labline™

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Zirkonzahn®

Application of full-contour ZIRCONIA

A case example of edentulous mandible and maxilla with four implants each

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Restorations on four implants: an introduction by the clinician

Oral rehabilitations on osseointegrated implants have been utilised in the last ten to fifteen years to minimise the mechanical instability of conventional complete dentures and their negative psychological social impacts, mostly related to the encumbrance and the length of the handwork both in the upper and in the lower jaw. However, the loss of alveolar bone often affects the conventional implant placement in edentulous patients.

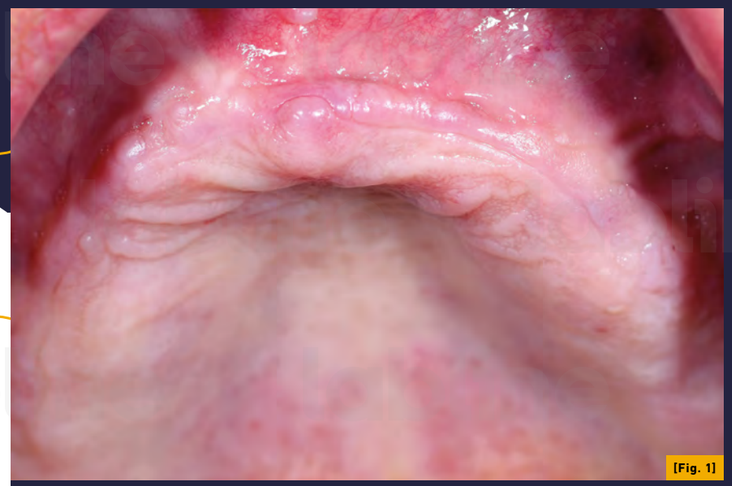
Driven by the need of placing osseointegrated implants on resorbed bone areas, especially in posterior regions, studies were encouraged to create alternatives to use the existing bone to fix implants. **(1)** The All-on-Four® (Nobel Biocare, Goteborg, Sweden) concept and further modifications (Columbus Bridge ® - Biomet 3i) were developed to overcome anatomical limitations in the mandible and maxilla without the use of complex techniques of bone augmentations **(2-3)**. The protocols include the placement of four anterior implants in the native bone for supporting a full-arch prosthetic in an edentulous jaw or in a post extraction arch after reducing the alveolar process to achieve a flat bone platform. The tilting of the two distal implants, between 35° and 45°, allows the use of longer implants favoring a good primary stability without interference in mental foramen or inferior alveolar nerve, in the case of the mandible, and without the need of maxillary sinus graft, in the case of the maxilla **(4)**.

An immediate prosthesis can be made following surgery, and the final prostheses are made four to six months later. The reduced number of implants promotes a cantilever that may result in higher mechanical stress on the prosthesis and implants, leading to the choice of a shortened arch rehabilitation. The traditional prosthetic technique includes the use of acrylic resin, which embraces a rigid melted or milled metal bar connecting the implant units together. Alternative materials have been proposed by other authors in order to minimise costs and weight, such as carbon fibers **(5)**.

The literature relates a survival rate between 92.2% and 100%; however, the scientific data is still limited and collected mainly on hybrid resin restorations. The high aesthetic demands of patients has led to the increased use of ceramic crowns connected to metal or full zirconia frameworks. Earlier studies reported good functional, biological, and esthetic outcomes of such restorations.

Initial situation

The edentulous patient **[Fig. 1]**, medically healthy and non-smoker, presented with the request for fixed, full-arch restorations to replace the two dentures that he had been wearing for twenty years. The extra-oral examination revealed a significant loss of vertical dimension, causing pronounced naso-labial wrinkles and initial ulcerations at the mouth corners. During the intra-oral examination, a severe instability of the two dentures was observed, as well as complete tooth abrasion of posterior lower and upper molars. The lower prosthesis was partially retained by a metal ball attachment placed in the root of tooth number 33 **[Fig. 2]**. The proposed treatment consisted of the placement of four implants on each edentulous arch with immediate temporary loading. After placement of a rigid metal framework and extraction of posterior teeth, the two old dentures were relined and used as immediate restorations before placing the prototype.



[Fig. 1]

[Fig. 2]

[Fig. 1] The initial situation revealed a significant loss of vertical dimension in the upper arch, causing pronounced naso-labial wrinkles and initial ulcerations at the mouth corners.

[Fig. 2] The lower prosthesis was partially retained by a metal ball attachment placed in the root of tooth number 33.

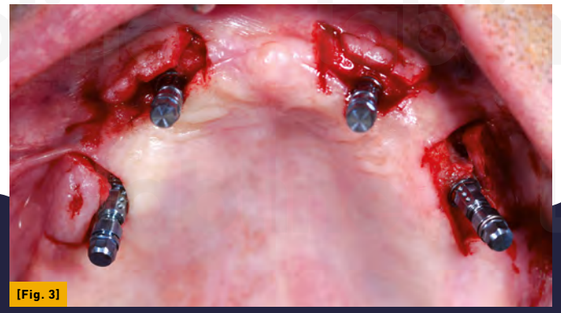
The dental technician's considerations about material selection

"Prettau® 2 Dispersive® enables us, dental technicians, to have total control over the aesthetic results of our restorations. This is due to the optimisation of translucency and the standardisation of the basic material colour, which no longer depends on the hand of each individual operator. In fact, Prettau® 2 Dispersive® is the result of the laboratories' growing demand to work on large restorations with a material that is easy to process, that shows the right translucency gradient – not too low, not too high – and that has characteristics suited to anterior teeth and small jobs. Together with the right translucency, the natural colour gradient with which the zirconia is provided perfectly reproduces the natural shades of the teeth from dentine to enamel. The result is a restoration with great colour fidelity and shorter processing times, since manual colouring is no longer necessary, although it can still be performed to achieve a more customised result", says Federico Presicci, DT. "For example, depending on the aesthetic requirements of the restoration, it is possible to further customise the structures through the manual application of pigments, such as blue in incisal areas as well as dentine and orange colours in cervical and proximal areas. In large dento-gingival prosthetics, as in this case, Prettau® 2 Dispersive® allows for excellent quality standards by applying aesthetic veneering materials such as ICE Stains 3D by Enrico Steger and gingival pink ceramic for the mucosa. Thanks to the continuous development of CAD software, it is also possible to give greater support to the rehabilitation by means of a milled titanium bar, which we have cemented to the zirconia creating a one-piece restoration."

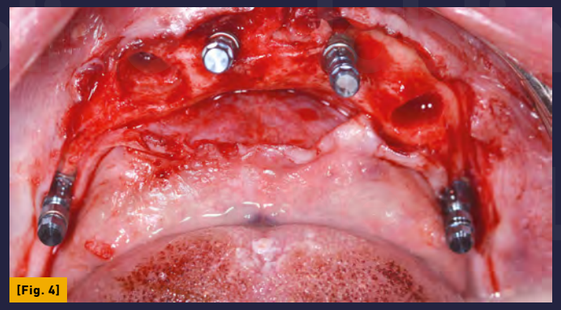
Clinical workflow

According to standard working protocols for treating edentulous cases, six radiopaque gutta-percha points were placed on the teeth in order to obtain a CBCT. Subsequently, the two dentures were scanned and the DICOM data were matched with the STL files on a dedicated software. This protocol allows the clinician to preview the case and perform implant-planning, taking into consideration the implants' diameter, length and angulations. In addition, if Multi Unit Abutments (Zirkonzahn) are needed, the dentist is able to assess the abutments' height and angulation right from the beginning.

Before the surgery, the two dentures were relined with soft acrylic resin and perforated exactly at the positions where the implants were supposed to be placed, in order to use the MAS surgical stents. Preoperative antibiotic therapy with 2g of Amoxicillin and Clavulanic acid was administered to the patient, who was placed under nitrous sedation. Local anesthesia was performed by using articaine with 1:100000 epinephrine on both jaws. In order to avoid losing contact between dentures and soft tissues, only minimal incisions and flaps elevations were made **[Figs. 3-4].**



[Fig. 3]



[Fig. 4]

[Figs. 3-4] Implants insertion phase. The reduced number of implants produced a cantilever. Cantilevers cause increased mechanical stress on the prostheses and on implants, which is why a reduced arch restoration is often produced.

On all eight implants, the prerequisite of an optimal primary stability was achieved and the multi-unit abutments were immediately placed and tightened at 35 Ncm **[Figs. 5-6]**. The following step included a further relining of the old dentures and the application of the temporary abutments, which were rigidly blocked in place with an acrylic dual resin, in order to provide the dental technician with the precise position of the implants with no rotations or distortions. The two immediate prostheses were delivered to the patient 24 hours after surgery **[Figs. 7-8]**. The patient was instructed not to brush for the first thirty days post-surgery. In a second phase, he started to follow a personal oral hygiene protocol with brushing limited to prosthetics only and rinsing using 20% Clorexidina, without the use of interdental brushes. After the fiftieth day post-surgery, standard oral hygiene regimen was reestablished. After three months, when the osteointegration was concluded, the dentist took an impression of the oral situation and the dental technician performed a passivity test, checking the positions of the implants on the impression. The positive result allowed the dental technician to proceed with the next steps. Before the prototype production, a light-curing resin bar was produced and placed on cannulas that had been screwed onto the impression, with the aim of verifying whether the implants and model positions corresponded to the post-impression situation. During the same chairside appointment, the dentist also checked intraorally two resin structures that had been conveniently cut and re-fixed into the patient's mouth during the visit, with the purpose of avoiding any possible force on the future restoration and on the milled bars. Upon delivery, the position of the bars was checked again via X-rays in order to avoid possible misfits. Subsequently, the clinician sent all digital patient data recorded to the dental laboratory (articulation, master models, scanmarkers) including the scans of the immediate restoration.

[Fig. 5]

[Fig. 6]

[Fig. 7]

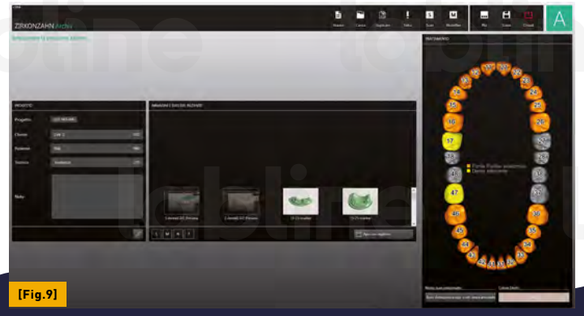
[Fig. 8]

[Figs. 5-6] On all eight implants, the prerequisite of an optimal primary stability was achieved and the multi-unit abutments were immediately placed and tightened at 35 Ncm.

[Figs. 7-8] As immediate restorations, the old dentures were used. To this aim, the dentures were religned and temporary abutments were applied onto them, rigidly blocked in place with an acrylic dual resin. The immediate restorations were used as a guide for producing the final zirconia restoration.

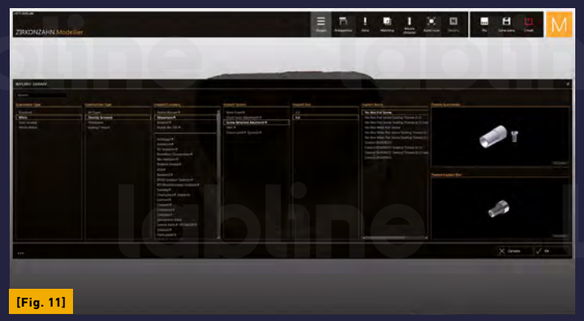
Dental technical workflow

The dental technical job started with the registration of all patient data in the software **[Fig. 9]**. The scans of the master models were matched in the Zirkonzahn.Scan software with Scanmarkers and were digitally mounted in the virtual articulator **[Figs. 10-12]**. Once the project was set, the scans of the immediate restoration sent by the clinician were used as a guide for producing an aesthetic prototype **[Figs. 13-14]**.

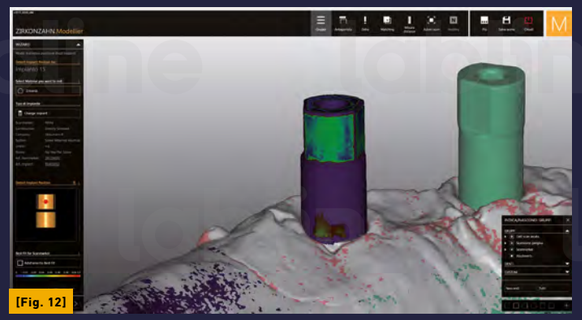


[Fig.9]

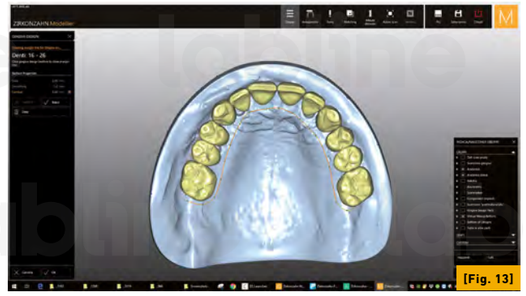
[Fig. 10]



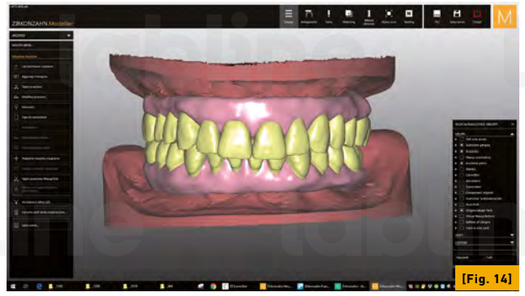
[Fig. 11]



[Fig. 12]



[Fig. 13]



[Fig. 14]

[Fig. 15]

[Fig. 9] All data related to this clinical case was inserted in the Zirkonzahn.Archiv software.

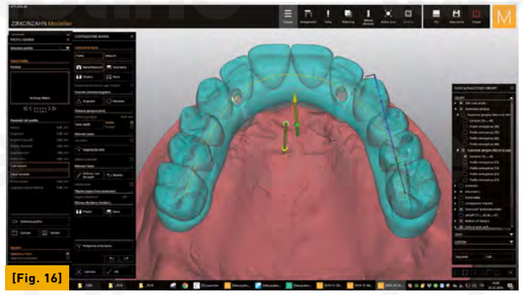
[Fig. 10] Scans of master models and Scanmarkers were matched in the Zirkonzahn.Scan software and digitally mounted in the virtual articulator.

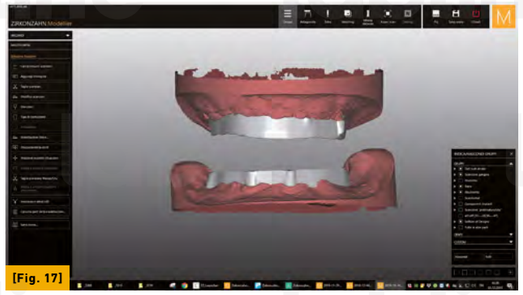
[Figs. 11-12] Suitable implant prosthetics components have been selected and a matching was made between the digital and analogical scanbodies.

[Figs. 13-14] Tooth set-up and design of the mucosa – The aesthetic prototype was produced based on the scans of the immediate restorations sent by the dentist.

[Fig. 15] During the prototype try-in, the prototype allowed the patient to obtain a real preview of the final restoration and the dentist to check phonetics as well as all aesthetic and functional aspects.

Once the prototype was milled, teeth and gingiva shapes were slightly finished by hand and characterised using colouring liquids for composites. Flanges were modelled using gingiva-pink composites in order to simulate the result of the final restoration. During the try-in, the prototype allowed both the patient and dentist to obtain a real preview of the final restoration and to check phonetics as well as all aesthetic and functional aspects **[Fig. 15]**.


[Fig. 16]


[Fig. 17]


[Fig. 18a]

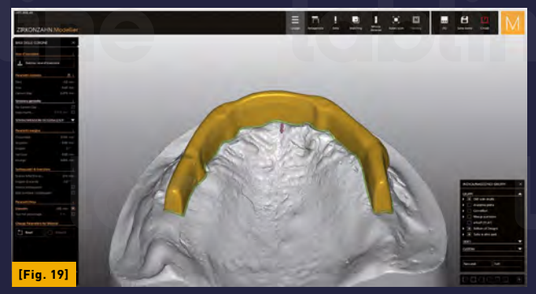

[Fig. 18b]

[Figs. 16-17] In order to provide more support to the zirconia structures, two bars have been designed individually in the CAD software and the bars milled in titanium, taking into consideration the thickness of the prototypes tried previously by the patient.

[Figs. 18a-b] The titanium bars once milled and parallelised.

[Fig. 19] After scanning the bars, the dental technician located the insertion axes, gingival margins and cement gaps.

[Fig. 20] Adaptation of the digital wax-ups to the prototypes previously tried by the patient.


[Fig. 19]


[Fig. 20]

The dental technical job continued with the production of the final restoration, for which two individual bars were digitally created to provide support to the zirconia structures **[Figs. 16-17]**. The two bars have been milled in titanium, taking into consideration the thickness values provided by the prototypes tried intraorally and then parallelised **[Fig. 18]**. After scanning the bars, the dental technician located the insertion axes, gingival margins and cement gaps. In this way, it was possible in a further step to adapt the digital wax-ups of the prototypes to the scans, reproducing the same shape tried previously by the patient **[Figs. 19-20]**.

Once adapted and milled from a Prettau® 2 Dispersive® zirconia blank, the two structures were finished to optimise texture and shape in terms of aesthetics **[Figs. 21-23]**. The mucosa was reduced for the subsequent ceramic layering. The finished structures were characterised on the incisal, cervical and occlusal surfaces with infiltration pigments – dentine-blue, A3 and Orange – **[Figs. 24-25]** and sintered at 1600 °C with a slow sintering process. The bars were then passivated into the zirconia structures in order to avoid any stress in the restoration and create a uniform cementation gap along the two surfaces.


[Fig. 21]


[Fig. 22]

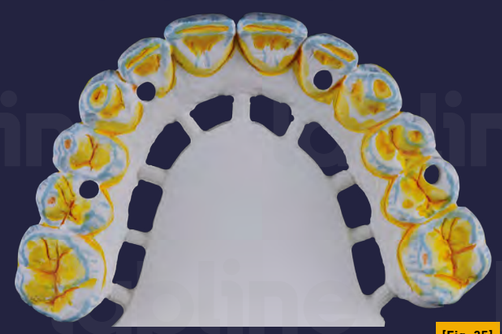
[Figs. 21-22] Once adapted, the two structures were milled from a Prettau® 2 Dispersive® zirconia blank.


[Fig. 23]

[Fig. 23] The restoration was finished to optimise texture and shape in terms of aesthetics.

[Figs. 24-25] The finished structures were characterised on the incisal, cervical and occlusal surfaces with infiltration pigments – dentine-blue, A3 and Orange – and sintered at 1600 °C with a slow sintering process.


[Fig. 24]


[Fig. 25]

[Fig. 26]

The case was finalised with the application of gingiva-shade ceramics on the mucosa and ICE Stains 3D to the white surfaces. Surface occlusal abrasions were polished with diamond pastes and rubber wheels in order to minimise friction generated by glave application and to better reproduce natural abrasions [Figs. 26-27]. Finally, the bars have been anodised in gold, bonded with dual cement [Fig. 28] and delivered to the dentist [Figs. 29-30]. No complications were observed during post-operative follow-up and the patient could experience the benefits of the two fixed restorations right from the beginning.

[Fig. 27]

[Figs. 26-27] Finishing the full-contour zirconia surface – A slight manual finishing of the CAD-designed restoration is essential for a natural, aesthetic result.

[Fig. 28] Both bars were anodised in gold for a more aesthetic and natural final restoration. Besides improving biocompatibility, the golden colouring aims at grey scale value reduction on the final restoration.

[Fig. 28]

CONCLUSIONS AND CLINICAL RECOMMENDATIONS

For each individual case, a careful selection of the type of clinical and dental technical treatment is essential to avoid complications. The clinical technique used dictates that an impression is taken after surgery using different materials (plaster or polyvinyl siloxane). When the patient owns an old prosthetics, it is reasonable to use the MAS temporary solution in order to save costs and time lapse from surgery to restoration delivery. Moreover, vertical dimension and repetitive occlusion are easily retrievable during the initial prosthetic phase. As far as the dental technical job is concerned, the treatment highlights an optimum method to fix monolithic zirconia on implants using a bar. In addition, for a customised and totally natural-looking final restoration, it is essential not only to know how to choose the right material, but also to have skilled hands to manually finish the CAD modelling working on shapes and individual colour effects.

[Fig. 29]

[Fig. 30]

[Figs. 29-30] During post-operative follow-up, no complications were observed: the patient could experience the benefits of the two fixed restorations right from the beginning.

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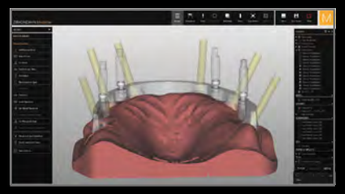
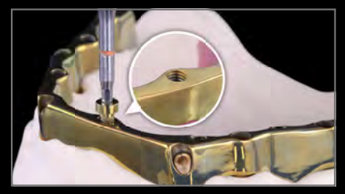
Zirkonzahn®

INTELLIGENT SOLUTIONS FOR DIVERGENT IMPLANTS

A bar-supported restoration is the best solution in cases of complete edentulism. However, due to various factors, this type of restoration is considered as one of the most difficult to realise, especially in cases of divergent implants.

To solve this problem, Zirkonzahn has developed four solutions that strike a balance between function, stability and aesthetics, ensuring the fabrication of high-quality restorations even for edentulous patients with divergent implants.





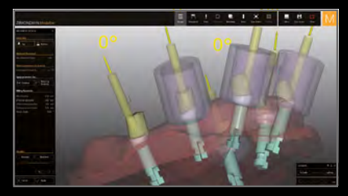
DOUBLE SCREW BAR

- *Special function where additional screw threads are created within the bar design with the Zirkonzahn.Modellier software*
- *Virtually genereted screw channels are integrated in the bar during milling*
- *The bar is screwed to the implants and the secondary structure is screwed onto the bar*
- *Prevents non aesthetic vestibular screw channels*



BARTPLATTE

- *Innovative bar design that enables the production of aesthetic restorations despite palatal-inclined implants*
- *Through the advanced function of the CAD/CAM Bars software module in the Zirkonzahn.Modellier software, the bar is geometrically adapted to the palatal surface of the wax-up and individualised by means of the free-forming function*
- *The CAD/CAM Attachments software module enables the creation of further bar retentions*




INDIVIDUAL RAW-ABUTMENTS®

- *Prefabricated abutment blanks made of high-quality medical titanium alloy (Ti-6Al-4V ELI according to ASTM F136 and ISO 5832-3) for the production of individual abutments*
- *The industrially prefabricated implant connection guarantees the highest fitting accuracy*
- *Compensation for implant divergences thanks to the individual design of the abutment geometry; vestibular protrusion of the screw channels is prevented*
- *Can be anodised (e.g. gold-coloured) using the Titanium spectral-colouring Anodizer*



TITANIUM BASES K80 ANGLED SCREW CHANNEL (ASC)

- *With a high chimney to ensure optimal stability and force distribution; chimney height can be adjusted to tooth length*
- *Side opening that permits to tilt the screw access channel from 0° to 30° to compensate for non-optimal implant positions*
- *With or without anti-rotation connection and an additional anti-rotation device located on the chimney that prevents the cemented restoration from twisting*
- *All titanium bases from Zirkonzahn are also available in a high-quality gold plating, but alternatively, they can also be anodised in different colours using the Titanium spectral-coluring Anodizer*

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DOUBLE SCREW BAR CASE GALLERY

BARTPLATTE CASE GALLERY

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