PROCERA® IMPLANT BRIDGE

A new treatment concept for a fixed restoration of the edentulous jaw

presented by
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Implant dentistry is a predictable treatment modality - it’s hard to imagine modern dentistry without implants. Due to its high long-term success rate osseointegrated implants have become the treatment of choice for partially- and fully-edentulous patients.

The classic "Brånemark“ concept of osseointegration of dental implants is a two-stage procedure. This method is scientifically proven, very reliable and predictable. Today, attempts are being made to simplify and accelerate the procedure from the installation of the implants to the prosthetic reconstruction. For example, techniques have been developed, which allow a one-stage procedure with early or immediate loading of provisional or definitive prosthetic reconstructions.

Nevertheless many dentists do not offer implant treatments to their patients, because

– of the confusing range of implant systems on offer,
– money- and time-consuming continuing education and
– the high additional cost of equipment.

For these reasons many colleagues judge implantology to be difficult and expensive.

With Procera® Implant Bridge Nobel Biocare has created a new treatment concept, which makes it possible to provide the patient with an edentulous arch with a fixed bridge in a short time. A team approach between prosthodontist, dental technician and oral surgeon is vital.

With Procera® Implant Bridge a new method of framework production is presented. A computerised industrial milling technique makes it possible to produce a bridge framework for implant restorations from a homogeneous titanium block without welds, lunkers and tension. The material titanium ensures the highest possible biocompatibility. The excellent and precise fit saves money and time and the patient is more pleased with the long-term result.

The prosthodontist, fitting the Procera® Implant Bridge only requires a single screwdriver. And you will feel the difference when tightening the prosthetic screws!

A clinical case illustrates in detail the Procera® Implant Bridge concept.

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2002 “Specialist for Implantology” of the Consensus Conference for Implantology
2001 Appointed “Specialist for Periodontics” of the German Society for Periodontics
1995 Private practice limited to oral surgery, implantology, periodontics and microendodontics in Lindau / Lake Constance, Germany
1994 Thesis “Pathological changes in the anterior horn of the spinal cord in Alzheimer’s disease”, Dr. med. dent.
1991-1994 Specialisation in oral surgery under Prof. Dr. Dr. Ralf Schmidseder, Frankfurt/Main, Germany
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Memberships:

- European Association for Osseointegration
- German Association of Implantology
- German Association for Restorative Dentistry
- German Society of Implant Dentists
- Workshop for Oral and Maxillofacial Surgery within the Society of DGZMK
- Society of German Oral Surgery
- German Society for Periodontics
- German Association for Esthetic Surgery

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Indications

The Procera® Implant Bridge concept is especially designed for edentulous patients, but is also indicated for smaller bridges. It is possible to veneer the titanium framework with denture teeth, resin composite or porcelain veneer. It is also possible to create bar reconstructions with this treatment concept. It is available for the Bränemark System®, Steri-Oss® und Replace® implants.

With this kind of technique it is possible to treat almost every edentulous jaw, which has a minimum height of 12-13 mm and width of 5-6 mm.

The patient has to be healthy enough to tolerate surgery lasting two and a half hours and be able to keep his mouth open adequately. The technique is useful for every shape and jaw relationship.

Advantages

The advantages of the Procera® Implant Bridge concept are:
- most precise and manufacturer guaranteed fit,
- fixed reconstruction in a short treatment time,
- immediate loading possible,
- framework out of one solid piece of biocompatible titanium,
- framework and implant pillar out of same material,
- absolutely tension-free bridge framework without any solder joints,
- the framework can be fabricated on implant level and on all platforms and abutment types,
- reduced costs as abutments are no longer necessary,
- reduced framework costs because of titanium instead of gold alloy,
Visualization of the Alveolar Crest

- the framework, which will be produced during the healing time after implant installation, makes impression in the prosthetic phase unnecessary,
- denture teeth, composite resin and porcelain can be added to the framework,
- high predictability.

Treatment sequence

The treatment of an edentulous mandible with Brånemark System® implants and a Procera® Implant Bridge is divided into the following major treatment steps:
- preoperative examination and treatment planning (Set-up),
- insertion of the Brånemark System® implants,
- intra-operative registration of the implant position,
- fabrication of the master cast,
- fabrication of the resin framework,
- scanning of the framework and the master cast in Sweden,
- CNC-milling of the titanium framework,
- finishing of the titanium framework,
- second-stage procedure,
- fitting the titanium framework,
- determination of jaw relation,
- fitting of wax try-in,
- completion of the fixed bridge in the laboratory,
- delivery of the Procera® Implant Bridge,
- maintenance and recall.

Although the new treatment concept "Procera® Implant Bridge" simplifies and shortens the procedure, the installation of the implants and intra-operative registration requires surgical experience and implant know-how.

Preoperative Examination and Treatment Planning (Set-up)

Prosthetic planning

For the prosthetic planning it is necessary to fabricate study casts and to determine the relationship between the jaws. The
Installation of the Brånemark System® Implants

try-in of a tooth set-up is a prerequisite for correct insertion of the implants and the registration of the implant positions and makes it possible for the technician to fabricate a resin framework (fig. 4 and 5).

Radiographic examination

The vertical height of the jaw and the volume of the mandible are the two most important criteria if the illustrated treatment concept is possible. A panoramic x-ray is necessary to show potential pathological structures and the anatomical structures, which limit the available bone (fig. 6). Profile radiographs illustrate the shape and width of the mandible in the middle of the jaw. For the treatment of an edentulous mandible with a fixed bridge, 5 to 6 implants in the interforaminal region are necessary. The interforaminal space should be wide enough to guarantee a minimum inter-implant space of 3 mm. Narrow platform implants and implants below 10 mm in length are unsuitable for this procedure. That is why the mandible should have a minimum height of 12-13 mm and width of 5-6 mm to install the implants correctly.

Placement of the Brånemark System® Implants

Incision

After local anesthesia, sedation or general anesthesia and sterile coverage of the patient a crestal incision is made to the region of the first molar (fig. 7). Laterally orientated releasing incisions make it easier to mobilize the full-thickness flap.

Leveling of the alveolar crest

After visualization of the buccal and lingual surfaces of the alveolar crest the foramina of the mental nerves are uncovered and the body of the mandible examined for concavi-

![Fig. 9: Direction indicators after drilling with the 2 mm twist drill show the correct angulation and spacing between the platforms of the implants](image1)

![Fig. 10: Surgical guide with direction indicators after drilling with the 2 mm twist drill](image2)

![Fig. 11: Six Brånemark System® implants with optimal spacing und angulation in place](image3)

![Fig. 12: For intra-operative registration of the implant positions the titanium registration copings are installed](image4)
ties. To create an adequate platform for the insertion of the Brånemark System® implants, it is necessary to level the alveolar crest moderately.

**Implant site preparation**

Maintaining the distance to the mental foramina implant site preparation starts by preparing initial marks with the guide drill. A minimum centre-to-centre distance of 7 mm is important to ensure adequate spacing between the implant platforms (fig. 8). The placement in vestibulo-oral direction has to be verified with the surgical guide. Subsequently with a 2 mm twist drill the first deep drill process is carried out under continuous cooling with sterile sodium chloride solution. Placement of the direction indicators makes it possible to always check the right relationship with the surgical guide (fig. 9 and 10). With the pilot drill the coronal part of the implant site is widened to 3 mm. The twist drills with 3 and 3.15 mm diameter are used to open the complete implant site. The use of the countersink makes it possible to place the implant head at bone level. If the interforaminal bone structure is very dense, the use of a screw tap is advisable although the Mk III implant design is self-tapping.

**Insertion of the implants**

Six Brånemark System® Mk III implants (diameter 3.75 mm, length 18 mm, TiUnite™ surface) are installed under control of the angulation and adequate cooling with sterile sodium chloride solution at 24 rpm (fig. 11). The Stargrip™ allows you to guide the implants exactly while having a close look at the implant neck.

**Intra-operative Registration of the Implant Position**

Following the installation of the implants the titanium registration copings are mounted to the implant platforms (fig. 12).
The surgical guide has, on occasions, to be relieved to fit without tension over the copings. It is also important to check that the occlusion between the surgical guide and the upper denture is correct. Pattern Resin (GC, Tokyo, Japan) is now mixed viscous and filled into single-use syringes. After a final check to ensure that the relationship to the implant registration copings and the upper denture is correct, the surgical guide is fixed in the region of the first molars on both sides with well-proportioned pressure. Pattern Resin is gradually filled between the copings and the surgical guide in small doses. It is necessary to ensure that the Pattern Resin is of such low viscosity that it does not come into contact with bone and soft tissue, but also that it is smooth enough to completely coat all copings and fixate the copings to the surgical guide (fig. 13). Just one moving or unstable implant registration coping is enough to make this treatment concept impossible. After hardening of the Pattern Resin the slot screws of the registration copings are unscrewed and the surgical guide removed from the oral cavity. After detailed control of the rigid fixation of all copings it is possible to reinforce the registration with some more Pattern Resin (fig. 14).

The wound area is now rinsed with sterile sodium chloride solution and cover screws are placed on the implants (fig. 15). To get a tension free flap adaptation a splitting of the periosteum is, in most cases, necessary. Alternating single and mattress sutures ensure tight wound adaptation (fig. 16). Postoperatively the wound is compressed with sterile swabs and a panoramic x-ray is made for control of the correct insertion of the implants (fig. 17). For perioperative medication clindamycine (3 times a day 300 mg) and bromelaine (3 times a day 100 mg) are administered. Ibuprofen 400 mg is recommended as needed. It is not allowed to wear the lower denture in the first two weeks. During
this time the patient should keep to a liquid diet and rinse two to three times per day with 0.2% chlorhexidine solution. Seven to ten days post-operatively the sutures should be removed. Two weeks postoperatively the lower denture should be ground and a soft tissue reline placed.

**Fabrication of the Master Cast**

The dental technician again checks the rigid registration of the copings to the surgical guide. He then mounts the implant replicas carefully (fig. 19). Before the implant replicas can be installed into the cast, an impression of the alveolar crest should be made. The technician now has the difficult job of fitting the surgical guide back to the working cast (on which the surgical guide was fabricated) by grinding shafts for the implant replicas into the cast. When the surgical guide fits without any tension on the cast, the implant replicas are fixed with plaster in the cast. To allow the scanning of the implant replicas a removable gingiva mask must be fabricated. Therefore the master cast has to be reduced in the region of the implants. After placing the impression of the alveolar crest on the cast, the resin gum material (Vesto Gum, Espe, Seefeld, Germany) is pressed through a shaft onto the master cast to create the removable gingiva mask (fig. 20).

**Fabrication of the Resin framework**

For the fabrication of a titanium framework the production facility in Sweden needs a resin framework and a master cast with a re-
movable gingiva mask. Therefore provisional cylinders are screwed to the implant replicas and the matrix which has been fabricated during the set-up, are fixed to the master cast (fig. 21). Now the design of the framework can be waxed up with distal extensions. When waxing up the framework it is important to anticipate the subsequent veneering technique. An impression is made from the wax-up of the framework in order to transfer the material into resin (fig. 22). In this case the framework was prepared for veneering with denture teeth.

**Scanning of the Resin Framework and the Master Cast in Sweden**

The master cast and the resin framework are sent to the Nobel Biocare production facility in Sweden (fig. 23). After removing the gingiva mask the positions of the implant replicas are scanned by a laser (fig. 24). The resin framework is covered with a white varnish to make the scanning process possible (fig. 25). The data from the scanning of the outline of the framework and the position of the implant replicas in the cast are compiled in the computer. For this reason it is not necessary to ensure a tension-free fit of the resin framework on the implant replicas.

**CNC-Milling of the Titanium Framework**

On the basis of the calculated computer data the rough titanium framework is milled out of a round, massive and homogeneous titanium block using an industrial CNC-milling technique (fig. 26 and 27). The abutment connections are milled very precisely and integrated into the framework. The framework is separated from the titanium block (fig. 28). The tension-free and precisely fit is verified on the master cast. The framework and the master cast are delivered to the dental laboratory in 5 working days.
Finishing of the Titanium Framework

Back in the laboratory the rough framework is finished coarsely with heatless-stones and titanium mills to fit to the gingiva situation of the master cast. The finishing process should not go too far at this stage, because small changes in the jaw relationship, which has to be checked once again, can result in big changes in the design of the framework (fig. 29). It is necessary to keep the framework strong enough to prevent fracturing of the distal extensions (fig. 30).

Second-stage Procedure

If all implants at the time of implant installation have primary stability, resist a torque of 35 Ncm and show good resonance frequency values, an early loading of the implants is possible. In this case the healing abutments should be connected immediately and the protocol should be changed to a one-stage procedure. It is also possible to use special one-stage implants, like the Replace Select Straight with a 3 mm machined collar.

When following the classic protocol of P.-I. Brånemark the second stage procedure will take place after 3 months of submerged healing. After local anesthesia a crestal incision on top of the cover screws is made to divide the attached mucosa to the lingual and buccal.

A mucoperiostal flap is carefully elevated far enough to the lingual and buccal to see the cover screws completely (fig. 32). The cover screws are removed and the implant platform and the inner aspect of the implant are cleaned with chlorhexidine. The healing abutments are selected by measuring the height of the surrounding tissue and screwed and tightened to the implant head. It’s im-

Fig. 29: Finished titanium framework which has been adapted to the gingival situation (ZTM Rainer Schmidt, Opfenbach, Germany)

Fig. 30: When finishing the titanium framework it is necessary to keep the dimension of the distal extension thick enough to prevent fracturing (ZTM Rainer Schmidt, Opfenbach, Germany)

Fig. 31: After three months of healing without irritations a cover screw in the right mandible gets slightly exposed through the mucosa

Fig. 32: Elevated full-thickness flap with the exposed cover screws
important to ensure a gap-free fit of the healing abutment on the implant shoulder. The tight flap adaptation around the healing abutments is achieved by using single interrupted sutures (fig. 33). A postoperatively panoramic x-ray shows the gap-free tightening of the healing abutments and the complete osseointegration (fig. 34). The denture has to be grinded to fit over the healing abutments. A few days later a new provisional soft reline is possible. One week after the second-stage procedure the sutures are removed. Two week postoperatively the mucosa shows excellent healing without irritations.

Try-in of the Titanium Framework

After disconnecting the healing abutments the Procera® Implant Bridge framework can be tried in the first time (fig. 35 and 36). For this the laboratory screws in the framework are loosened and removed with a slot screwdriver.

After desinfection of the framework and the implant platforms with chlorhexidine the framework is tried in on the implant shoulders. You can now feel how precisely the framework fits without any rocking, wobbling and feeling of tension on the implant heads. Six TorqTite® Unigrip™ abutment screws are placed into the screw access holes and tightened by the wheel nut principle with a Unigrip™ screwdriver. When tightening the screws you will feel the difference of the guaranteed, gap and tension-free fit (fig. 37).

To ensure a gap-free fit a panoramic x-ray should be made. This confirms the perfect fit between the titanium framework and the implant heads (fig. 38).

The work of the oral surgeon is now completed. The process is finished off by the prosthodontist and the dental technician.

An impression of every single implant is unnecessary because of the fitting frame-
Try-in of the Framework and Jaw Relationship

work. To make the finishing of the framework easier for the dental technician, impression material should be injected under the basis of the framework. This shows the actual mucosal situation. Back in the laboratory the original gingiva mask is removed from the master cast, the framework with the impression material is connected to implant replicas and lined with plaster. Now the technician has a master cast which shows the actual soft tissue situation.

Determination of Jaw Relationship

To mount the casts in relation to the skull into the articulator, the use of a face bow is necessary. To determine the height of the bite you have to fix the resting position and compare it with the old denture. The height of the bite should normally be fixed 2 mm below the height of the resting position. For provisional determination of the jaw relationship Pattern Resin is placed at three points on the framework. The height of the bite and the symmetrical occlusion at the three Pattern Resin points have to be checked.

In the laboratory the cast of the upper jaw is mounted in the articulator in relation to the skull. The cast of the lower jaw is fixed by the provisional bite with Pattern Resin. To register the movements of the lower jaw, a registration plate is fixed to the framework (fig. 39).

For the upper jaw a resin basis is prepared with a pen. Because of the rigid fixation of the registration plate on the framework, an exact registration of the lower jaw is possible. With this it is possible to track the movement of the mandible. The bite has to be fixed in centric relation with the registration material. In the laboratory the lower jaw cast is mounted again to the new registration. The framework has now to be finished based on the new jaw relationship, the actual soft tissue situation and the matrix of the set-up for the new denture. In this case the framework is prepared for additi-
Completion of the Procera® Implant Bridge

Fitting of the Wax Try-in

With the matrix in place the denture teeth were adapted so that each tooth is supported by a metal pin of the framework. Because of the exact treatment planning and parallel and right angulated implant installation you can now see that the screw access holes lie centrally underneath or lingual to the teeth. Canine guidance is established in the presence of a well fitting upper denture. In case of a fully but slightly moving denture in the upper jaw you should adjust the teeth in a balanced occlusion.

After fabricating the denture set-up in wax in the laboratory they are delivered to the prosthodontist for intraoral try-in. In addition to colour, design and position of the dentition the horizontal and vertical dimensions and the occlusion have to be checked. Following small adjustments once again a bite check with registration material should be made (fig. 40). If, in the meantime, there have been changes in the gingival situation impression material may be injected under the basis of the framework again. If the patient and the prosthodontist are pleased with the outcome of the wax try-in, the Procera® Implant Bridge is sent back for completion for the last time to the dental technician.

Completion of the Fixed Bridge in the Laboratory

The dental technician can now start finishing Procera® Implant Bridge. First implant replicas are connected to the Procera® Implant Bridge and a special master cast is fabricated. The cast is invested for completion using hydrocolloid material. After steam cleaning the wax the framework is sandblasted, prepared for silanisation (Rocatec, Espe, Seefeld, Germany) and covered with tooth and pink coloured opaque veneering materials. Before the pink resin (Inkotherm 85, Hedent, Germany) is pressed into the mold, the gingiva at

Fig. 41 and 42: Completed Procera® Implant Bridge from occlusal and basal; the cleaning channels for the interproximal brush are clear to see (ZTM Rainer Schmidt, Opfenbach, Germany)

Fig. 43 to 45: Completion of the Procera® Implant Bridge; interproximal brushes in the cleaning channels in place (ZTM Rainer Schmidt, Opfenbach, Germany)
Delivery of the Procera® Implant Bridge

After finishing in the laboratory the healing abutments are finally removed. The laboratory screws, which retain the bridge to the cast are loosened and removed with a slot screwdriver. The Procera® Implant Bridge and the implant heads are disinfected thoroughly with chlorhexidine. Final connection can now be made to the implants. The TorqTite® Unigrip™ abutment screws are placed into the screw access holes and are tightened by the wheel nut principle with the Unigrip™ screwdriver (fig. 46).

At this stage the screw access holes are just closed provisionally (for instance with Fermitt, Vivadent, Liechtenstein), as the screws will be retightened after a few days. The symmetrical occlusion in the maximal intercuspal relationship should be checked (fig. 47). In this case, because of the well fitting denture in the upper jaw, it is possible to achieve an ideal canine guidance. A panoramic x-ray should be made at this stage to be able to subsequently compare the remodelling and the marginal bone structure after functional loading.

On this day the patient is able to appreciate the benefits of a permanently fixed implant bridge. The figures show the perfect integration of natural looking dentition. Fixed teeth increase the patient’s quality of life and self-confidence.
Final closure of the screw access holes

One or two weeks later the provisional fillings which close the screw access holes are removed again. The Unigrip™ abutment screws are tightened with a torque of 35 Ncm. It is therefore possible to use the manual torque wrench or the machine screwdriver with the Torque Controller. Subsequently the TorqTite® abutment screws are covered with warm gutta-percha.

In case of the necessity of opening the screw access holes once again, the screw heads won’t be damaged (fig. 48).

The final closure of the screw access holes should be done with an opaque tooth-coloured resin composite (fig. 49).

Maintenance and Recall

Instructions for oral hygiene

Immediately after delivery of the Procera® Implant Bridge the patient is advised about the special oral hygiene requirements of a fixed cross-arch prosthetic restoration.

Special attention should be given to the use of interproximal brushes with a triangular head. These are pushed through the cleaning spaces at the basis of the bridge from the labial to the lingual site and the opposite way (fig. 44).

The pressure of the interproximal brush should be at the transition between the peri-implant mucosa and the titanium framework. An electric tooth brush with a rotating, small diameter head, to clean especially the deep lingual sites thoroughly, is also recommended.

Recall

Depending upon the oral hygiene situation the patient should be recalled at regular intervals between one and six months, to check the oral hygiene as well as the clinical and radiological situation.

With panoramic and intraoral x-rays the marginal bone level and the osseointegration of the implants should be checked every year (fig. 51).
THE FABRICATION OF THE PROCERA® IMPLANT BRIDGE FRAMEWORK