Implant Surgery Using Short Implants with Sintered, Porous Surface

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_In conjunction with the clinical parameters, the implant surface has a considerable effect on the integration of the implant within the surrounding bone tissues. The use of short, root-shaped implants with porous surface is a predictable treatment method for an implant restoration even in difficult anatomical situations. Our case reports document the very effective function of short (5 mm and 7 mm) sintered press-fit implants with porous surface. In comparison with the majority of screw-type implants[4, 6, 9] the sintered implants with porous surface also in short lengths in general show a good performance. This is probably the result of their integration mechanism by ingrowth of the bone into the porous surface.[8, 3]

_The Endopore Implant System

A number of surface treatments is available for implants which create a rough surface and thereby enlarge the surface for contact with the bone. The additional porous multilayer of spherical titanium alloy particles of a defined size enables the ingrowth of the bone into the existing rough structure of the surface. A three-dimensional mechanical bond between bone and implant is achieved (Fig. 1). This mechanism of osseointegration is unique and only possible with a porous surface and was used in orthopedics for iliac endo-prosthetics in early 1970. All other types of surface treatment have only minimal or no porousities, and the implants are stabilized only by friction 8. The Endopore implant (Oraltronics/Sybron Implant Solutions, Bremen) was developed in 1983 at the University of Toronto and shows a well-defined surface topography 7. The aim of this development was to create a predictable implant anchorage by bone ingrowth into a porous surface which was produced by a sintering process. The implant consists of a titanium alloy (TI-6Al-4V), has a conical root shape and achieves primary stability by press-fit. The multilayer generates a significant increase in the surface due to multiple undercuts (Fig. 2) and provides a three-dimensional

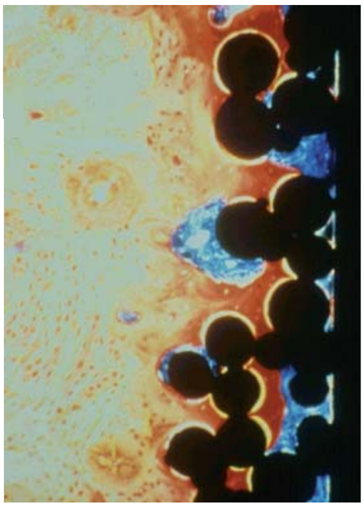


Fig. 1_ Histological specimen of an implant with porous surface 18 months post-op. The majority of surface porosities is filled with ingrowing bone substance (magnification 25 x).

Fig. 2_ Comparison of surfaces: tooth, machined, Endopore implant.

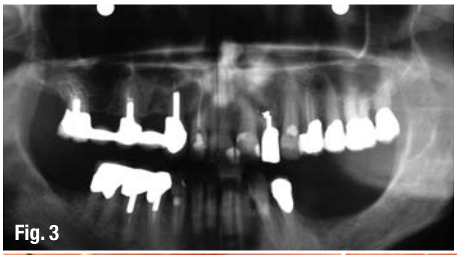
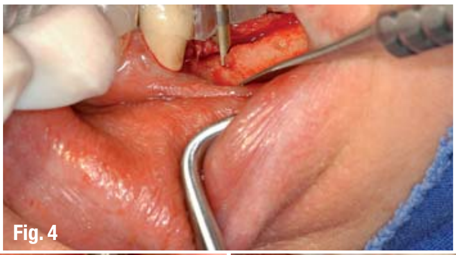


Fig. 3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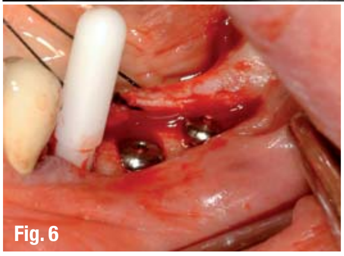
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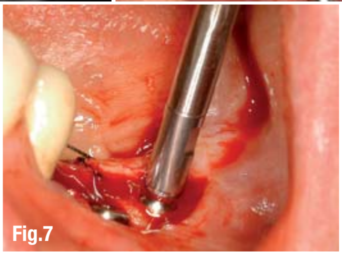
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Fig. 8


Fig. 9

mechanical connection between bone and implant. In difficult anatomical situations such as severe atrophy of the alveolar bone, it is in many cases possible for an implant-prosthetic restoration to avoid an extensive augmentation or bone transplantation. Since the total surface of the implant is increased by the porous structure, we can predictably use shorter implants.[1,2] Based on the number and the scientific methodical quality of clinical investigations of the Endopore Implant System, these documentations comply with the criteria of extensive clinical documentation 5. Six centers in four countries have conducted long-term studies. A total of 1,352 implants were controlled over a period of up to eight years after surgery. The total rate of success of the six centers is 95.9 %.[1, 2]

_Case Report of a prosthetic restoration with fixed dentures at extreme atrophy of the posterior mandible

A female patient (59 years) in good general state of health was referred to us, she wished to receive prosthetic rehabilitation with fixed dentures. After restoration of the maxilla and finalizing the necessary preparatory measures, we planned an implant-supported restoration with crowns in the lateral maxilla. The teeth 35, 36 and 37 were missing.

The vertical available bone was limited due to a severe atrophy, and a significant horizontal bone loss was ascertained (Fig. 3). The preoperative diagnostics revealed a limited available bone of 6 mm in region 36 and 37 and of 8 mm in region 35. The patient was informed about alternative treatment methods, especially vertical and horizontal augmentation, and she decided for an implant insertion of short implants. We selected an Endopore implant of 7 mm length (diameter 4.1 mm) for region 35 and two Endopore implants of 5 mm length (diameter 5 mm).

The implant surgery was scheduled for June 2006. After anesthesia a crestal incision was made in region 35-37, the mucoperiosteal flaps and the supporting bone prepared. The implant positions were determined (Fig. 4) and the pilot drillings made. The insertion direction of the implants was

Case 1

Fig. 3_ Preoperative X-ray.

Fig. 4_ Determination of implant positions and pilot drilling.

Fig. 5_ Preparation of the implant bed.

Fig. 6_ Implant insertion.

Fig. 7_ Final implant position using the punch handle.

Fig. 8_ Checking the primary stability and cover screw.

Fig. 9_ Post-operative X-ray control after implant insertion.

Fig. 10_ Abutments inserted, control at re-entry surgery.

Fig. 11_ Post-operative X-ray after exposure.

Fig. 12_ Preparation and procedure for impression-taking.

Fig. 13_ Finished denture on the model.

Fig. 14_ Denture inserted.

Fig. 15_ Control of the inserted restoration.

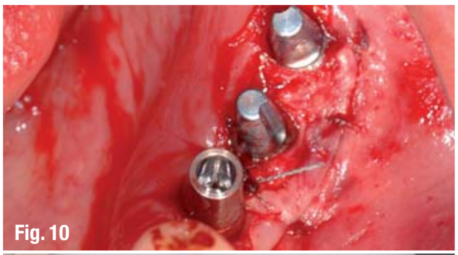


Fig. 10


Fig. 11

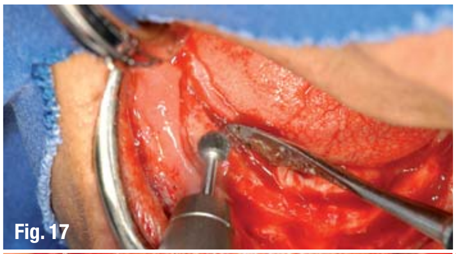

Fig. 12


Fig. 13


Fig. 14


Fig. 15


Fig. 16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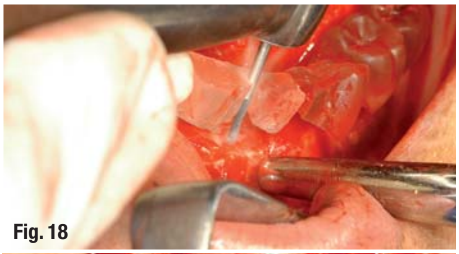
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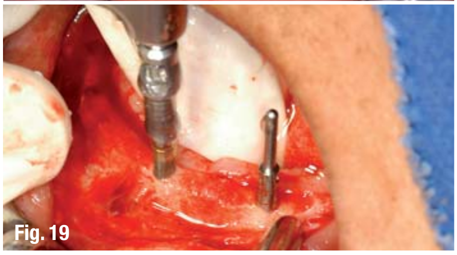
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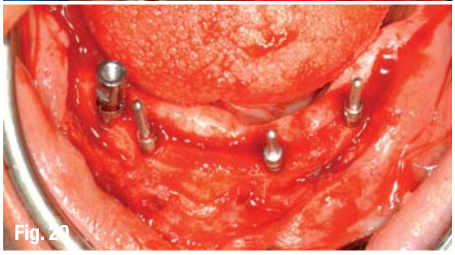
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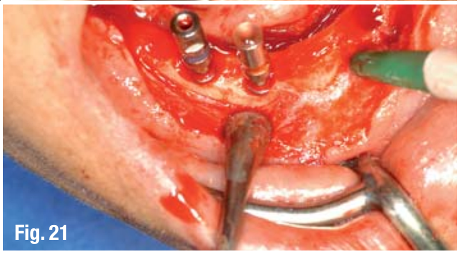
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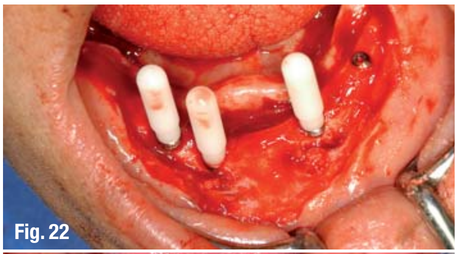
Case 2
Fig. 16_ Pre-operative situation.
Fig. 17_ Preparation of the flaps and of the anchoring bone.
Fig. 18_ Determination of the implant positions.
Fig. 19_ Pilot drilling.
Fig. 20_ Direction control.
Fig. 21_ Checking the osteotomy with the parallel indicators.

controlled by using the parallel indicators. As soon as the predetermined depth was reached with the pilot drill, the implant site was extended with an implant drill (of the corresponding implant dimensions) (Fig. 4). The implant site was controlled with a matching Trial Fit Gage (final osteotome tips). The shoulder of the conical osteotome gage should remain slightly below the alveolar crest. The selected implants have to be removed from the sterile packing under aseptical conditions and immediately placed into the insertion site. The implants should only be in touch with the acrylic insertion aid and contact with soft tissues must absolutely be avoided. Using the punch handle, the implant is placed into the final position and the stable fit of the cover screw checked and the primary stability verified (Fig. 6-9). A healing period of minimum 18 weeks is recommended, in order to guarantee an undisturbed reorganization of the bone structure into lamellary bone.

The reentry and exposure of the implants was performed in January of 2007. At the time of insertion of the abutments, some free gingiva was transplanted in order to achieve a stable gingiva around the implants. Then the abutments were placed (Fig. 10). An X-ray control for checking the exact fit of the prosthetic abutments is recommended (Fig. 11). Six weeks later, in February of 2007, the crowns (Fig. 13) were prepared after direct trimming of the abutments (Fig. 12) and impression taking. The design of the occlusal surfaces are based mainly on theoretical considerations since pilot studies and in-vivo examinations are hardly existing in literature. It should be reasonable to displace transversal stresses which could have a negative effect on the implants, to the anterior region as far as possible. The oro-vestibular width of the occlusal surface has considerable influence on the extent of the bending point. The material used for design of the occlusal surfaces seems to have a secondary effect for the long-term success 11. The denture should be carefully checked on correct precision fit and the design of the occlusal surfaces (Fig. 14 and Fig. 15).

The use of short implants enables an extension of the indication by the possibility to provide the patients with fixed dentures even at severe atrophy of the bone.

Fig. 22_ Implant insertion.
Fig. 23_ Final implant positioning using the punch handle
Fig. 24_ Post-operative X-ray control
Fig. 25_ Situation after soft tissue healing (gingival former).
Fig. 26_ Impression posts.
Fig. 27_ X-ray control of impression posts.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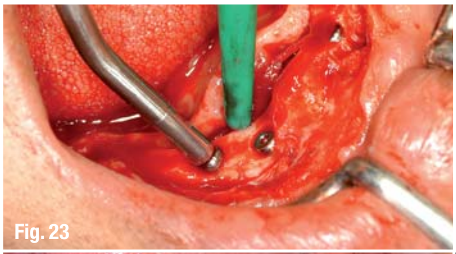
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Fig. 25


Fig. 26

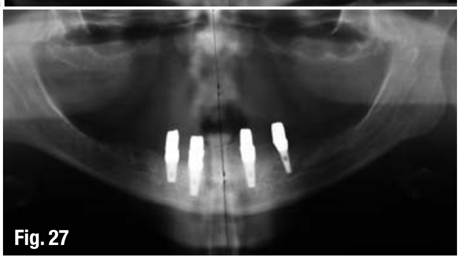
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Fig. 28

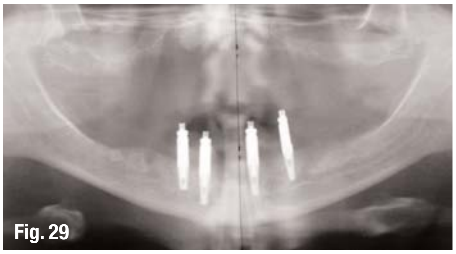
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Fig. 31


Fig.32


Fig. 33


Fig. 34

Fig. 28_ Abutments inserted according to telescoping primary crowns.
Fig. 29_ X-ray control of the prosthetic elements (abutments).
Fig. 30_ Denture inserted in November 2003.
Fig. 31–35_ Situation 4 years after restoration

_Case Report of a telescopic implant-supported denture with control 4 years post-op

A female patient (52 years) with good general state of health was referred to us for implant surgery and prosthetic rehabilitation in the mandible. The patient was edentulous in the maxilla and in the mandible (Fig. 16).

After informing the patient on alternative possibilities of restoration, especially including vertical and horizontal augmentation, the patient decided in favour of implant surgery with short implants based on the smaller risk.

The implant surgery took place in June 2003. After anaesthesia and crestal incision from region 35 to 45, the mucoperiosteal flaps were prepared and bilaterally the mental nerve was identified and the supporting bone prepared (Fig. 17). The implant positions were determined (Fig. 18) and the pilot drillings performed (Fig. 19). The direction position of the implants was controlled by using the parallel indicators. As soon as the desired depth was reached with the pilot drill, the implant site was expanded with a final implant bur (according to the selected implant dimension) (Fig. 20). The implant site was controlled with corresponding trial fit gages (final osteotome tips). The shoulder of the conical trial fit gage should remain slightly below the alveolar crest (Fig. 21). The further surgical steps proceeded as presented in the above preceding case. By using the punch handle, the implant was tapped into the final position, and the stable fit of the cover screw and the primary stability was checked (Fig. 22, 23 and 24).

A healing period of at least 18 weeks is recommended, in order to guarantee the undisturbed transformation of structured bone to lamellary bone. The implants were exposed in September of 2003. After soft tissue conditioning, the preparation of the final restoration was started in October 2003, and in November 2003 the final denture was inserted (Figs. 25-30).


Fig. 35

The patient moved to another country for professional reasons and did not return for dental / individual prophylactic control in the meantime. She came back for control in October 2007. The restoration showed no abnormalities, neither at X-ray control nor at clinical check-up (Fig. 31-35).

_Conclusion

The use of short root-shaped implants with porous surface enables a predictable less invasive treatment method for the restoration with dental implants, even in difficult anatomical situations. The surface enlargement of the porous multi-layers of spherical titanium particles allows the ingrowth of bone into the rough surface structure and leads to a three-dimensional mechanical bond between bone and implant. The Endopore implant system allows in many cases a minimal-invasive surgical restoration.

The literature list can be requested from the editorial office.

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