



Soft Tissue Conditioning by Immediate Restoration of Immediately Placed Implants in Full-Arch Rehabilitation: The Double Provisional Technique

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Abstract

The safety and effectiveness of full-arch implant-supported fixed partial dentures have been established. Thus, clinicians are now focusing on the treatment modalities that can reduce patient discomfort, treatment time, and cost, and that could enhance the esthetic outcome of the restorations. Full-arch implant-supported rehabilitations are used when the patient is edentulous or if the residual dentition has a poor prognosis. In order to improve patients' comfort and avoid the use of a removable prosthe-

sis, some protocols for immediate replacement of hopeless dentitions have been proposed, but there are no data on their outcomes regarding the soft tissues. The aim of this article is to describe the double provisional technique and to show evidence of its efficacy in easily achieving predictable esthetic results when immediately restoring a hopeless dentition with a fixed implant-supported restoration.

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Full-arch implant-supported fixed partial dentures (FPDs) have shown excellent long-term results.¹⁻⁴ Clinicians are now exploring treatment modalities that reduce patient discomfort, treatment time, and cost, and that enhance the esthetic outcomes. Full-arch implant-supported restorations are used when the patient is edentulous or if the residual dentition has a poor prognosis.

To reduce treatment time and discomfort, it has been suggested that the intervals between extraction of teeth and implant placement and between implant placement and prosthetic loading may be reduced or, in some cases, eliminated.

Various studies have reported acceptable results when placing implants at the time of extraction.⁵⁻⁷ The drawback of this technique is the difficulty in predicting hard and soft tissue healing, which can lead to poor esthetic outcomes.⁸

Further, many studies have demonstrated that immediately loaded implants placed in the edentulous mandible show predictable results.⁹⁻¹³ However, few data are reported for maxillary cases,^{11,14,15} and it may be stated that immediate loading of implants placed in an edentulous maxilla is not a routine procedure.¹⁶

Moreover, even if immediate loading may lead to excellent functional and esthetic results, it should be considered that if a residual hopeless dentition is present at the beginning of treatment, the patient must wear a provisional removable denture after extraction of the residual teeth and before implant placement and loading.¹⁷

To reduce treatment time and patient discomfort in cases with a hopeless dentition, some authors have used the immediate replacement technique. This consists of extracting the teeth and placing and load-

ing the implants with a provisional FPD in the same session or within 24 hours.^{18,19}

Few papers have described the results of this approach, and in particular, few data are available on hard and soft tissue responses to implants immediately placed in the extraction sockets in the esthetic zone.^{8,20,21} Therefore, the immediate replacement technique cannot be considered a routine procedure.

Many variables need to be considered when planning the replacement of the residual teeth with a full-arch implant-supported FPD, such as implant number and positioning, final prosthetic design, cemented or screw-retained provisional prosthesis design, and timing and methods of soft tissue conditioning. Many of these variables have not been examined by the literature.

The aim of this article is to describe a technique that helps achieve easy and predictable esthetic results when immediately restoring a hopeless dentition with a fixed implant-supported restoration.

Description of the technique

Patient selection

To be eligible for this procedure, the patient must have no general or local contraindications to implant surgery.²² The residual dentition should be hopeless, or it should be assumed that maintenance of some or all of the residual teeth may jeopardize the prognosis of the desired restoration.²³

Local acute inflammatory lesions should be eliminated before surgery is planned. The residual alveolar bony dimensions should permit the insertion of an adequate number of implants.¹⁶ At least five implants



in the mandible and eight in the maxilla are suggested, since some of the implants will be inserted in fresh extraction sockets and may show reduced primary stability.²⁴

Surgery

Extraction of the residual teeth, flap elevation, and implant placement are carried out in a routine fashion. Implant positioning is crucial: the placement of adjacent implants in the esthetic zone should be carefully evaluated. Improper positioning may cause interimplant bone resorption and a consequent lack of papilla.^{25–28} Optimal esthetic results can be achieved with adjacent implants only if the necessary anatomic conditions are present and some technical precautions are taken.^{24,29}

Since immediate loading of a full-arch implant-supported fixed prosthesis in the maxilla is not well documented,^{16,30} there are no definitive surgical guidelines for this procedure. However, even if definitive conclusions cannot be drawn from the literature, some indications can be found to minimize the risks when planning such an approach:

- The amount of bone must be sufficient to avoid the placement of short implants, especially in the posterior maxilla, where the failure rate is higher.³¹
- The bone quality must guarantee sufficient implant stability (types 1 to 3, according to Lekholm and Zarb³²).¹⁸ Primary stability should be achieved, as it is important for success of the rehabilitation. Some authors advise obtaining an insertion torque of at least 35 Ncm for immediately loaded implants in the maxilla.¹⁴
- Optimal stability should also be assured for the provisional restoration to avoid micromovements that can lead to im-

plant failure. For this reason, the number of implants should be increased, and their distribution should be uniform and optimal.^{11,33,34} Some authors suggest a prosthetic units–implants ratio of at least 1.4:1 in the maxilla.¹⁵

- The immediate loading procedure should be avoided in patients with bruxism, because parafunction may jeopardize implant survival.³⁵
- To achieve a predictable esthetic outcome, the clinician must consider vertical and horizontal ridge resorption during socket healing.³⁶ In cases of a thin buccal cortical plate, vertical and horizontal ridge resorption may occur, and so a deeper positioning of the implant should be considered.^{8,29}
- Parallel positioning of the implants is necessary to permit the use of a cemented provisional restoration.

First provisional restoration

Before surgery, a diagnostic waxup is performed and clinically checked. This waxup is duplicated, and an acrylic resin metal-free provisional restoration is prepared with the palatal or lingual aspects of the restoration extending on the mucosa, as with a complete denture.¹⁷ These extensions allow easy three-dimensional repositioning of the provisional restoration at the relining phase, and thus offer an easy achievement of the occlusal relation.

After implant insertion, solid abutments for cemented restorations are connected and hand tightened, and their parallel positioning is checked. If minor bone grafting is considered at the marginal portion of the implants, it is postponed until after relining of the provisional has been completed.

Next, the provisional restoration is trimmed and adapted to the abutments to



achieve a perfect fit of the mucosal distal and palatal extensions with the tissues. Sutures are then placed to partially close the wounds. The provisional restoration is relined with acrylic resin. It should be noted that the goals of this first provisional are to splint and protect the implants and to guarantee a comfortable restoration for the patient. Since the primary goal is stability, marginal precision and adaptation for this restoration are not crucial.

Attention to soft tissue contouring is limited to the interimplant region and extraction sites, and the ovate pontic technique is used.^{37,38} The provisional restoration's occlusal scheme is very important at this stage of treatment. The occlusal contacts in centric relation should be checked very carefully and adjusted to be uniformly distributed with cusp-to-fossa contacts. A wide freedom in centric occlusion should also be achieved. Smooth, even, lateral excursive movements without working/nonworking interferences should be established with a group function. However, balancing contacts, such as those built for complete dentures, should be considered for immediate loading procedures, as they may contribute to load distribution.³⁹ The buccopalatal width of the occlusal surface should also be reduced, to transmit lower loads to the implants. Cantilevers are avoided in this phase.^{40,41} These precautions are important for all implant-supported restorations, but become critical when immediate loading is performed, since the implants should be protected from overload and micromovements, both of which can lead to failure. For these reasons, a soft diet is prescribed to the patient for the first 8 weeks.⁴²

The provisional restoration is polished and then cemented only after definitive soft tissue suturing.

The provisional should not be removed and should remain undisturbed in place until the healing period has passed, to allow good healing of the hard and soft tissues.^{33,34}

Second provisional restoration

After the healing phase (8 weeks), a second provisional restoration is delivered to the patient. This second restoration aims to achieve ideal soft tissue contour and to definitively check the esthetic outcome of the restoration.

An impression is taken using normal abutment transfers, and the first abutments are left in place. A master model with silicone soft tissue replica is fabricated, and the second acrylic provisional FPD is prepared in the lab. At this time, the restoration may be segmented, since implant stability has already been achieved and there is no further need for cross-arch splinting of the implants.¹⁷ The occlusal scheme can be modified and a more physiologic occlusion can be established with lateral group guidance to distribute the lateral forces on more than one implant. The working and nonworking interferences should be eliminated, and the occlusal surfaces may be enlarged. There is no further need for a soft diet for the patient.^{39,41,42}

The use of a prefabricated interface with the implant shoulder is helpful to achieve a precise fit. In the following weeks, the provisional may be adjusted many times before achieving the desired soft tissue contour.

When soft tissue conditioning has been successfully achieved, it is possible to take the definitive impression and fabricate porcelain-fused-to-metal one-piece or multiple-piece FPDs with the routine procedures. It must be noted that the initial abutments may be changed, because the final impression is taken at the implant level.

Case report

The patient (male, 54 years old) presented with a request for a functional and esthetic rehabilitation of the maxillary arch (Figs 1 and 2). This particular case was very challenging, since at presentation the patient stated he could not wear a removable appliance because of a pathologic vomiting reflex.

Advanced periodontal disease and insufficient plaque control were present. Tooth migration had occurred, causing a severe deep bite malocclusion. A deep overbite was present as a result of the overeruption and migration of the anterior teeth and the bite collapse secondary to the loss of many posterior teeth.

However, the occlusal analysis indicated that the interarch relationship could be corrected with a fixed rehabilitation without vertical bony augmentation, since the interarch discrepancy of the bony structures was acceptable in the anteroposterior, transverse, and vertical dimensions.⁴³

Panoramic radiography showed that despite the advanced periodontal disease, the residual alveolar bone height was sufficient for the placement of implants (Fig 3). A fixed implant-supported restoration was planned.

After an extensive discussion with the patient regarding various treatment options, it was decided to perform an immediate placement and loading protocol since the patient insisted he would not wear a removable provisional restoration. Thus, it was planned to place some implants in fresh extraction sockets and others in the residual bone and to load all implants immediately after placement. The patient was informed that this treatment option was described only in a few papers,



Fig 1 Frontal view of the initial situation.



Fig 2 Occlusal view of the initial situation.



Fig 3 Panoramic radiograph of the initial situation. Horizontal bone resorption secondary to advanced periodontal disease was present, but there was sufficient residual bone apical to the remaining teeth for implant placement.



Fig 4 Removal of the pocket epithelium after extraction.



Fig 5 The eight SLActive implants were placed in a single-stage surgery. The implant axes were parallel to permit the use of a cemented restoration without angulated abutments.



Fig 6 The first provisional restoration. The palatal extension allowed three-dimensional positioning and achievement of the correct occlusion.

but that it demonstrated excellent clinical results in selected cases.^{18,19}

A standard initial periodontal treatment was carried out, and the patient was instructed to perform the proper oral hygiene procedures. When the patient demonstrated that he could maintain good plaque control, the surgery was planned. In a single session, all teeth were to be extracted, with four implants placed in extraction sockets and four in the residual alveolar bone.

Extractions were performed, and a full-thickness flap was elevated in the left quadrant. Implants in left central incisor and canine positions were placed in the extraction sockets, and implants in the left first and second premolar positions were placed in the healed alveolus. Extractions were then performed on the right quadrant, and another full-thickness flap was elevated. It must be noted that during flap elevation, great caution was used to remove the epithelial portion of the pocket from the flap, to eliminate inflammatory tissue (Fig 4). This was safely and easily performed in this case because of the thick periodontal biotype. Implants in the right lateral incisor and canine positions were placed in the extraction sockets, and implants in the right first and second premolar positions were placed in the native bone (Fig 5). Since this may be considered a demanding procedure from a biomechanical standpoint, it was decided to use SLActive implants (Straumann), which have been associated with a more rapid integration with bone.⁴⁴

Standard abutments for cemented restorations were connected, and the provisional restoration was adapted and relined (one-piece acrylic resin with palatal extension to permit three-dimensional positioning in order to achieve correct occlusion) (Fig 6). After relining, the marginal

portion of the provisional FPD was intentionally trimmed to leave a vertical gap between the implant shoulder and the prosthesis, while ovate pontics were used in the edentulous spaces.

Locally harvested autogenous bone resulting from the drilling procedures was added in the postextraction sites where the horizontal peri-implant defect was greater than 2 mm. The flap was then sutured in place.

After 8 weeks of undisturbed healing, the soft tissue had shrunk, and a second, more precise provisional FPD was prepared to begin final soft tissue conditioning (Figs 7 to 9). An impression was taken, a plaster model was prepared, and acrylic resin provisional components were placed over the abutment analogues. Multiple-piece acrylic restorations were easily fabricated (Figs 10 and 11).

The second provisional FPDs had a prefabricated interface with the implant shoulder and easily achieved a precise fit (Fig 12). At this stage, the provisional restoration was slowly and gently inserted. At the first insertion, the gingiva looked ischemic because of the pressure exerted by the provisional restoration (Fig 13). In fact, since the first provisional was intentionally trimmed short, the soft tissues were covering the implant shoulder (see Fig 9). However, after 4 weeks and two visits and with small adjustments to the provisional, an acceptable soft tissue contour was achieved (Figs 14 to 16).

Next, the final impressions were taken and the porcelain-fused-to-metal FPD was delivered to the patient, 6 weeks after the insertion of the second provisional restoration and 14 weeks after the first surgery. The final prosthetic design was a 3-piece cemented restoration with one distal can-



Fig 7 The first provisional restoration after soft tissue healing. The tissues have shrunk, thus revealing the gap between the prosthetic margins and the implant shoulders.



Fig 8 Frontal view 8 weeks after surgery. The tissues around the implants have healed, and final soft tissue conditioning may begin.



Fig 9 Occlusal view 8 weeks after surgery. Since the provisional margins were placed 2 mm coronally, the soft tissue covers the implant shoulders.



Fig 10 Snap-on transfers for the impression of the abutments to prepare the second provisional restoration.



Fig 11 Master cast for the second provisional restoration. Prefabricated components were used to achieve a precise implant-provisional fit.



Fig 12 The second provisional restoration was segmented in three pieces. There was no longer a need for a one-piece splinted restoration.

tiler unit on each side (Figs 17 and 18).⁴⁵ In this case, since the implant placement was appropriate, there was no need for individual abutments, and so the same abutments used at the time of surgery were used for the final prosthesis.

In radiographs taken after 1 year, there was no evidence of any anomaly around the eight implants supporting 12 prosthetic elements, and it can be stated that ideal bone-to-implant contact was achieved. An ideal relationship between the implant-supported FPD and the periodontal tissues was also achieved. It should be noted that with the double provisional technique, the soft tissue contour improved enormously from the sixth to the twelfth week after surgery (see Figs 8 and 15).

Discussion

The crucial clinical step with simultaneous extraction, implant placement, and loading is the immediate provisional restoration.¹⁸ The provisional FPD can be constructed with different modalities. It is possible to take an impression immediately after implant placement and to adapt the provisional to a mounted plaster cast in the lab,¹⁸ or the restoration can be relined in the patient's mouth.¹⁹ Further, cemented or screw-retained restorations may be used.

Many problems must be taken into account when deciding how to construct the provisional FPD. At this stage, the patient has already undergone extraction and implant placement, and so a simple and fast procedure is needed. As in normal immediate loading cases, it is mandatory that the provisional restoration is rigidly connected to the implants and remains stable during the healing period.



Fig 13 The second provisional restoration at try-in. The tissues were ischemic because of the pressure applied by the provisional.



Fig 14 The second provisional restoration 2 weeks after delivery. Soft tissue conditioning was proceeding.



Fig 15 The soft tissues at the time of final restoration.



Fig 16 The soft tissues at the end of the conditioning.

Many basic science and clinical studies have shown that in good quality bone (types 1 to 3), implants with sandblasted, large-grit, acid-etched surfaces proved able to osseointegrate after 6 to 8 weeks, because of their high capacity to immobilize and preserve the cell-binding fibronectin domain.⁴⁶⁻⁵⁰ The immediate loading approach is more demanding because the occlusal loads tend to cause micro-movements of the implants; therefore, the previously mentioned precautions should be strictly followed during this healing period to permit implant osseointegration.

Because many of the implants are placed in fresh extraction sockets in the esthetic zone, the implant shoulder may be placed at the level of or slightly below the residual alveolar crest, to maintain ideal soft tissue esthetics after hard and soft tissue healing. To achieve optimal bone integration and ideal soft tissue esthetics, implants should be placed only as deep as necessary.⁵¹ When simultaneous extraction and implant placement are performed in patients with some degree of periodontal breakdown, there is usually a soft tissue excess that shrinks during healing to



Fig 17 The final restoration.



Fig 18 The final panoramic radiograph.



achieve a normal biologic width at this stage. For this reason, the soft tissue width is greater at the end of surgery than it will be after healing.

As a result, using a cemented provisional restoration may cause some problems for tissue healing. The restoration must be relined directly on the abutments with the fresh wounds, which poses some risk of tissue damage. Once the restoration has been relined, trimmed, and polished, it is cemented in place, and it may be difficult to remove the excess cement, which at this stage is deep under the gingival margin.

The use of screw-retained restorations, such as the pickup technique,¹⁷ may create two problems: (1) increased chair time during the first surgical prosthetic session, and (2) the possibility of interfering with socket healing, because the prosthetic interface is very deep in the tissues.

The technique described in this paper overcomes most of these problems. The first provisional FPD margins are constructed short (placed 2 mm more coronally than the ideal prosthetic interface), thus reducing interference with tissue healing. Further, provisional relining in the patient's mouth is fast and simple, and the FPD can be provided to the patient at the end of the session, within 3 hours from the beginning of the procedure.

The drawbacks include the need for implants with parallel axes, the need to have a second, very precise provisional restoration to complete soft tissue contouring, and the impossibility of removing the provisional during the healing phase (8 weeks).

Regardless, this technique appears, in the authors' experience, to be very useful in selected cases when the patients refuse a removable provisional. The immediate placement approach seems to enhance

the maintenance of the soft tissue architecture and papillae compared to the conventional delayed approach. This may be attributed to the support of the soft tissues by the implants and the provisional restoration. In fact, it was hypothesized that the relationship between the osseous peaks and the papillae is not a one-way relationship.^{52,53} As the gingival height seems to be based on the supporting bone levels, it also seems that the network of collagen fibers around the teeth is fundamental to maintain the bone levels.⁵⁴ Mankoo²¹ suggested that alveologingival and interpapillary fibers help preserve bone height when immediate support is provided by means of immediate implants and provisional restorations, and that this explains the superior esthetic results obtained with immediate placement compared to delayed placement.

However, immediate placement should not be performed as a routine procedure, since there is still not enough evidence regarding its safety. Although there are a few articles showing good results using this procedure, studies with large sample sizes and well-defined inclusion and exclusion criteria are lacking, and the data collected are not homogeneous.¹⁶ It is up to the clinician to analyze every factor that determines the treatment plan for each patient and to decide when this approach will be useful.

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