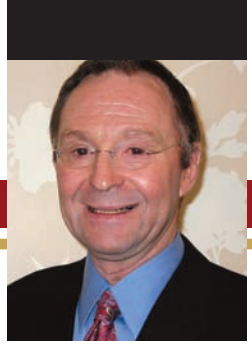
Classically, implants were installed and remained unloaded for a period of time to allow bone to attach to the surface. The original machined titanium surfaces needed three to six months before they could receive an occlusal load.[5] Microroughened surfaces require less time to be restored.[6] In fact, only four weeks is necessary before loading some of the newest surfaces.[7]

The concept of immediately loading a full arch can be traced to Schnitman, who installed additional implants in an edentulous mandible in order to protect other healing implants from micromotion.[8] Since then, many authors have demonstrated success utilizing an immediate load protocol to treat a full arch.[9-11] However, in most cases, the arch was already edentulous. Jaffin and associates demonstrated that at 60 months, there was no difference in crestal bone levels between immediately loaded implants and those with a delayed loading protocol.[12] They also showed no difference in crestal bone height between implants placed in healed bone or in fresh extraction sockets in immediately loaded cases.

Numerous patients develop progressively failing dentition. Multiple etiologies are evident (eg, fear of dental treatment, downhill periodontal health, high susceptibility to caries, failing prostheses, unsuccessful endodontic therapy, genetic disorders). These patients will lose their teeth and either require a full denture, implant-supported overdenture, or a full-arch implanted-supported prosthesis.

Classically, patients who were losing their dentition and committed to a full-arch implant-supported restoration either went into a full denture while the implants were healing or underwent

FIGURES 1A THROUGH 1C A 55-year-old female presented with displeasing esthetics, shifting of the maxillary teeth, and failing periodontal health.



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serial extractions. The challenge with wearing a full denture over healing implants is that the denture can create micromotion, which may lead to implant and/or bone loss.

Serial extraction involves saving enough teeth to place a full-arch provisional fixed restoration, extraction of the remaining teeth, and either installing implants in the sockets or permitting the sockets to heal before placing the implants. This treatment provides an ideal way to avoid wearing a denture. However, many disadvantages are evident. The selected abutment teeth frequently preclude the placement of all the implants required. As a result, a second series of extractions and implant surgery would be necessary. Therefore, a second and possibly third provisional bridge would need to be fabricated when the implants integrate and the remaining teeth are extracted. These provisionals frequently require adjustment and/or repair. Multiple surgeries and provisionals will increase the time (ie, as long as two years) and cost involved with the case.

With immediate loading, the patient benefits by going from a failing dentition to a repaired one within 48 hours, and the problems associated with serial extractions and full dentures are eliminated. Jaffin and associates,[13] Ganeles and associates,[14] and others have shown success rates of more than 90% on full-arch cases.

The implants to be installed must offer a microroughened surface so they integrate as quickly as possible to reduce the likelihood of overload. The primary stability of the implant comes from the frictional bond between the bone and the screw. This diminishes over time as new bone forms and existing bone resorbs. Therefore, the sooner osseointegration occurs, the sooner patient interference ceases to be a concern.

TREATMENT PLANNING

Once it has been established that the teeth are beyond repair, extensive presurgical planning by the restorative dentist and surgeon must be undertaken to ensure a smooth process the day of surgery. The restorative dentist must perform a prosthetic evaluation (ie, esthetic parameters, smile line, midline, tooth proportion, tooth position, lip support, phonetics, type of occlusion, tooth length). In addition, the amount of soft tissue loss and the patient's occlusal patterns and habits must be taken into consideration. The patient's esthetic expectations and psychological make-up must also be acknowledged (Figures 1a through 1c). This work-up will determine whether the case can be loaded immediately and whether a hybrid or crown and bridge type prosthesis, cement- or screw-retained, or direct or indirect technique (implant must be indexed) will be utilized (Figures 2 and 3).

FIGURE 2 The teeth were prepared on a cast.

FIGURE 3 A wax-up cast was prepared.

FIGURES 4A AND 4B Templates were fabricated for use during implant surgery.

Templates must be fabricated. If the patient is going to be scanned, radiopaque markers can be added to the stent so the patient can wear it during computerized tomography (CT). The templates will be used during implant surgery. One should be an omnivac that will cover the palate or have a positive seat in the mandible. The other stent should be reinforced with a non-pliable material with the buccal half of the teeth cut away and a 2.0-mm groove in the center of the tooth where the bur can be placed (Figures 4a and 4b). During the planning stage, it is advisable to attempt to retain during surgery one tooth, preferably a molar, on each side of the arch to help stabilize the template and aid with biting.

Radiographic evaluation should begin with a full series of parallel periapical radiographs (Figure 5). From these, crestal

FIGURE 5 Radiographic evaluation should encompass a full-mouth series of radiographs.

bone levels, apical bone volume, root proximity, and periapical pathology can be observed. Anatomic structures (eg, the mandibular canal and maxillary sinuses) can also be viewed. If the periapicals do not reveal the above, an interactive CT is recommended.

The interactive CT provides a more accurate assessment of the bone and teeth. Precise distances can be measured, including tooth length, apical bone, distance to the mandibular canal, and implant size. The density of the bone adjacent to the implant, a key determinant for successful immediate loading, may be determined, as can interimplant position to determine parallelism of the implants. In this manner, the entire case may be planned beforehand, ensuring a greater degree of predictability and success (Figures 6a through 6d).

Individual sites are selected so that at least 8.0 mm of the implant is embedded in bone with a density greater than 375 to 400 Hounsfield units (Figure 6b). Adjacent maxillary anterior implants are avoided to reduce esthetic complications and restorative difficulties. A distance of 2.0 mm to 3.0 mm must be present between adjacent implant shoulders (Figure 6a).

The primary goal is to supply sufficient foundation to support a full arch of teeth for the immediate load and final restoration (ie, 10 to 12 teeth). In the maxilla, six implants are recommended and in the mandible, four to six. Placing an insufficient number of implants will lead to overload and implant loss. By installing more than six implants in an arch, passivity of the provisional bridge becomes an issue.

In the mandible, the ideal positions for six implants are first molar, first bicuspid, and lateral incisors; if four are to be placed, the ideal positions are first bicuspids and lateral incisors. If the mandibular cuspids are fresh extraction sites, they are not considered primary implant sites due to the diameter and length of the root and the thin buccal plate. If the location of the mandibular canal precludes placing an implant of 8.0 mm in length, then all implants are placed at least 5.0 mm anterior to the mental foramen to avoid the canal and anterior loop. Due to its anatomy, parallelism of the implants is generally achievable in full mandibular cases.

In the maxilla, the first molar, first bicuspid, and lateral incisor sites are ideal to produce a 12-tooth arch. However, the first molar is rarely available as an implant location without augmentation. Therefore, the second bicuspid site is the most common distal implant position in immediate load cases. If the cuspid is a fresh extraction, the socket is generally

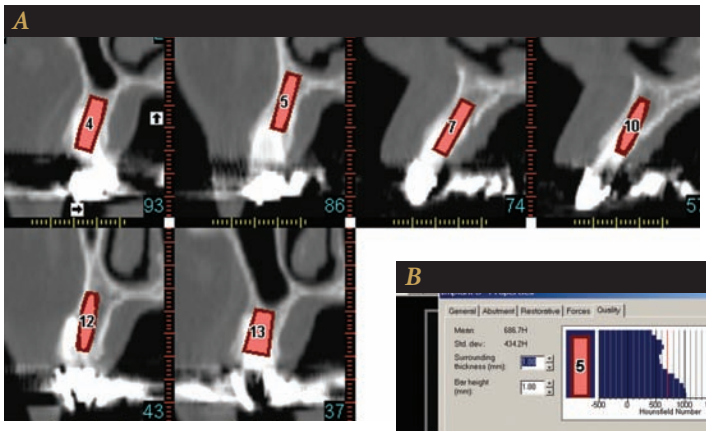


FIGURE 6A Computerized tomography (CT) evaluation, including site analysis and three-dimensional views (eg, cross-sections of six sites), provides a more accurate assessment of the bone and dentition. The entire case may be planned prior to treatment to ensure predictability and success.

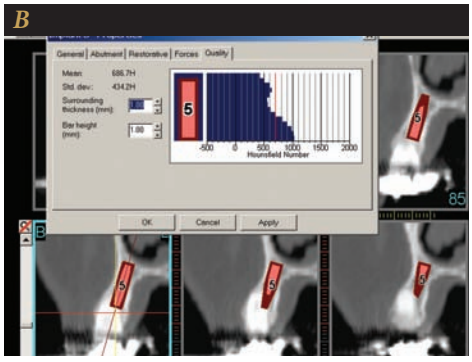
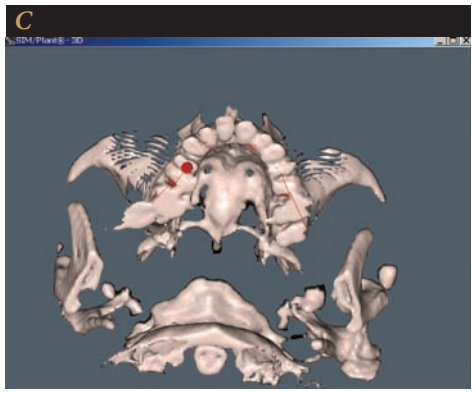


FIGURE 6B Individual sites are selected (eg, site No. 5 with density measurement noting density of the apical portion of the implant) so that at least 8.0 mm of the implant is embedded in bone with a density greater than 375 to 400 Hounsfield units.

too wide and deep and has a thin buccal plate; it offers a poor site for an immediately loaded implant. The lateral incisors provide the ideal anterior position because they are not adjacent to each other, and the socket with a thick palatal wall offers excellent stability for the implant.

Implant parallelism from right to left sides is usually not achievable due to the resorptive pattern of the maxilla. This can be visualized using the three-dimensional view in the interactive CT program. There are many ways to compensate for this. If a cement-retained provisional is planned, the implants on each side are installed parallel, the provisional is fabricated in two pieces (ie, right and left), then luted in the mouth at the middle. If a screw-retained provisional is planned, the implants at the lateral incisor sites are placed parallel, with the screw access chambers in the cingulum. The posterior sites are parallel to each other on each side, with the access channels in the central fossa. *Note: this will become important in the final restoration.* If a one-piece, cemented provisional is planned, angled abutments likely will be necessary (Figures 6c and 6d).



FIGURES 6C AND 6D *Planning for implant parallelism from right to left sides is possible by employing the three-dimensional view in the interactive CT program.*

In the presurgical planning phase, all contingencies must be anticipated. A patient who is dentate and having his or her teeth extracted expects to have "new" teeth placed that day or soon thereafter. If there is any doubt that the case may not be loaded, a denture must be readily available as an alternative. Implant sites are never prepared for the largest possible size in the event that a "rescue" implant becomes necessary. Templates with sleeves are not used because if there were a change in angulation due to loss of a site, the template would be rendered useless. Therefore, the template must accurately give tooth position without limiting implant angulation.

SURGERY

The patient should be premedicated with an appropriate antibiotic (eg, amoxicillin 2.0 gm) one hour prior to treatment. Extractions, including sectioning of molars, should be performed as atraumatically as possible. All sockets should be thoroughly debrided. An antiseptic scrub (eg, chlorhexidine gluconate 2%) should be applied throughout the oral cavity. The templates are then checked to verify a positive seat. The patient is draped for implant surgery.

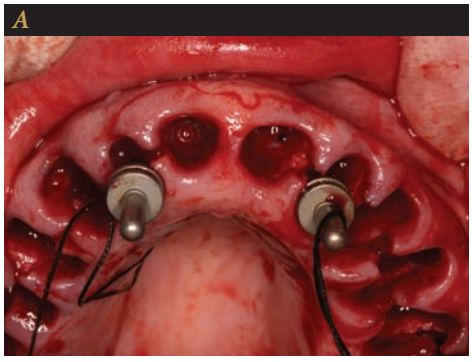
As a general rule, selected sites should have the best bone while avoiding anterior adjacent implants. The anterior sites are prepared first. Sharp new burs are employed to avoid chattering, which can shatter a site. In general, if all walls are present, no augmentation will be required.

In the mandible, once the teeth have been extracted and the patient draped, the ridge should be flattened to avoid ridge height discrepancies so that the implant shoulders will be at an equal height. The template is placed in the mouth and the anterior sites are prepared. If the case is going to be screw-retained, the access holes will be on the cingulum. If a cement-retained prosthesis is planned, the implant should line up to the incisal edge. This is verified with the clear ominivac stent.

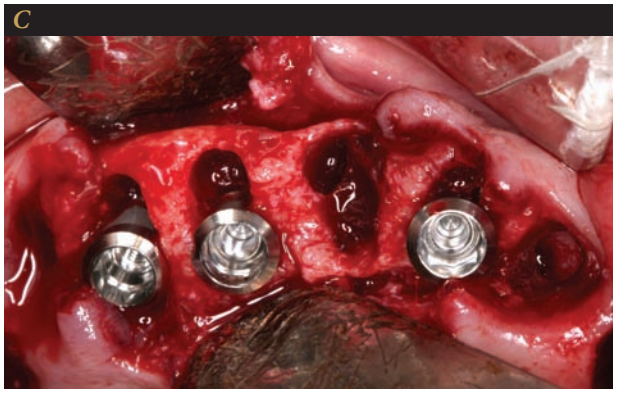
The posterior sites are subsequently prepared utilizing the solid template with the buccal grooves. Parallelism is generally attainable and can be verified with directional indicators and the clear template. Once the sites have been prepared and the implants installed, a visual check will determine whether bone covers any part of the implant shoulder. Should this occur, a bone mill would reduce the excess. If significant scallop to the socket exists, chisels may also be required.

In the maxilla, the surgery is typically more difficult in the anterior segment. The apices of the lateral incisors generally have a distal cant, so care must be taken to ensure the implants do not emerge from the interproximal (ie, lateral/central) areas. The initial access hole should be in the palatal bone approximately two-thirds of the way toward the apex of the socket. The solid template with grooves is helpful in attaining these positions. If a screw-retained prosthesis is planned, the access holes must emerge from the cingulum. If a cement-retained restoration is planned, the solid abutment should line up to the incisal edge. This is verified with the clear stent (Figures 7a and 7b).

Posterior implant placement will depend upon the type of restoration to be fabricated. If cement-retained, the posterior



FIGURES 7A AND 7B *During implant surgery, a solid template is helpful for attaining proper directional indicators.*



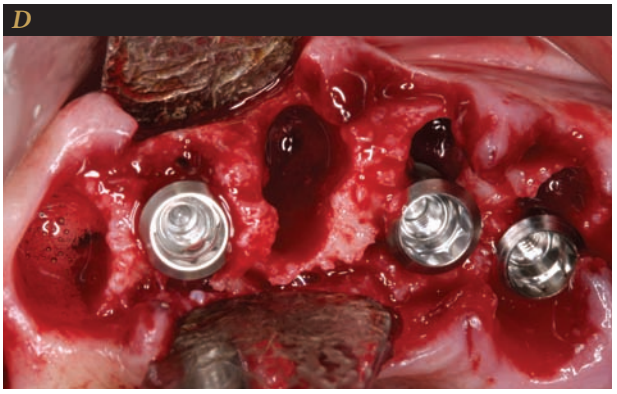


FIGURE 7C THROUGH 7E Given that many of the implants are sitting in sockets that are scalloped, caution must be taken to remove any bone over the implant shoulder, since this could preclude proper seating of the impression or the temporary cylinder. A bone profiler and chisels will be required for this purpose.

implants must be parallel to the anterior implant on that side. Since there is a labial flare to the premaxilla, the posterior implants will either have an anterior tilt or angled abutments will be necessary. Screw-retained prostheses permit vertical placement of the implants in the posterior sockets, since lack of parallelism can be compensated for in the bridge.

Considering that many of the implants are sitting in scalloped sockets, great care must be taken to remove any bone over the implant shoulder, which could preclude proper seating of the impression or temporary cylinder. This will require the use of a bone profiler and chisels (Figures 7c through 7e).

PROSTHETICS

A. Screw-retained Provisional

Once the implants have been placed, the shoulder and internal configuration should be free of tissue and blood. Solid abutments are loosely connected to the implants, and a bite is taken with a fast-setting registration mousse (Figures 8a and 8b). Any teeth that may have been retained to help establish a bite and vertical may now be extracted. An implant-level open tray impression utilizing a heavy body material is taken (Figure 9). Large healing covers, lubricated with an antibiotic ointment[a] or petroleum jelly, are gently affixed to the implants (Figure 10). The flaps are loosely sutured.

Analogs are connected to the impression cylinders and the model is poured. The casts are mounted with the aid of the

[a] Neosporin®, Johnson & Johnson Products Company, Morris Plains, NJ

FIGURES 8A AND 8B Solid abutments are connected to the implants, and a bite is taken with a fast-setting registration mousse.

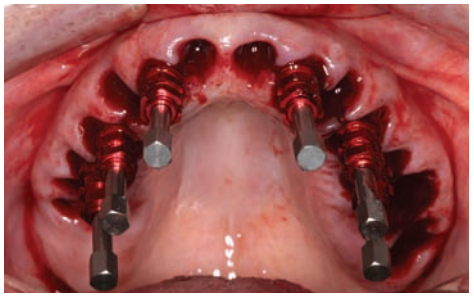


FIGURE 9 An implant-level open tray impression is taken.

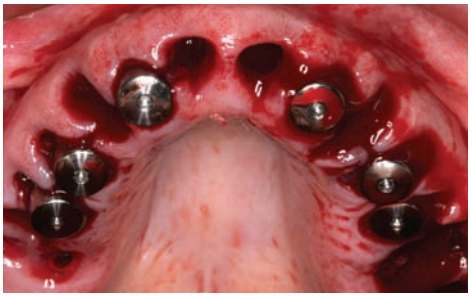
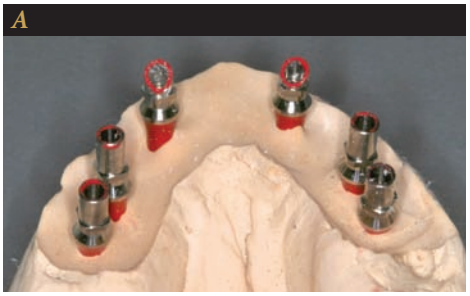
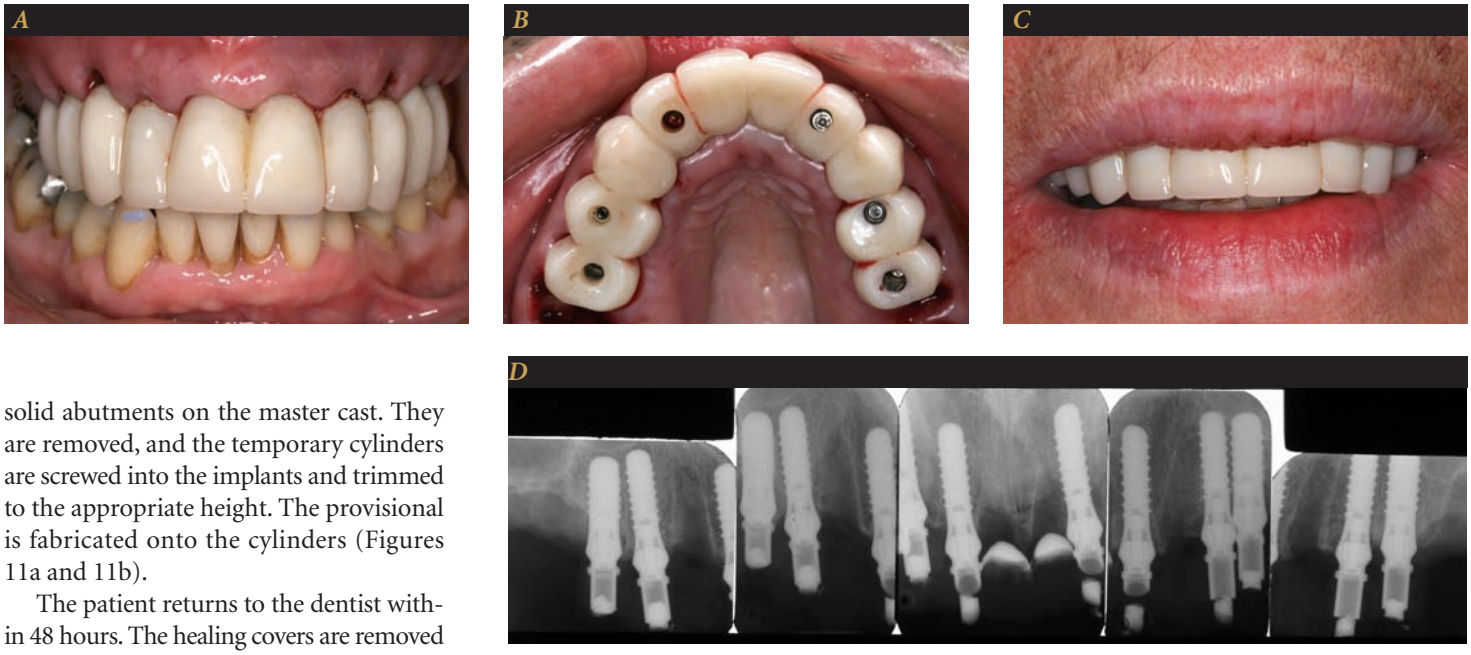


FIGURE 10 Healing covers are placed on the implants.



FIGURES 11A AND 11B After analogs are connected to the impression cylinders and the model is poured, the cast is mounted with the aid of solid abutments on the master cast. They are removed, and the temporary cylinders are screwed into the implants and trimmed to the appropriate height; the provisional is fabricated onto the cylinders.



FIGURES 12A THROUGH 12D The patient returns to the dentist within 48 hours. In this instance, the provisional was placed at 24 hours. The healing covers were removed, the provisional was seated, and radiographs were taken to confirm seating. Screws were hand-tightened, and access holes were covered with cotton and a temporary filling material. The occlusion was checked for bilateral simultaneous contact, with no interferences in lateral excursions. The occlusion was rechecked over the next week.

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The patient returns to the dentist within 48 hours. The healing covers are removed and the provisional is seated. Radiographs are taken to confirm seating. The screws are hand-tightened, and the access holes are covered with cotton and a temporary filling material. The occlusion is checked for bilateral simultaneous contact, with no interferences in lateral excursions. The occlusion is rechecked over the next week (Figures 12a through 12d).

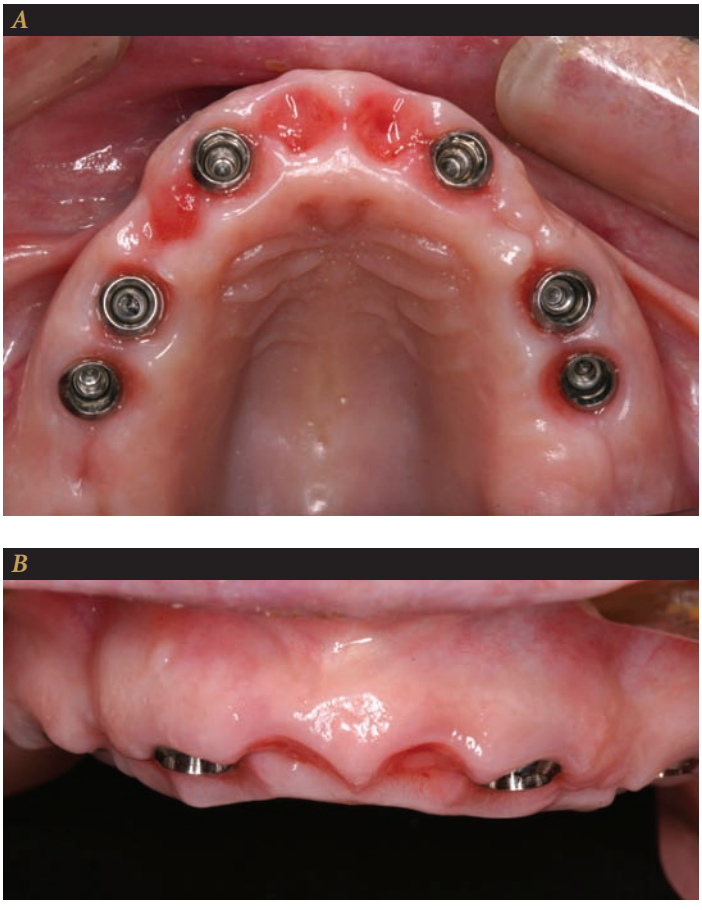
The patient is instructed to remain on a soft diet for six weeks. At one week, sutures are removed. At the next visit (ie, six weeks later), the bridge is removed and the implants are checked for integration. If the implants are tight and the patient is asymptomatic, he or she is directed to return to a normal diet. If any implants are loose, they are replaced with a wider/longer implant and the bridge is reinserted but not attached to the "rescue" implant.

At 12 weeks, the bridge is removed and all implants are torqued to 35 Ncm. Radiographs are taken. If the implants tolerate the torque test, fabrication of the final restoration may commence (Figures 13a and 13b; 14a and 14b).

B. Cement-retained Provisional

The implant shoulder and internal configuration are cleared of blood and tissue. Solid abutments are placed with hand torque after selecting the appropriate height. Temporary cylinders are placed on the abutments. The acrylic shell is then luted with acrylic to the temporary cylinders at the proper vertical dimension and bite, then removed from the mouth so it can be carved and polished. While this is occurring, either impression cylinders or healing covers are placed on the implants to avoid collapse of the soft tissue over the implants. The provisional is fabricated with care to finish the acrylic to the shoulder of the implant. The implant covers are removed, and the provisional is seated and cemented. All excess cement is carefully removed.

Should an angulation discrepancy occur, an implant-level impression is taken to select the proper components. A bite is captured and the impression is poured. Healing covers are placed on the implants.



FIGURES 13A AND 13B At 12 weeks when tissues had healed, the bridge was removed and all implants were torqued to 35 Ncm.

FIGURES 14A AND 14B If the implants pass the torque test, the final restoration is fabricated.

The casts are mounted. The appropriate abutments are selected and indexed with a jig. The provisional is fabricated. The patient returns to the dentist, who removes the healing covers and, with the aid of the jig, places the abutments with hand torque. *Note: if an angled abutment receives too much torque, the implant may rotate, which would alter the angulation of the abutment.* Once the abutments are in place, the provisional is seated and cemented.

The patient follows the same dietary and postoperative instructions previously outlined. At 12 weeks, radiographs are taken and the implants are torqued to 35 Ncm. If the patient is asymptomatic and passes the torque test, the final restoration may commence. In such cases the soft tissue has thoroughly healed around a properly contoured provisional restoration while the implants were integrating. Therefore, the final impression could then be taken.

CONCLUSION

A predictable protocol has been developed to transform an arch of highly unsatisfactory teeth to a fixed implant prosthesis utilizing immediately placed, immediately loaded implants. This technique has been successfully employed on more than 200 arches in the author's practice. The implant success rate exceeds 97% on the mandible and 92% in the maxilla. The immediate load protocol permits patients who are losing their teeth to be transitioned into implants and remain in fixed dentitions while foregoing multiple surgeries and provisionals.

The major cause of implant failure is micromotion. This is created by patient interference (ie, eating a hard diet during the four to six weeks after implant placement) or as a result of an improperly fitted provisional restoration.

Extensive presurgical planning is vital to ensure a successful case and prevent sequelae. If one or even two implants fail to integrate, they may be replaced while the patient continues to wear the provisional bridge.

The concept of utilizing two surgical templates offers the convenience of being able to prepare osteotomy sites while visualizing the bur with the buccal half of the template cut away. Templates with sleeves offer the benefit of a fixed position for the bur. This works well with a fully edentulous arch. However, in patients who are losing multiple teeth, sites may be lost after extraction due to fracture of buccal and/or interproximal bone. If this occurs, a fixed template with sleeves would be rendered useless.

Utilizing a prefabricated shell from an articulated wax-up cast provides many options. If implant position or angulation change from the initial plan, the shell may still be employed. Increase or decrease in pontic size is easy to accommodate. In a prefabricated provisional, these alterations are more difficult, if not impossible, to achieve.

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