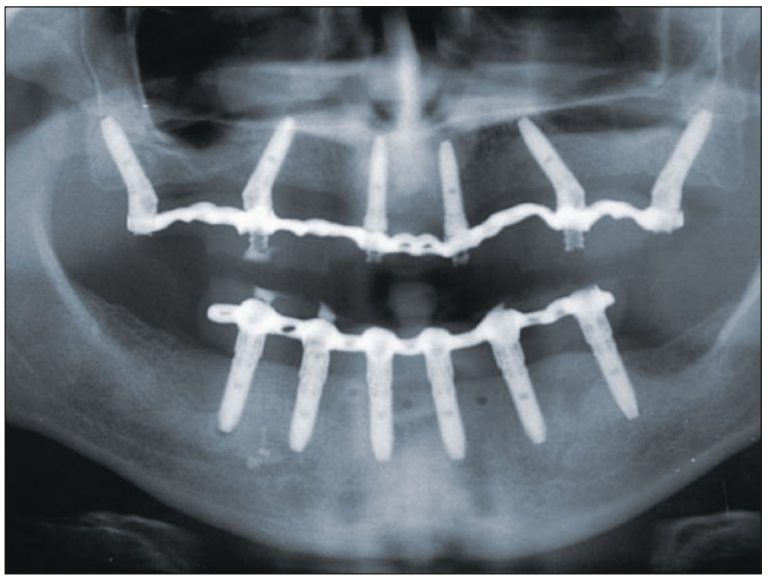
Experts Reach Consensus Concerning the Optimum Number of Implants

Placing "reserve" implants no longer deemed advisable

Organized under the auspices of the Foundation for Oral Rehabilitation (FOR), an international consensus conference was recently held on patient-centered management and the optimal number of implants for the treatment of edentulism. The moderators report on the group's findings in the following article.

By Professors Wilfried Wagner and Daniel van Steenberghe



Two previously edentulous jaws restored with prosthetic teeth attached to six implants in each jaw. The radiograph is published courtesy of Dr. Enrico Agliardi.

Loss of teeth and their surrounding tissues should be considered a form of amputation. Edentulism often results in a loss of quality of life, and it remains a major problem in oral health, since the decline of its prevalence is offset by the sheer volume of the aging population.

The serendipitous discovery by Per-Ingvar Brånemark of osseointegration makes it possible for permucosal titanium implants to provide a permanent anchorage to dental prostheses.

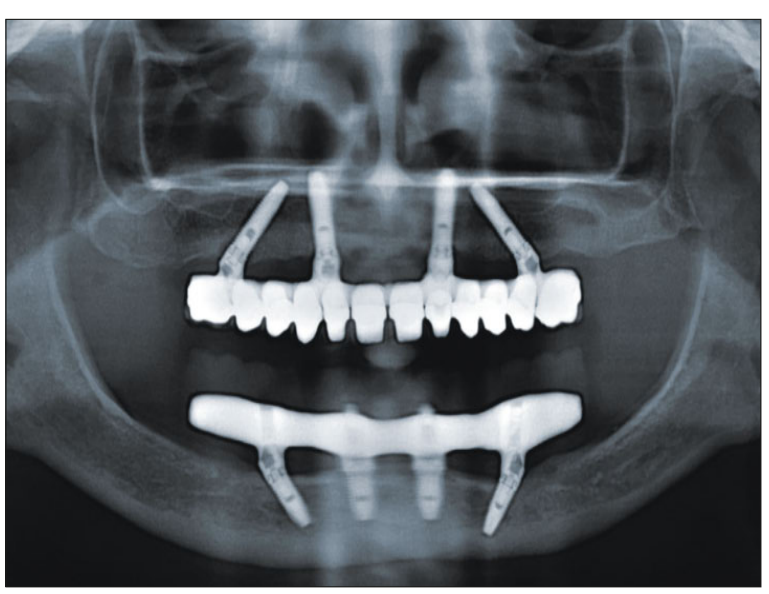
Oral implants are subject to significant loads—commonly ≥30 kg—during chewing or parafunction, which must be counteracted by reactions at the bone-to-implant interface, leading to stress and strain. Since the nature of the interface changes during the healing phase and over time, it is important to avoid improper levels of stress and strain in the bone around implants.

It should be noted that although Ante's law on crown-to-root ratios, dating back to 1926, hardly applies to the natural dentition, it very definitely does not apply to implant-supported fixed prostheses.

Although scientific evidence resolving the issue is widely available, the number of implants needed to support or retain a dental prosthesis remains a matter of debate in some parts of the world.

FOR, as a global organization, therefore invited an international team of eight experts to scrutinize and elucidate different aspects of edentulous jaw rehabilitation. Their investigations of the literature ranged from quality-of-life assessments to biomechanics, and from jaw function to prosthodontics.

Each expert produced a critical review of the literature, not limited to randomized controlled trials, but also including retrospective and prospective cohort studies (in order to avoid ignoring significant, clinically relevant information). Their findings were distributed within the expert group, which subsequently met for two days at the University of Mainz to compose a consensus text.



Based on just four implants in each jaw, precision-manufactured NobelProcera frameworks have been used here in a case carried out according to the All-on-4® treatment concept. The radiograph is published courtesy of Dr. Paulo Maló.

Patient-centered findings

When the use of oral implants to anchor dental prostheses became routine in the eighties, it was common practice to install a large number of implants, the idea being that, even if one implant failed, there would be no need to replace it, since the remaining implants would hopefully suffice to support the fixed prosthesis.

Today, with improved implant surfaces and well-proven protocols, the incidence of failure has become so rare that the placement of supplementary implants to avoid such revision surgery no longer seems reasonable. The optimal number of implants should solely be deter-

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Moving Forward

FOR Launches in Germany, Austria and Switzerland: June 27–29, 2014

The FOR chapter for Germany, Austria and Switzerland (FOR DACH) was launched during an exciting three-day Nobel Biocare Symposium being held at the BMW Welt in Munich. This sold-out event introduced innovative programs specifically designed for German-speaking dental professionals. The theme of the symposium was modern treatment concepts and all aspects of successful oral rehabilitation, such as digital treatment planning, immediate implant placement and patient follow-up and maintenance.

→ for.org/events

FOR SCIENCE EDUCATION HUMANITY
FOUNDATION FOR ORAL REHABILITATION

FOR Launches in North America: July 18–19, 2014

FOR regional chapters expanded with the launch of FOR North America during the stimulating two-day Nobel Biocare Symposium being held in Marina del Rey, California, in the United States. Bridging together education, science and research, the symposium provides dental clinicians with tremendous learning and networking opportunities. Moderated by the FOR US Council Members Drs. Jay Malmquist, Charles Goodacre and Bill Becker, participants will learn the latest advancements in esthetic management, immediate implant placement and soft tissue management.

→ for.org/events

FOR Emerging Leaders Group Now on Facebook

Young clinicians now have another channel available in which to present and discuss treatment histories thanks to the new FOR Emerging Leaders Group on Facebook. Developed as an offshoot of the recent Emerging Leaders Workshop held in Feusisberg, Switzerland, back in February 2014, this new group is dedicated to excellence in modern implant and prosthetic dentistry, and provides an open setting for young clinicians to gather, share cases and gain valuable advice from experts and peers.

Young clinicians also are encouraged to demonstrate their experiences. Moderated by the Emerging Leaders Council creators, Drs. Bernard Touati and Eric Rompen, the group welcomes cases that show modern treatment protocols, materials and digital tools. The only requirements are that the posts will be in English and any images posted should be of the highest quality. To submit your case, visit the Emerging Leaders Group on Facebook.

→ facebook.com/groups/FOR.Emerging.Leaders/

Expert Consensus on Number of Implants

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mined by a patient-centered approach to the challenge at hand.

Concerning the minimal number of implants needed, one study (Brånemark P-I et al, *Clin. Oral. Implants Res.* 1995) compared fixed prostheses in edentulous jaws supported by either 4 or 6 implants, depending on the available bone volume.

All patients had been treated by Brånemark himself during the pioneering years. All had 10 years of follow-up. No statistical difference for implant survival rates was found in cases where either 4 or 6 implants were placed. These findings counteracted the widespread tendency at the time to systematically insert 6 implants or more for each edentulous jaw.

Consider the side-effects

When available bone volume is limited due to advanced bone resorption, inserting 6 implants or more can necessitate bone augmentation procedures. Side-effects of bone graft harvesting from different intra- and extra-oral donor sites should not be underestimated. Morbidity is the rule after horizontal and vertical crestal bone augmentation procedures. Sinus inlay grafts impact less on the quality of life in postoperative periods.

In a patient-centered approach, the aim should be to avoid more invasive procedures, such as grafting, when a more limited number of implants offer the same reliable long-term outcome. The pros and cons of invasive and less invasive treatments should at least be discussed with the patient. The arguments should be put into the context of age, general health condition, and functional and esthetic demands.

When providing a fixed prosthesis to rehabilitate an edentulous jaw, limiting the support to 4 implants leads to high survival rates. In this context, it should be noted that tilted implants help to achieve a sufficient anterior-posterior spread and are not associated with more marginal bone loss than axial ones.

The forces in the tilted configurations comprised of 2 tilted and 2 axial implants can actually be lower than configurations comprised solely of 4 axial ones, due to a greater anterior-posterior spread and more limited cantilever spans. Calculations demonstrate that adding supplementary implants does not improve the load distribution.

Literature also reveals that for overdentures in the lower jaw, 2 or 4 implants lead to high survival rates and great patient satisfaction. Although a fixed prosthesis comes closer to the jaw function of dentate subjects, patients who have been edentulous for some time often prefer an overdenture to a fixed prosthesis.

Several studies indicate that even one central implant can stabilize an overdenture in the lower jaw. A randomized control trial of denture wearers, comparing one midline mandibular implant with the classical two-implant approach, revealed no difference in patient satisfaction.

In the upper jaw, however, overdentures preferably should be retained by 4 implants with individual locator-abutments or interconnected by a bar.

To avoid grafting procedures one can also use short (≤8 mm) and/or narrow (≤3.5 mm) implants. Another approach is to use extra-maxillary anchorage locations, such as the zygoma.

The use of 2 to 4 zygomatic implants, with or without anterior maxillary implants, also offers a predictable outcome for the support of a complete fixed prosthesis. This advanced treatment option is most appropriately carried out at specialized centers.

Weigh risks against benefits

When considering treatment alternatives for the rehabilitation of edentulism, one should consider the risks and benefits. The "cost" of pain, of treatment time and of the patient's unavailability to normal social/professional life are as relevant as financial costs.

As far as the financial costs are concerned, using only 4 implants to support a fixed prosthesis is—on average—several thousand dollars cheaper, and less time-consuming, than treatment based on 5 to 8 implants (Babbush et al, *Impl. Dent.* 2014). However, esthetic demands can lead to the insertion of 6 implants or more, especially in the maxilla. To achieve a passive fit of the cross-arch prosthesis, when no CAD/CAM technique is used, segmentation of the prosthesis may become mandatory. In such a situation ≥6 implants should be inserted.

The consensus group concluded that for a fixed prosthesis in the edentulous maxilla or mandible, 4 or 6 implants are appropriate numbers if their placement does not necessitate major bone grafting procedures.

As a predictable alternative to more invasive surgery, one can opt for 4 implants only, with the 2 distal ones tilted dorsally to augment the anterior-posterior spread.

Patient satisfaction and quality of life should be the leading principles in opting for a treatment scheme. In future, clinicians ought to mention the number of patients treated, rather than the number of implants placed. <

The experts and the expertise each covered

Bernhard Pommer	Patient preferences
John Brunski	Biomechanical considerations
Regina Mericske-Stern	Optimal implant numbers for fixed reconstructions
Claudia Dellavia	Functional jaw muscle assessment
Massimo Del Fabbro	Marginal bone around straight vs. tilted implants
Gerry Raghoebar	Optimal implant numbers for overdentures
Emeka Nkenke	Bone grafting to offset resorption, pros and cons
Bilal Al-Nawas	Bone substitute materials used with oral implants

Group moderators: Wilfried Wagner and Daniel van Steenberghe

→ More to explore!

All the underlying papers and the consensus text have recently been published as a special issue of the *European Journal of Oral Implantology*. Eur J Oral Implantol 7 (2014), No. 2 (24.06.2014) including supplement. For more details, as well as the complete references for this article, please visit: for.org

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