The BARI technique: a new approach to immediate loading

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Abstract

When dealing with full-arch rehabilitation, the provisional phase is important in order to define the correct occlusal, intermaxillary, and esthetic relationships for each individual patient. In these cases, it is difficult to transfer this information to the final restorations. Several techniques have been developed to transfer the information from tooth- or implant-supported fixed provisionals to the definitive rehabilitations. The present article describes a technique proposed by the authors to transfer the information from a removable prosthesis to an implant-supported restoration.
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Introduction

Immediate loading has become more popular in recent years. It consists of delivering a fixed restoration in occlusal function within 48 hours after implant placement.[1,2] This procedure was developed and has been initially used in mandibular edentulous arches,[3] where the bone quality and quantity is more favorable and the possibility of gaining primary stability of implants is high.[4] Immediate loading in the mandibular arch can be considered a well-documented and scientifically validated approach, both for overdentures and for fixed prostheses. Promising results are available for immediate loading in the maxillary edentulous arch, but further studies are needed to definitively validate these procedures.[2]

During recent years, different protocols have been proposed in order to rehabilitate patients with immediate loading so as to reduce treatment time and provide patients with fixed prostheses in one day.[5-9] The development of implant design and surfaces as well as new surgical approaches has allowed for a dramatic decrease in treatment time. In some cases, the one-day approach in totally edentulous patients could be difficult from a prosthetic point of view because these patients very often show alteration in the mandibular position, especially when they are used to inadequate old prostheses with worn acrylic teeth.[10] In such cases, the physiological mandibular position should be determined with the aid of removable prostheses, and this phase can take several weeks.[11-13]

The aim of the present article is to present the authors' approach to these complex rehabilitations, mainly focusing on the diagnostic phase and on the clinical and laboratory procedures used to record and maintain the occlusal information gathered in the diagnostic phase.

The BARI technique

The presented technique is called the Boosting Advanced Rehabilitation on Implants (BARI) technique. Bari is also the name of the city where this technique was developed.

The authors' belief is that provisional prostheses (fixed or removable) should not only be devices used to give reasonable function and esthetics to patients while their definitive prostheses are being made, but should also serve a diagnostic function, having the ability to be modified several times until a satisfactory esthetic and functional result is obtained. Thereafter, the definitive prostheses could be a copy of the provisional prostheses but using a different and more durable material.

Some techniques have been proposed to transfer all the prosthetic information (vertical dimension, centric relation, frontal and lateral guidances, esthetics) in cases treated with fixed provisional prostheses supported either by teeth or by implants.[14] The BARI technique is used to transfer the same information recorded if the provisional and diagnostic phase is performed with a removable denture.

Case report

We present a case of a patient treated with the BARI approach. The 62-year-old male patient presented for consultation wearing old dentures. He complained about their relative instability and their unsatisfactory appearance. The clinical analysis showed that the prostheses were unsatisfactory because of an inadequate extension of the prosthetic bodies, wrong occlusal contacts, and inadequate intermaxillary relationship. The progress of bone resorption and the wear of the polymethyl methacrylate (PMMA) teeth caused the anterior displacement of the mandible and its counterclockwise rotation in the sagittal plane, thus giving the patient the characteristic aspect of skeletal class III malocclusion.

All the information needed for the planning and realization of the rehabilitation, such as intraoral and extraoral photos of the patient with and without the prosthesis (Figs 1 to 4), and alginate impressions of the edentulous arches were gathered and recorded.

The treatment objectives and the sequence of therapies were planned: a removable denture for the maxillary arch, and an implant-supported overdenture for the mandible. The patient was already wearing two removable dentures, and fixed, full-arch, implant-supported prostheses were rejected for financial reasons. A removable complete denture in the maxillary arch is a safe and effective rehabilitation at a reasonable cost. In the mandible, a removable complete denture is not the treatment of choice since it is very difficult to obtain a stable prosthesis.[15] For this reason, an implant-supported overdenture

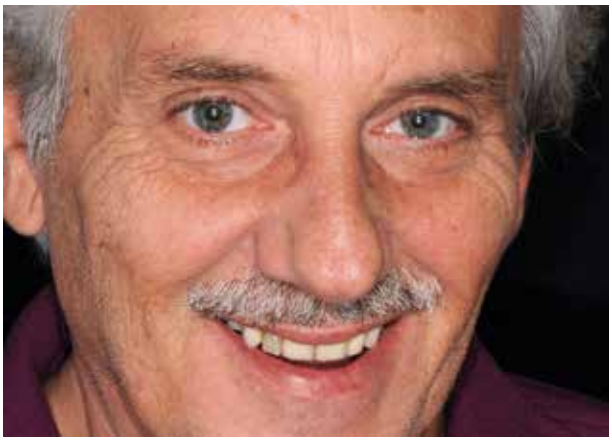

Fig 1 Extraoral photo of the patient at the moment of presentation at our center. Inadequate esthetics is evident.

Fig 2 Intraoral photo of the patient at the moment of presentation at our center. It is evident that the old prostheses were modified several times, which has resulted in inadequate function and esthetics.

Fig 3 Photo of the old prostheses.

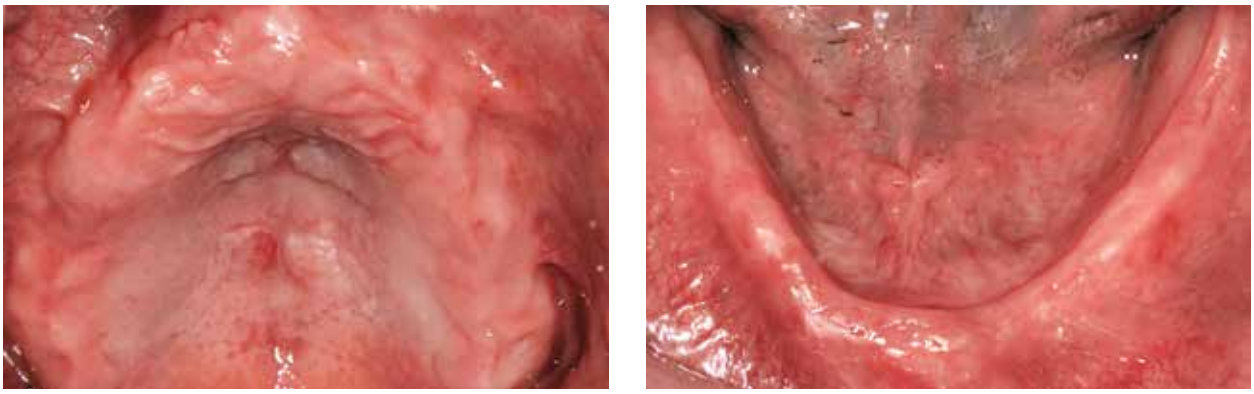

Fig 4 Occlusal view of the edentulous arches at the moment of the first visit.

was planned. The use of four implants allows an improvement of mandibular prosthesis stabilization and may reduce posterior mandibular bone resorption over a 10-year follow-up period, probably because of reduced movements of the prosthesis in the posterior areas.[16,17]

Regarding the treatment sequence, an intermediate provisional phase was planned to find the correct intermaxillary and occlusal relationships with the aid of a couple of removable dentures.

Fig 5 Combined occlusal scheme with maxillary semi-anatomic teeth and mandibular plain teeth.

On the cast obtained from the initial impressions, individualized impression trays were built with a self-curing resin (SR Ivolen, Ivoclar Vivadent). Great care was taken to functionalize the customized impression trays with a polyether material (Impregum, 3M ESPE). This material is usually used for fixed prosthesis impression, but some clinicians find it very useful to functionalize the flanges.[18] Baseplates with wax registration material were built and the facebow recorded in order to mount the maxillary cast in the articulator. The intermaxillary relations were then recorded according to the phonetic tests,[19-25] and the mandibular arch was coupled with the maxillary one. After the try-in of the teeth mounted on the baseplates, a couple of removable dentures were delivered to the patient (Figs 5 to 7). The authors consider these dentures as "diagnostic dentures" because they were built with a peculiar occlusal scheme obtained with plain teeth in the mandibular posterior segments (0-degree cuspid inclination; Orthoplane DCL, Ivoclar Vivadent), with

Fig 6 Intraoral frontal view of the first removable prosthesis with plain teeth in the mandibular arch. Note that this "diagnostic denture" is built so as to have no overbite.

Fig 7 Extraoral view of patient's smile with the first removable prosthesis ("diagnostic dentures").

semi-anatomic teeth in the maxillary posterior segments (18-degree cuspid inclination; SR Ortholingual DCL, Ivoclar Vivadent). In the anterior segments, nanohybrid composite teeth (SR Phonares II, Ivoclar Vivadent) were used to obtain an improved esthetic result. The teeth were mounted so as to have an overjet of 2 mm and an overbite of 0 mm. This phase of the treatment allowed the clinician to test the new interarch relationship. The plain teeth in the mandibular arch and the absence of overbite allow the mandible to move in its favorite and physiological position.[26] In the presented case, the mandible moved backward after 1 week, and the clinician created small occlusal fossae in the mandibular plain teeth to stabilize the occlusal relationships (Fig 8). The patient was checked every 2 weeks and the fossae were deepened so as to further stabilize the position and to achieve the correct overbite.

After 2 months, the prostheses were relined and the teeth mounted again in the articulator with the final occlusal relationships (Figs 9 and 10). A new facebow registration was performed to mount the maxillary cast, while the mandibular cast was mounted in accordance with the position of the prosthesis. For this stage, semi-anatomic PMMA teeth were used, both in the maxillary and the mandibular arches (SR Phonares II Lingual, Ivoclar Vivadent).

Fig 8 Rearrangement of mandibular teeth after the diagnostic phase.

Fig 9 Clinical photos of the occlusion of the new teeth.

Fig 10 Profile of the patient before and after the diagnostic phase. Note the dramatic change in the relationship between the maxillary and mandibular jaws.

Fig 11 Transparent acrylic resin copies of the first set of dentures, at the end of the diagnostic phase.

Fig 12 The teeth on the acrylic copies are replaced with nanohybrid composite teeth. The teeth used are identical to those mounted on the diagnostic denture. They are mounted in exactly the same position with the aid of a silicon index.

Fig 13 Extraoral view of the try-in of the replaced teeth in the anterior areas. Although the mounting of the teeth is easy because they are the same teeth mounted on the exact replica of the diagnostic denture with the aid of a silicon index, this procedure is checked in the patient's mouth.

The prostheses were delivered at this point in order to test the achieved results for 2 months. When the reevaluation of the prostheses showed a stable and repeatable occlusion, adequate function, and good esthetics, the prostheses were replicated with a transparent acrylic resin (ProBase Clear Cold, Ivoclar Vivadent) (Fig 11). These copies of the prostheses with mounted teeth were used as individualized trays for an impression with a zinc-eugenol material.

Fig 14 Intraoral view of the duplicate of the diagnostic denture. This set of prostheses will be the definitive prostheses. Implant placement will be performed in the mandibular arch, and the mandibular denture will be connected to the implants.

Fig 15 Extraoral view of the patient wearing the final prostheses. The mandibular prosthesis will be connected to the implants with an immediate loading procedure.

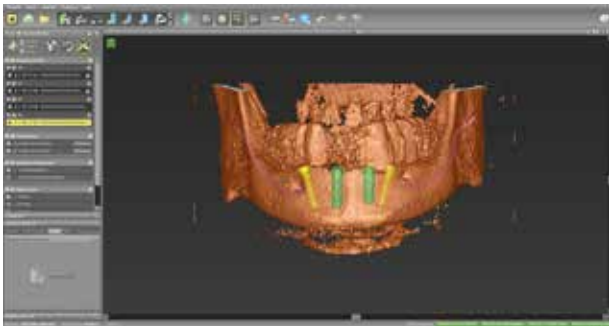

Fig 16 A copy of the final denture is realized with radiopaque teeth in order to have a cross-sectional radiograph image and 3D computerized planning.

The copy of the maxillary prosthesis was used to record a facebow and to mount the upper edentulous model on the articulator. The copy of the mandibular prosthesis allowed for the easy mounting of the lower model. A second set of prostheses was obtained with the SERT technique described in a previous article: the transparent acrylic teeth are trimmed and replaced with nanohybrid composite teeth (Figs 12 to 15).[27]

A radiopaque acrylic resin copy of the prostheses was realized and used to perform a 3D radiographic evaluation with software designed for surgical navigation (CodiagnostiX, Institut Straumann AG) (Fig 16). This step of the treatment is very important because it allows for the best possible determination of the position of the implants according to the prosthetic project, and allows for the evaluation of the amount of available bone in the planned implant sites. Four implants were planned in the interforaminal area so as to respect the recommended ratio between the distal cantilever of the prosthesis and the length between the implants.[28]

The master models, already mounted in the articulator (as previously described), were excavated using the one-model technique.[14] Thereafter, two plates with three occlusal stops were built from the master model in order to record the implant position. These were designed to be stabilized by the closure of the patient against three occlusal stops, without interfering with the prosthetic components (Figs 17 and 18).

On the day of the surgery, the consistency between the planned project and the intraoral situation was checked. After the placement of four implants (Institut

Straumann AG), impression transfers were screwed on the implants and connected with orthodontic wire. An acrylic resin (Pattern Resin, GC America) was used to connect the transfers to the previously realized plates (Fig 19). A new set of impression transfers was then placed on the implants and connected to them.

Implant analogs were connected to the transfers embedded in the plates. The plates then allowed for the repositioning of the analogs in the excavated master models already mounted in the articulator (as previously described).

Fig 17 The models obtained by pouring the cast in the final prostheses. The upper model was mounted in the articulator with a facebow registration, while the lower model was positioned with the aid of the dentures themselves. The lower model was excavated as described by Biscaro et al.

Fig 18 Two resin plates were built in the articulator. The lower plate was built to record the implant position. The upper plate was designed so as to stabilize the lower one when the patient was asked to close his mouth. The upper and lower plates had contacts at the incisive level and in the molar area.

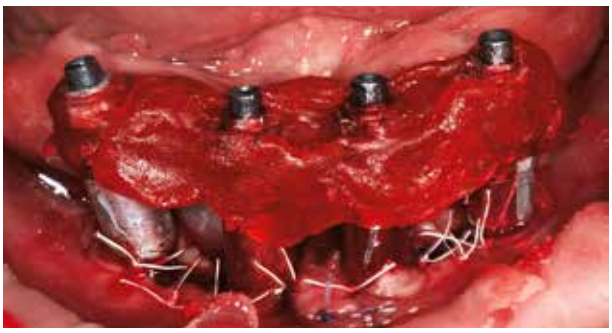

Fig 19 Implant transfers were connected to the plate with orthodontic wire and resin.

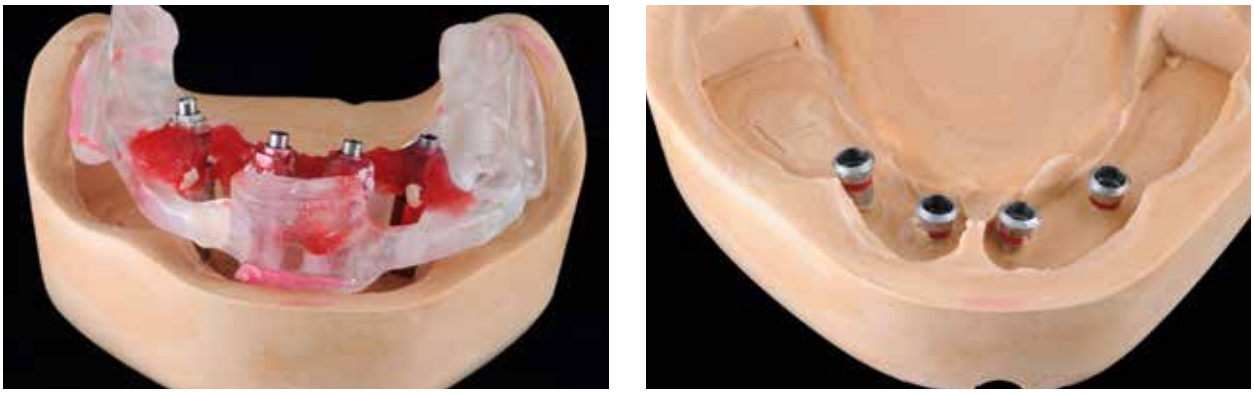

Fig 20 Implant analogs were screwed to the transfers and then positioned on the excavated cast. They were blocked with grade IV plaster stone. With this procedure, the position of the implants was transferred in the casts mounted exactly with the occlusal relationship obtained from the diagnostic phase.

Fig 21 Titanium implant abutments were selected and adapted with the aid of a silicon index. Thereafter, a burn-out resin was used to design a bar that was then casted and luted to the implant abutments with an adhesive cement.

Fig 22 The definitive mandibular prosthesis was excavated so as to provide the space for the metallic framework. It was blocked to the maxillary prosthesis with wax, according to the recorded occlusal relationship. At this moment, the metallic framework was screwed onto the analogs and the final mandibular prosthesis repositioned on top of it and blocked with removable denture acrylic resin.

The analogs were blocked into the casts with grade IV plaster stone (Fujirock EP, GC Europe). When the stone was set, the plates were removed (Fig 20). A silicone index was taken in order to replicate the soft tissue around the implants. The result was that the models obtained from the removable prostheses were available with implant analogs in this phase. The second set of transfers connected with resin was used to check the position of the analogs and to avoid possible errors.

All the information previously recorded regarding interarch relationships could be used for the implant-supported rehabilitation. The provisional diagnostic phase with the removable dentures was conducted with care and with great effort in order to find the correct interarch relationships. This information should be kept, and with this technique no information was lost.

At this point, it was possible to build and deliver the restorations the same day of the surgery (immediate loading). Titanium abutments were used. A metallic framework was casted and luted to the abutments with anaerobic cement (Panavia SA Cement, Kuraray). The second set of prostheses was excavated and positioned onto the metallic framework to verify its passive fit. The framework and the prostheses were connected with the resin for removable dentures, after which the prostheses extension was reduced, removing parts of the flanges (Figs 21 and 22). Finally, the prostheses were polished. At the end of this procedure, the mandibular removable denture was transformed into an implant-supported, screw-retained fixed prosthesis. The use of a casted framework luted to the abutments allowed for the rigid splinting of the implants to achieve a passive fit, thus avoiding the micromovements that could interfere with bone healing.[29,30] Similar excellent results in terms of passivity and precision could also be obtained by means of CAD/CAM techniques.[31] In this case, the authors used a casted framework luted

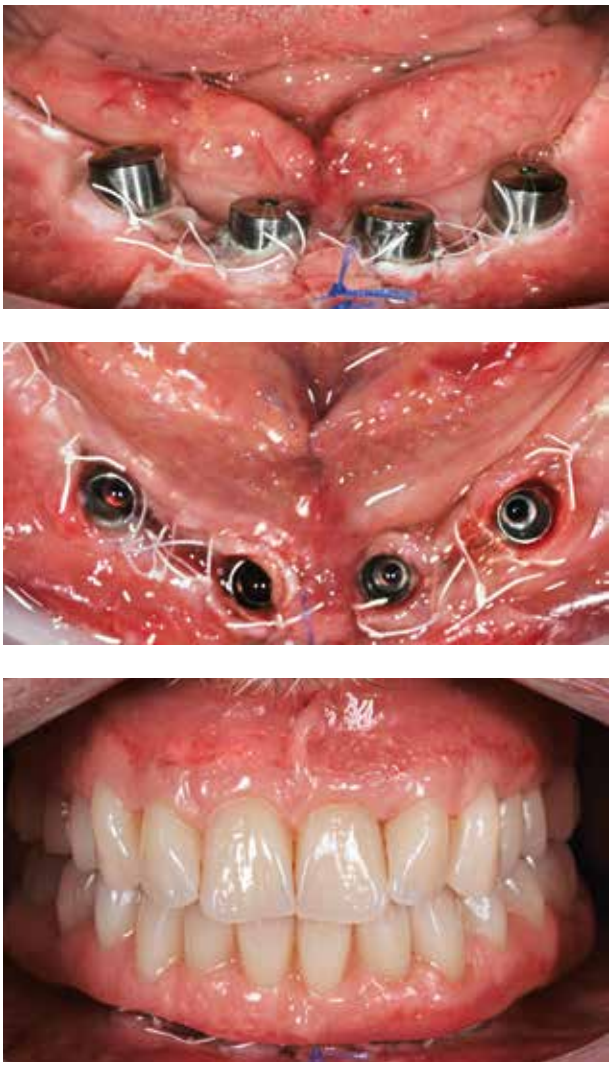

Fig 23 The delivery of the final implant-retained prosthesis within 24 hours after implant placement. The flanges were reduced so as to permit the cleaning maneuvers beneath the overdenture.

Fig 24 Extraoral photo of the patient after the placement of the final prostheses. The mandibular implant screw-retained prosthesis was delivered with an immediate loading procedure.

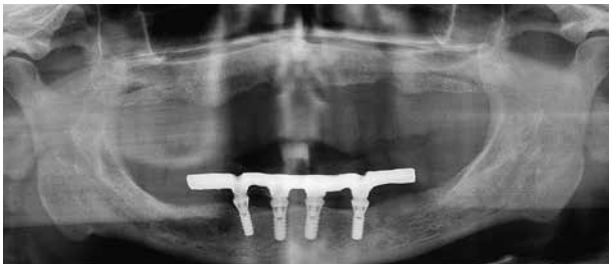

Fig 25 Final panoramic radiograph.

to the abutments because it allowed for a fast prostheses delivery within 24 hours after implant placement. A CAD/CAM approach usually requires industrial milling centers, so the framework cannot be delivered within 24 hours.

A few hours after implant placement, the prostheses were delivered to the patient, with the screws being tightened at 35 N/mm (Figs 23 to 25). The care taken in the procedures of information transfer allowed the avoidance of major occlusal adjustment at the moment of delivery, as well as the maintenance of the esthetic and functional conditions that had already been extensively tested for several weeks in the patient's mouth.

The sutures were removed after 8 days. The patient was controlled again every month after surgery for the first period of 4 months. He was then allocated to the maintenance recall program, which entailed visits to a professional hygienist every 4 months and a control with the dentist once a year. At the 1-year follow-up visit, a very good functional and esthetic outcome was evident (Figs 26 and 27).

Discussion

The effectiveness of the procedure of immediate loading in the mandible is extensively documented. The primary stability of implants, together with the proper occlusion, seems to be the determining factor accounting for the success of the procedure. Thus, it can be stated that immediate loading in the mandibular edentulous jaw is a safe and effective procedure.[2,3]

Very often, edentulous patients have lost any occlusal reference and it can be very difficult to perform a correct recording of intermaxillary relations and a correct evaluation of the vertical dimension, phonetics, and esthetics.[12] The same problem could be present in patients with hopeless dentition because of posterior bite collapse and pathologic migration of the periodontally compromised teeth.[32]

The presented case needed a prolonged diagnostic phase with removable diagnostic dentures with an occlusal scheme that allowed the mandible to reposition comfortably. The mandibular denture with plain teeth and no overbite worked as a bite plane to recon-

Fig 26 Clinical view of the mandibular arch with the attached bar over the implants taken soon after the delivery and 14 months after the surgery.

Fig 27 Clinical view of the maxillary and mandibular prostheses taken soon after the delivery and 14 months after the surgery.

dition the neuromuscular masticatory apparatus. The diagnostic mandibular denture could be modified several times until the patient found a correct mandibular position, pleasant esthetics, and comfortable phonetics. At this point, the plain teeth could be replaced with semi-anatomic teeth mounted in the achieved mandibular position. This modification was tested again for some weeks. It is evident that the whole process took a lot of time and effort. Consequently, it was mandatory to retain the information gained so as to achieve an easy delivery of the final restoration without having to repeat half of the work already done.

This is the reason for the authors having developed this information transfer technique. Using this approach, once the diagnosis has been performed, all the information can be maintained in a predictable manner and a final implant-supported restoration that is identical to

the diagnostic denture can be delivered to the patient. The use of the diagnostic dentures to record the facebow and to mount the models on the articulator, and the use of the resin plates to transfer the implant position into the excavated models, guarantees that intermaxillary relationships are not lost. When the implant analogs are embedded in the master models and the intermaxillary registration is maintained, it is easier for the clinician and the technician to finish the work.

It seems, therefore, that if various technologies (such as improved implant surfaces and design, and guided surgery) permit the reduction of the treatment time needed to deliver a fixed restoration, it is possible to invest that time in the diagnostic phase so as to provide the patient with the best possible rehabilitation.

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