DI DENTALE IMPLANTOLOGIE
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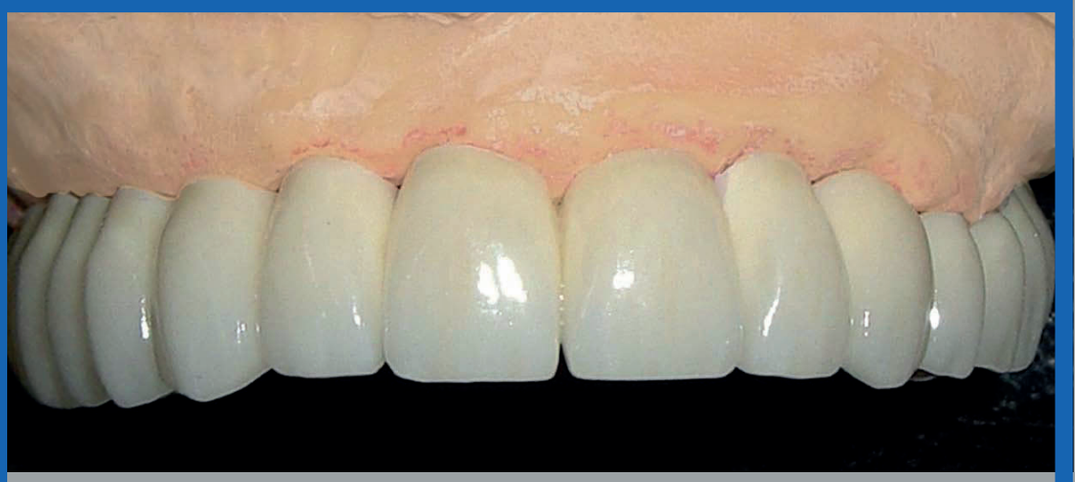

Full-arch one-piece zirconia bridge supported by twelve immediately loaded compression implants

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Key words: full-arch zirconia bridge, transgingival insertion, immediate loading, minimally invasive insertion

In the presented case report, 12 one-piece implants were placed by transgingival insertion. Restorative treatment was completed by definitive cementation of a full-arch zirconia bridge within 5 days. After preliminary diagnostic planning, a planning and drilling template could be fabricated. This aid resulted in a painless implant procedure without mucosal swelling. Subsequently the implants were immediately loaded with a temporary bridge structure.

Full-arch stabilization must be accomplished without delay (ideally within 72 hours). This requirement is essential to successful immediate loading of large-span restorations as described in this article. One-piece zirconia bridges of this type require a stable bridge structure that is perfectly accessible for periodontal maintenance.

Surgical considerations

A female patient aged 56 years presented at our office. Her existing maxillary restoration based on precision attachments had become periodontally inadequate over the years. Following a detailed examination, the course of treatment was discussed with the patient. It was planned to insert 12 implants specifically designed for immediate loading (KOS, Dr. Ihde Dental, Munich, Germany) using a transgingival approach. Only 5 days later, a one-piece zirconia bridge was going to be delivered by definitive cementation (Figures 1 and 2). Treatment was started by extracting all residual teeth in the patient's maxilla. Then an interim restoration was placed. The implant procedure was performed 5 months later. A total of 12 KOS implants were placed within 2 hours, using a transgingival approach. Implant lengths and insertion sites had been determined previously based on a diagnostic wax-up and fabrication of a radiographic template (Figures 3 to 5). No bleeding was observed immediately after placing the implants. Almost no gingival swelling ensued. As a result, the conditions for impression-taking were excellent (Figure 6 and 8). It only took a few minutes to prepare the abutments and optimize their parallelism, using a tungsten-carbide cutter with irrigation. Gentle

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chamfers were prepared for optimized seating of the planned zirconia restorations (Figure 7). Placement of the 12 implants was immediately followed by delivering a full-arch temporary bridge made from resin. The patient was instructed to eat only soft food in this temporary phase.

Thanks to the minimally invasive approach, no evidence of inflammation or swelling was observed even 5 days after implant placement (Figure 8). Minor cosmetic adjustments were made in the laboratory shortly before definitive insertion. Subsequently the final bridge was delivered with a resin cement. Following this step, abrasive instruments are used to make final occlusal adjustments in accordance with the individual chewing pattern. We prefer to establish group function. Our policy is to devote considerable attention to "sliding in centric" as a major reference for articulation during these adjustments.

Laboratory procedures

Full-arch zirconia bridges were generally considered problematic for immediate loading of implants until around two years ago [1]. Mörmann et al. did not recommend this approach for routine use. Their main point was lack of long-term results. Meanwhile, industry has succeeded in improving its reliability. Better CAD/CAM systems and more refined software applications have emerged. Also, the range of indications has become clearer thanks to interdisciplinary communication [2]. As a result, we have increasingly adopted this technology in our practice. Thanks to the high biocompatibility offered by zirconia, we consider immediate loading to be even safer than previously [3]. This hold true especially in complex cases involving the use of KOS implants [4].

Full-arch bridges offer maximum splinting of implants and good force distribution in the presence of immediate loading. In contrast to formerly held beliefs, osseointegration will develop very predictably in this situation [7]. This is not a temporary phenomenon, but splinted implants will retain their osseointegration over many years. A 9-year longitudinal study was conducted, including 89 full-arch bridges supported by 678 implants. These were followed up for a mean of 3 years. A respectable implant success rate of 95.7% was obtained [6]. This high success rate was due to the insertion technique and the use of one-piece implants. A minimally invasive approach of transgingival placement was taken, associated with lateral bone condensation around the implants. Moreover, all

Figure 1 Situation immediately after transgingival insertion.

Figure 2 The completed restoration five days after implant insertion.

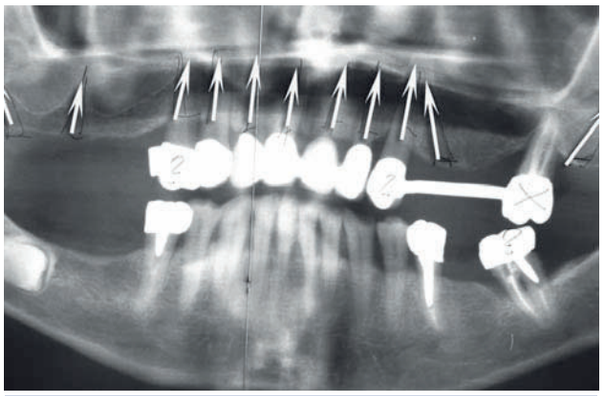

Figure 3 Diagnostic radiograph, five months prior to treatment.

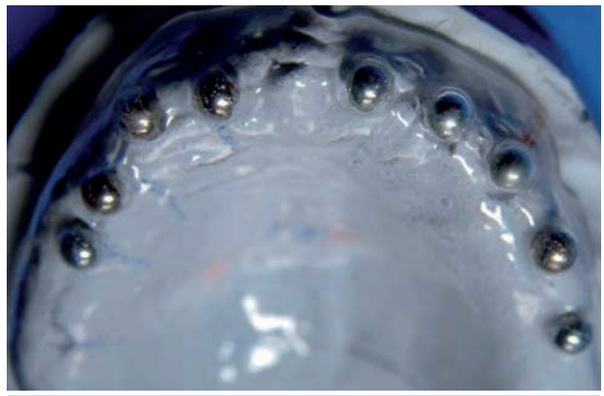

Figure 4 Radiographic template

abutments involved were immobilized right after implant placement. Success rates can be expected to rise even further, since the duration of treatment has become continuously shorter in recent years. Treatment should ideally be completed within 3 days of insertion. True bone remodelling will not begin earlier. If treatment is completed by that time, any destabilizing forces acting on the implants during framework try-in and removal of the temporary bridge will fall into this early phase of approximately 72 hours (Figure 9) [9].

Today we understand the parameters to be considered by technicians. Numerous years of experience reported by Möhrmann et al. have greatly contributed to this understanding [5]. After scanning the residual tooth preparations on a scan model (Figure 10) and creating a three-dimensional data model, the framework is obtained by form milling (Figure 13). Zirconia should be handled very cautiously before sintering, as its structure is highly sensitive in this phase. Wall thickness should be a major focus of attention when designing the framework. Numerous risks are also present in the phase of subsequent adjustment. Errors might include overly coarse processing, or lack of cooling leading to excessive heat. System compatibility between the framework and veneering ceramic must be ensured. Any major discrepancies will carry a risk of chipping or even fractures down the road. Another essential requirement is to implement a common insertion path. The KOS system in particular offers a variety of options to achieve this goal more easily.

Connector thickness between abutments must be adjusted to values between 9 and 12 mm² [5]. Values below this level carry a risk of crack formation in situations of extreme loading, thus causing fractures at a later time and eventually resulting in treatment failure. Considerable attention should be devoted to the pseudopapilla in the gingival transition zone. Reasons include aesthetic considerations and requirements of periodontal maintenance (Figure 15). Implants milled from a single blank offer definite advantages in this respect. Unlike two-piece implants, they do not involve a microgap, such that microleakage cannot occur. Numerous years of clinical experience have demonstrated that one-piece implants featuring a polished transmucosal surface are rarely, if ever, associated with peri-implantitis. They are also seldom associated with major pockets in the surrounding bone [6]. Stresses should be avoided at all costs during insertion of the framework. Again, there should be no interference with early bone remodelling. No pressure must be applied.

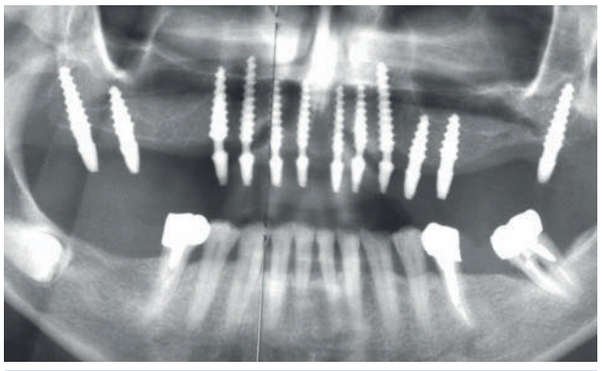

Figure 5 Radiograph taken immediately after implant insertion.

Figure 6 Unmodified implants in situ.

Figure 7 Gentle chamfer preparation directly following insertion.

Figure 8 Gingiva, five days postoperatively.

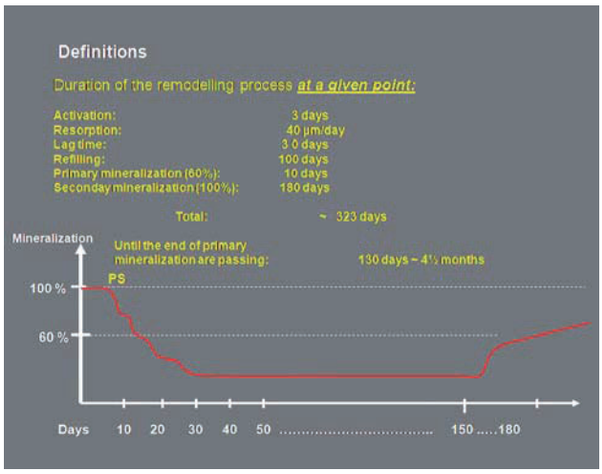

Figure 9 Chart of the remodelling phase.

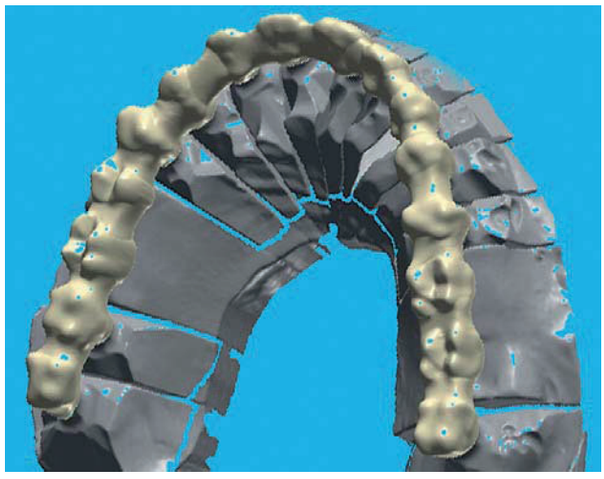

Figure 11 Scan of the corresponding wax-up.

Figure 13 Bridge prior to glaze firing.

Figure 15 Bridge on the cast after glaze firing.

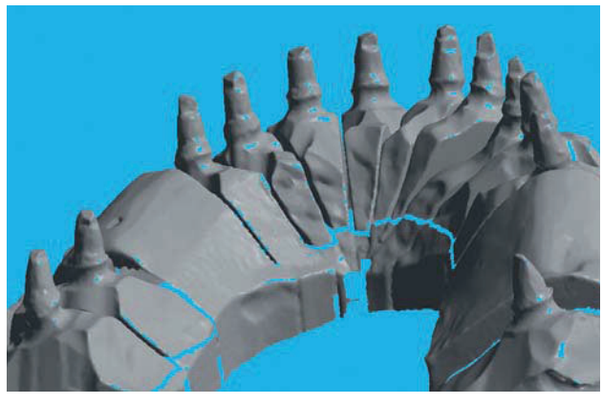

Figure 10 Scan of the prepared dies.

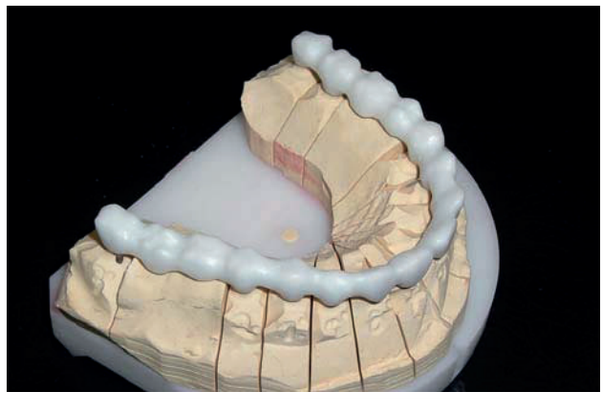

Figure 12 Zirconia framework on the cast.

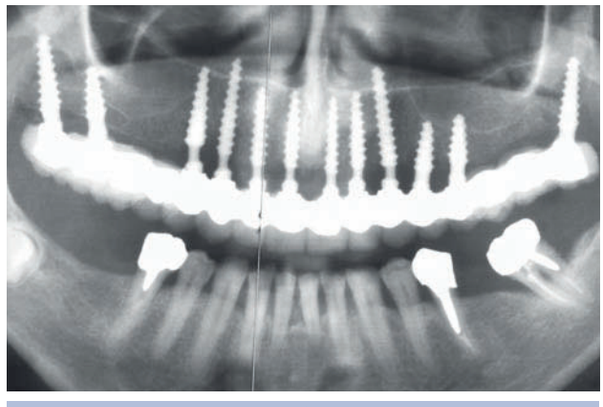

Figure 14 Control radiograph of the cemented bridge.

Figure 16 Final result after five days.

Our cementation technique has included both Panavia 21 TC (Kuraray, Frankfurt, Germany) and Rely X (3M ESPE, Seefeld, Germany). The abutment surfaces were slightly roughened prior to cementation. Alumina blasting of the internal bridge surfaces can be used in advance to optimize bonding. After scanning, the technician has an opportunity to establish and adjust the thickness of the restorative material (Figures 11 to 14). Insufficient dimensions carry a risk of failure.

Discussion

Immediate loading in combination with a 16-unit bridge milled from a single piece of zirconia is certainly a very challenging approach. Several considerations have prompted us to adopt this strategy. We have reached an excellent success rate for immediate loading of full-arch metal-ceramic bridges over a period of 10 years [6]. Our experience also demonstrates that close-to-perfect aesthetics can be attained with zirconia bridges on titanium implants even today (Figures 15 and 16). Conditions permitting, many of our patients will request having their newly inserted implants restored with uniform and white crown or bridge restorations. They are also keen on having them restored as quickly as possible. Thus patients and their expectations are increasingly leading the way in implantology. Our task as implantologists is to strike a responsible balance. This trend (i.e. patients demanding highly aesthetic restorations within a very short time) is reflected in the case herein presented. A zirconia restoration was successfully used in combination with KOS implants to meet the patient's demands. The stage thus appears set for routine application of zirconium restorations. However, there will always be numerous exceptions. Traditional alloys have yielded good results in the past, and they will certainly have a role in the future. One example of such an indication would be bruxism. Most importantly, the indication for immediate restoration and loading must be well defined. Established rules of immediate loading must be strictly observed. Meticulous planning is essential.

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Transgingival implant placement does require some experience in conducting surgical procedures. The simplicity of inserting one-piece compression implants cannot change the fact that obstacles may be present. These may not be evident if concealed by the bone architecture. Misjudging these situations can lead to complications or failure down the road. CT scans are mandatory if certainty is not obtained by conventional planning. They will offer additional reassurance for the clinician and patient.

We do not, however, give our wholesale endorsement to computer-assisted planning. While approaches of this type are currently being broadly advocated, it would be wrong to delegate any decisions on implant placement entirely to the newly emerging institutes using advanced equipment in 3D diagnostic centres. Close collaboration with the laboratory is indispensable. Herein lies a major key to success. True partnerships as they have developed in recent years are definitely the way to go in the future [8].

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