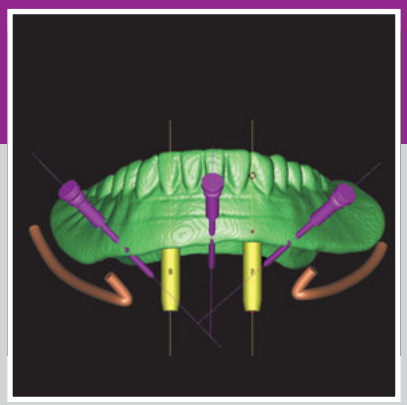
Christoph T. Sliwowski

IMPLANTOLOGY STEP BY STEP



QUINTESSENCE PUBLISHING

Second edition

Christoph T. Sliwowski

IMPLANTOLOGY STEP BY STEP

2nd Edition, fully revised and extended

Co-authors:

Stefan Hümmeke
Dominika Sliwowska
Christian F. J. Stappert

QUINTESSENCE PUBLISHING

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Introduction

Dear reader, dear colleagues,

A few years ago saw the publication of the two-volume work *Implantologie Step by Step*, starting with part I "Maxilla" and followed by part II "Mandible," in both German and Polish. Interest in a practical implantology "cookbook" was great and both volumes quickly became bestsellers. Since then, implantology has evolved with such speed that it seemed a good idea to revise both volumes fully, and to update and extend them. The result is now in your hands.

The division into maxilla and mandible has been retained, but the two parts have now been brought together in a single volume. Sub-sections covering the anterior and posterior regions and the edentulous jaw have also been retained. A section on totally edentulous patients has been added for the sake of completeness. Chapter 3 entitled "The Edentulous Mandible" has been totally revised, describing not only the cantilever fixed bridge but also the new Sliwowski Overdenture System concept. This technique makes it possible to provide the patient with a high-quality immediate restoration on a minimally invasive and economic basis.

The diagnostic tools and treatment plan are outlined before each treatment is described. One new feature is that the year when the treatment began is given in the summary at the end of each case, alongside the treatment course and timings of the various procedures. The aim of this is to allow you to place the treatment on the developmental timeline of implantology. Another new addition to the case reports is the "Continued follow-up" section, which may span a number of years, allowing better evaluation of the long-term results. As in the first edition, both general and important additional information relating to the described cases is highlighted under the "Note" or "Attention" headings.

The authors' attitude to the presented material has also changed. We present not just a selection of "good" and successful cases, but also those particularly critical, controversial and problematic ones which can teach us a lot, but which we practitioners rarely bring to light in the normal course of things, and usually prefer to keep "in the drawer."

Along with long-established and tried-and-tested concepts, this book also gives consideration to further developments and current trends in implantology. Conventional 2D diagnosis is becoming more and more a thing of the past and is being replaced by 3D diagnosis and planning. The availability of cone beam computed tomography (CBCT) scanners continues to grow, making this type of diagnosis a reality. The immediate non-functional and functional loading of implants is also increasing, often replacing the conventional load-free healing period of implant treatment.

Finally, I would like to extend my most cordial thanks to all our readers for their huge interest in the previous edition, and wish all our colleagues lots of enjoyment in referring to this book and much success with the treatment of their patients.

Christoph T. Sliwowski
Zahnimplantat Klinik Düsseldorf,
November 2014

Authors

Dr Med Dent Christoph T. Sliwowski

Christoph T. Sliwowski studied Dentistry in Warsaw (graduating in 1982). He has been practicing in Germany since 1987. Since 1989, his main interest has been implantology; in 1995, he took his doctorate in this subject with Prof Hubertus Spiekermann in Aachen. Since 1997, his main focus of activity has been in implantology, and since 2003 he has been an Accredited Implantology Specialist with the German Society for Dental Implantology (DGZI) and the European Association of Dental Implantologists (BDIZ EDI). From 1998 to 2008, he was Medical Superintendent at the Zahnklinik Rhein-Ruhr, a specialist clinic for implant dentistry and esthetics in Mülheim on the Ruhr. Since 2010, he has been Director of the Zahnimplantat Klinik Düsseldorf, a dental implant clinic that he set up at the St. Vinzenz Hospital in Düsseldorf.

Dr Sliwowski is a member of several implantology societies, including the German Society for Implantology (DGI), the German Center for Oral Implantology (DZOI), BDIZ and the Polish Association of Implant Dentistry (OSIS); he is an Active Member of the DGZI and Diplomate of the International Congress of Oral Implantologists (ICOI). Since 2003, he has been a consultant for continuing professional development with the BDIZ, the German Association of Oral Surgeons (BDO), the German Association for Oral and Maxillofacial Surgery (DG MKG), DGI and DGZI. Since 2007, he has acted as an expert assessor with the BDIZ EDI and as Vice-President of the Polish Medical Association in Germany (Polnische Medizinische Gesellschaft in Deutschland e. V.).

Dr Sliwowski is also author of the patent for the Sliwowski Overdenture System, an innovative restoration concept for the edentulous mandible.

Dr Med Dent Stefan Hümmeke

Stefan Hümmeke, born in 1972, studied Dentistry at the University of Münster, Germany and took his doctorate in dentistry in 1998. In 2003, after several years of further training, he was awarded the title of Dental Surgeon Specialist in Oral Surgery.

From 2001 to 2007, he worked at the Department of Oral and Maxillofacial Surgery at the Klinikum Osnabrück hospital in Osnabrück, Germany, as Senior Staff Member from 2004. From 2007 to 2009, he worked with Prof E. Esser at the Implantat Centrum Osnabrück (ICOS) center for implant treatment. In January 2010, he founded the oral surgery center Oralchirugie Osnabrück (OCOS) and set up his own oral surgery and implantology practice in Osnabrück.

The main focus of his work is on all-ceramic restorations, along with imaging investigations and the surgical implementation of virtual implant planning by navigation surgery and stereolithographic surgical templates.

Dominika Sliwowska, DDS

Dominika Sliwowska studied Dentistry in Poznań, Poland from 2004 to 2009, graduating as a Doctor of Dental Surgery (DDS). From 2010, she was Assistant Dentist and, since 2013, she has been Junior Partner at the Zahnimplantat Klinik Düsseldorf, the dental implant clinic at the St. Vinzenz Hospital in Düsseldorf, Germany. Her key activities include implant-supported prosthodontics, periodontology and the treatment of peri-implantitis.

Dr Med Dent Habil Christian F. J. Stappert, DDS, MS, PhD

Christian Stappert studied Dentistry and earned his doctorate and DDS from the Johannes Gutenberg University Mainz, Germany. After working as an Assistant Professor and research associate at the Department of Prosthodontics at the University RWTH Aachen, Germany (under Prof H. Spiekermann), from 1997, he continued his postgraduate Prosthodontics training at the Department of Prosthodontics (Prof J. R. Strub) of the Albert-Ludwigs University in Freiburg, Germany (as Senior Staff Member from 2001), where he gained his postdoctoral teaching qualification in 2008, in the key area of prosthodontics.

Until March 2012, Dr Stappert worked as Director of Aesthetics and Periodontal Prosthodontics at the Department of Periodontology & Implant Dentistry (under Prof D. Tarnow) and also as Chief Research Officer at the Department of Biomaterials & Biomimetics (under Prof Dr V. Thompson) of the New York University College of Dentistry. He is currently Professor and Director of Implant Periodontal Prosthodontics at the Department of Periodontics at the University of Maryland School of Dentistry.

His research focus is on ceramic materials and restorations. He has published internationally on these topics and is an editorial board member of several learned journals in his field.

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I want to give my warmest thanks to my former business partners and colleagues Dr Michael Weber and Dr Ali Alexander Pacyna for their close and confidential collaboration in the joint treatment of our patients.

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I want to thank my former assistants, Sahra Osmani, Andrea Graf, Dorothea Vogel, Christel Kloster, Andrea Terjung-Jahn, Caroline Wojtynowski, Gülcan Cek and Aldijana Gashi, as well as my current assistants at the Zahnimplantat Klinik Düsseldorf, Andrea Karst, Sandra Bohnen and Anna Schmiebusch, for their dedicated work and assistance in the treatment of patients and for the accompanying photographic and radiologic documentation.

Similarly, I would like to give very special thanks to my former dental technicians, Horst Mosch, Fernando Abrantes, Ute Olbers, Ivonne Levik, Olaf van Iperen, Gerhard Makowski, Willi Knepper and Jochen Essel, along with the technicians at Denta-Lab, Ludger Jansen, Marian Jansen, Ingo Gleichner and Frank Paffrath, for their careful planning and painstaking creation of prosthetic devices.

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Christoph T. Sliwowski

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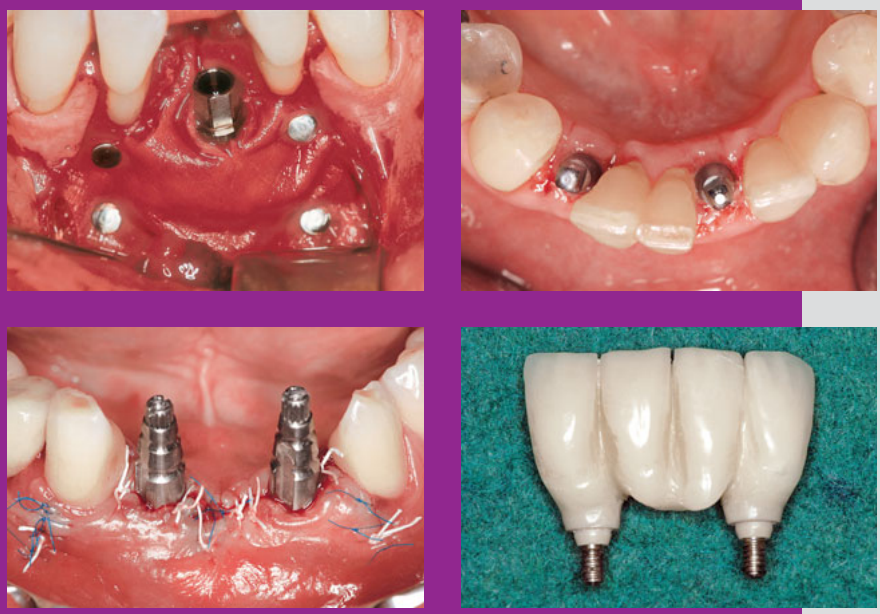


The Anterior Mandible

1

The anterior mandible represents the most comfortable operating area for the implantologist. The main contributing factors for this include: good access and a good view of the operation site; a generally sufficient bone supply; no sensory anatomical structures; a lower risk of esthetic problems than in the maxilla; and less functional stress on the implants. For reasons such as these, this region is best suited for immediate non-functional or even immediate functional loading. However, the chief problem in this area is the smaller diameter of the mandibular incisors relative to standard implants. The replacement of one or two adjacent incisors presents a particular challenge.

3D diagnosis and planning

Pronounced residual ridge atrophy

Radiologic and dental cast analyses are two key components of the preoperative diagnostic investigations. In the standard panoramic radiograph, the visualization of the anatomical structures in the anterior tooth region often lacks sharpness, so that it needs to be supplemented with a single-tooth radiograph. Far more reliable planning can be achieved with the aid of either conventional computed tomography (CT) or cone beam CT imaging (CBCT), also known as digital volume tomography (DVT). Both methods provide a metrically exact representation of the region, free of any superimpositions, thus allowing precise three-dimensional (3D) planning.

A CBCT image provides not only a pictorial overview of the situation, but also enables very detailed planning. The 3D reconstruction gives the best overview. In the case presented here, tooth 41 is sited far from the residual ridge and hangs loosely in the soft tissue (Fig 1-1a). The bone defect that has developed appears correspondingly extensive, and it may be assumed that augmentation will be necessary. The gap following the loss of tooth 31 has closed completely, so that only one incisor can be replaced, even though both the middle ones are missing. The distance between the roots of the neighboring teeth is relatively big, so that sufficient space is available in the mesiodistal direction (Fig 1-1a). For detailed planning, the data are input into a planning program, in this instance SimPlant (Dentsply). In the SimPlant program, the intended implant can be taken from a library (collection of all current implant types) and placed in the jaw. An abutment can also be selected after the positioning of the implant, and placed onto it. In this case, the program allows a Brånemark System implant (Nobel Biocare), 18-mm long and with a diameter of 3.75 mm, to be selected based on the available bone supply. The implant abutment (in this case, CeraOne (Nobel Biocare), height 5 mm) can be seen in all three dimensions and in the 3D reconstruction (Fig 1-1b). The distance between the implant and the neighboring teeth is best assessed on the consecutive panoramic sections (Fig 1-1c). The most important view when planning each individual implant is the cross-sectional view, which shows the width of the residual ridge (Fig 1-1d). It allows the transverse and vertical bone supply to be assessed accurately, providing a basis for the prognosis of the primary stability of the implant. Any bone deficits that are present can be identified and a need for augmentation already becomes apparent in the planning phase. The 3D reconstruction provides a good overview of the available bone supply and the positioning of the implant (Fig 1-1e). Better assessment of the position of the implant relative to the nerve (which needs to be marked manually; Fig 1-1f) is delivered by the semi-transparent view or full fade-out of the bone structures. The model, with the section going through the implant, may be rotated in any direction, giving a view of the planned implant position from all perspectives (Fig 1-1g). The bone densitometry function provides good guidance on the expected bone quality at the implant site (Fig 1-1h). However, because of the poorer quality of the detailed visualization compared to CT, this analysis is of limited use when applied to CBCT images.

For the treatment course, see page 13.

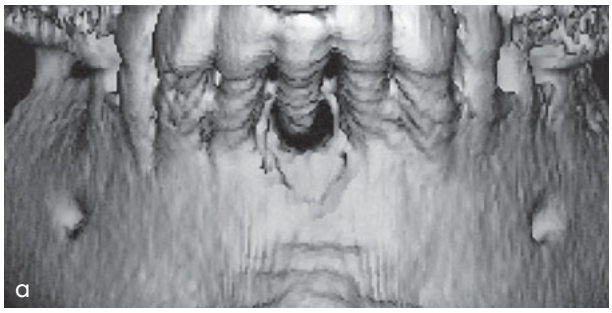


Fig 1-1a 3D reconstruction. Tooth 41 is now being retained only by the soft tissue.

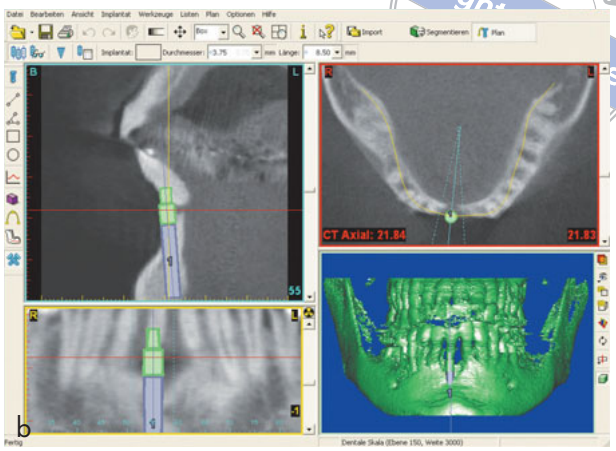


Fig 1-1b Implant planning with the SimPlant program: viewed in three aspects and 3D reconstruction.

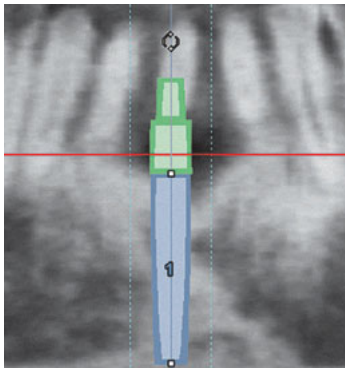


Fig 1-1c Panoramic section. Virtually inserted 3.75 × 18-mm Brånemark System implant with a 5-mm CeraOne abutment.

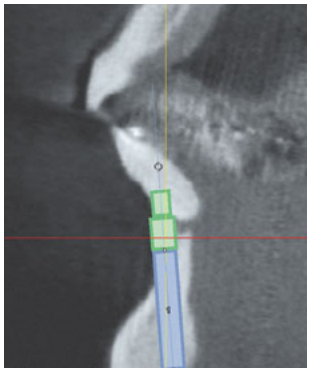


Fig 1-1d Cross-sectional view. Narrow residual ridge – labial bone deficit.

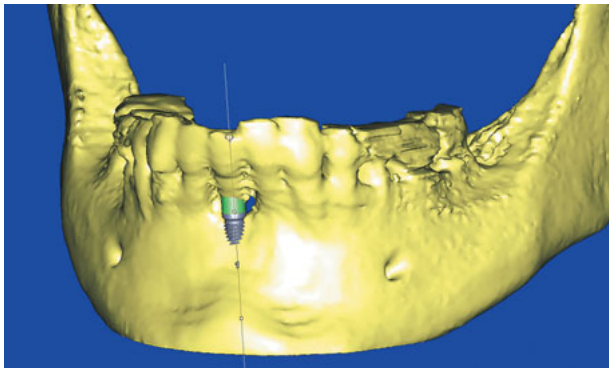


Fig 1-1e 3D reconstruction. Visualization of the position of the implant.

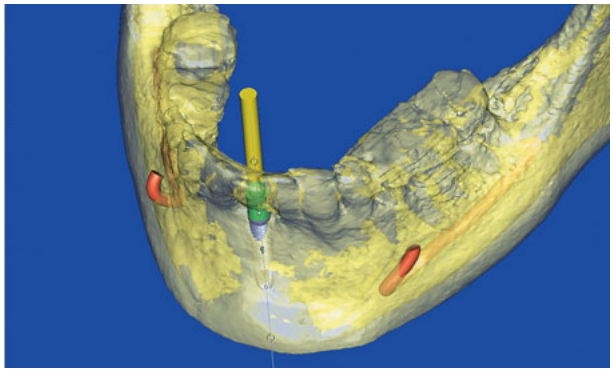


Fig 1-1f Semi-transparent 3D reconstruction with the nerves and longitudinal axis of the implant marked.

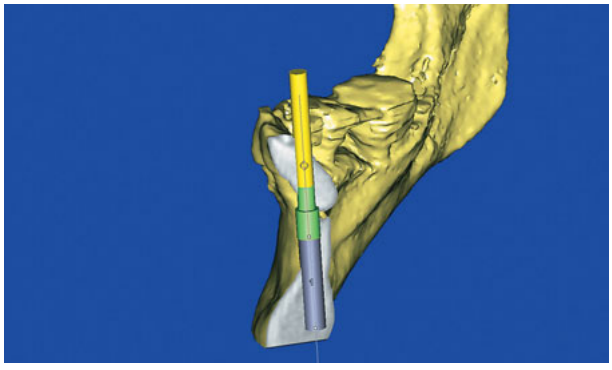


Fig 1-1g 3D visualization of the cross-sectional view.

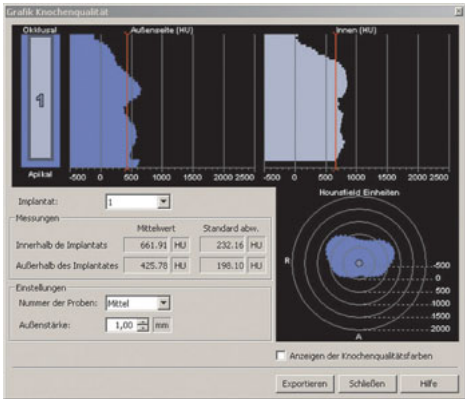


Fig 1-1h Bone densitometry around the planned implant.

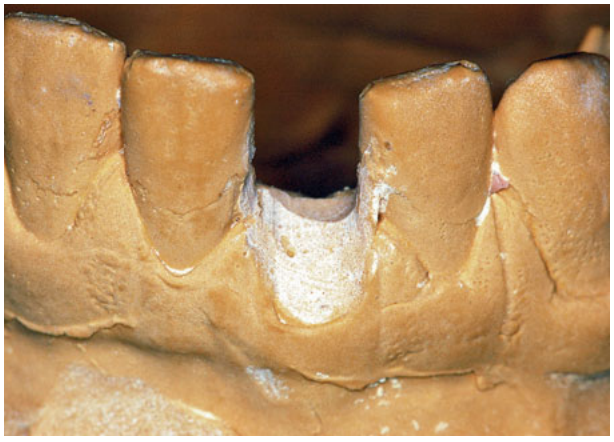


Fig 1-1i Dental cast analysis after tooth 31 has been removed.

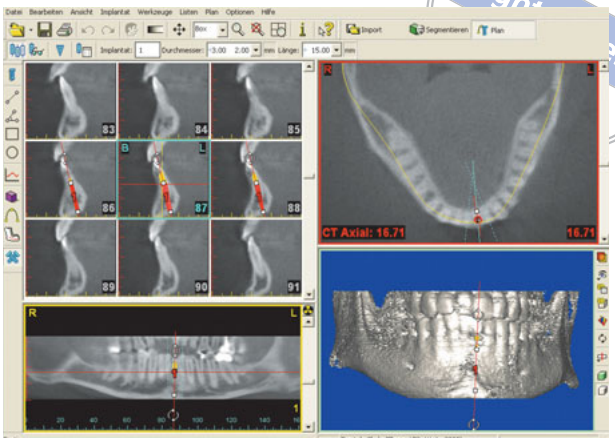
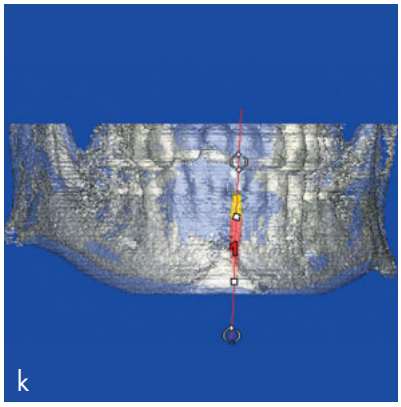
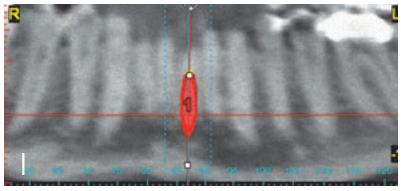
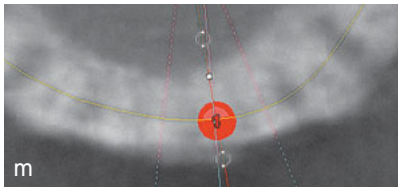


Fig 1-1j SimPlant planning.







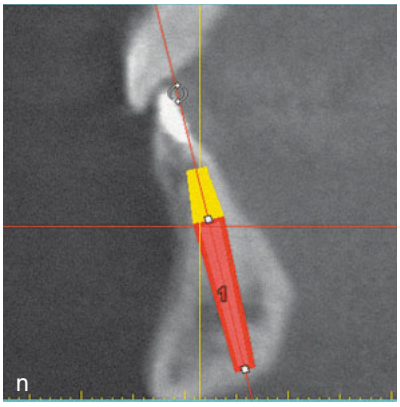


Fig 1-1k Semi-transparent 3D reconstruction with planned implant.
Fig 1-1l Panoramic section. Checking distance to neighboring teeth on the consecutive slices (from labial to lingual).
Fig 1-1m Axial section. Checking distance to neighboring teeth on the consecutive slices (from apical to coronal).
Fig 1-1n Cross section. Orientation of the implant taking account of anatomical and functional aspects.

Shortage of space, insufficient distance to the neighboring teeth

In this case, tooth 31 is not preservable due to painful internal resorption, and must therefore be extracted. This internal resorption has been confirmed on the CBCT images in all three planes. The width of the gap can be measured with high accuracy, not only radiologically, but also on the model after erasing tooth 31 (Fig 1-1i). The implant is planned using the SimPlant software (Fig 1-1j). One of the narrowest available implants, NobelDirect (Nobel Biocare), 16-mm long and with a diameter of 3 mm, has been selected due to the shortage of space. This implant is placed into the jaw virtually. The planning process is performed in all three planes and also with the aid of the 3D reconstruction. A visual representation of the positioned implant and its spatial relationship to the neighboring structures, particularly the teeth, becomes clearly apparent on the semi-transparent 3D reconstruction (Fig 1-1k). The panoramic section allows good assessment of the problem zones along the roots (Fig 1-1l).

It is advantageous to carry out an additional check of the spatial visualization on the horizontal (axial) section (Fig 1-1m). The most important evidence in most cases – the cross-sectional view – confirms that the dimensions of the residual ridge are adequate in this instance (Fig 1-1n).

For the treatment course, see page 16.

Single-tooth gap

The implant rehabilitation of a single-tooth gap in the anterior mandible, following the loss of one mandibular incisor, requires not only a special set of instruments, but also a particularly high level of precision from the implantologist. In most cases, the resultant gap is very narrow and the available space between the roots of the neighboring teeth extremely limited. Iatrogenic injury to the neighboring teeth can only be avoided with detailed preoperative radiologic investigations and by performing the surgical procedure with great care. If the residual ridge has healed, the freshly inserted implant can be loaded directly with a prosthesis, which is highly advantageous for both the patient and the dentist.

Because of the limited space, implants of reduced diameter, ie, narrow platform (NP) implants such as NobelActive (diameter 3.0 and 3.3 mm) and NobelDirect (diameter 3.0 mm) from Nobel Biocare, or Touareg (diameter 3.0 mm) from Adin or the K.S.I. Bauer screws, are particularly suitable for minimizing the risk of damage to the roots of neighboring teeth. Instruments required for implant placement include long shank drills, extra-long thread cutters and dental screwdrivers, as well as drill extensions, which can reach to the required depth in the narrow gap between the neighboring teeth (see page 16). Surgical guides or templates are used only in rare cases due to the limited space.

In the anterior tooth region, the single-tooth implant may be inserted directly after the tooth is extracted (immediate implant placement) or after the socket has fully healed (delayed implant placement). Requirements for immediate implant placement include: first, an adequate bone supply of good quality to anchor the implant with primary stability; and, second, the absence of any acute inflammation. After implant placement, the implant can be fitted with a cover screw and allowed to heal submerged, or with a healing abutment for transmucosal healing. In immediate implant placement, a healing abutment helps preserve the anatomical structures, such as the gingival margin and interdental papillae. Instead of a healing abutment, this function can also be performed by an interim crown on a provisional abutment, but these must be placed entirely out of both static and dynamic occlusion.

For the preoperative 3D investigations, see page 2.

Typical treatment course

Late implant placement with immediate loading

Baseline situation

Having lost teeth 31 and 43, this patient was fitted with a removable prosthesis that she had worn for many years, but that she found very uncomfortable and troublesome (Fig 1-2a). The patient wished to be rid of the prosthesis as soon as possible. Both gaps were very narrow and the jaw, particularly the region of tooth 43, had degenerated considerably (Fig 1-2b).

Diagnostic tools

- Clinical examination
- Dental cast analysis
- CBCT and SimPlant planning

Treatment plan

1. Implant placement, augmentation and immediate loading

Fig 1-2a Missing teeth 31 and 43.

Fig 1-2b Horizontal atrophy.

3D analysis and SimPlant planning

A CBCT image was taken before implant placement and the implants were virtually positioned in the SimPlant program (Fig 1-2c). Because of the shortage of space and good bone quality, the plan was to use K.S.I. Bauer screws for both sites.

Attention: ***The advantage of K.S.I. Bauer screws is that they provide good primary stability and can be loaded immediately. They have been successfully used by the main author for many years as provisional implants for immediate loading. Despite earlier doubts, they are eminently suitable for use as definitive implants in extremely narrow gaps. They have a flexible section to allow the crown to be adjusted with regard to any prosthetic aspects.***

Implant placement

Implant placement took place under general anesthesia and was performed in combination with the osteotomy of retained tooth 28 and bilateral sinus elevation. Before implant placement, the teeth located either side of the gaps were stripped slightly, to

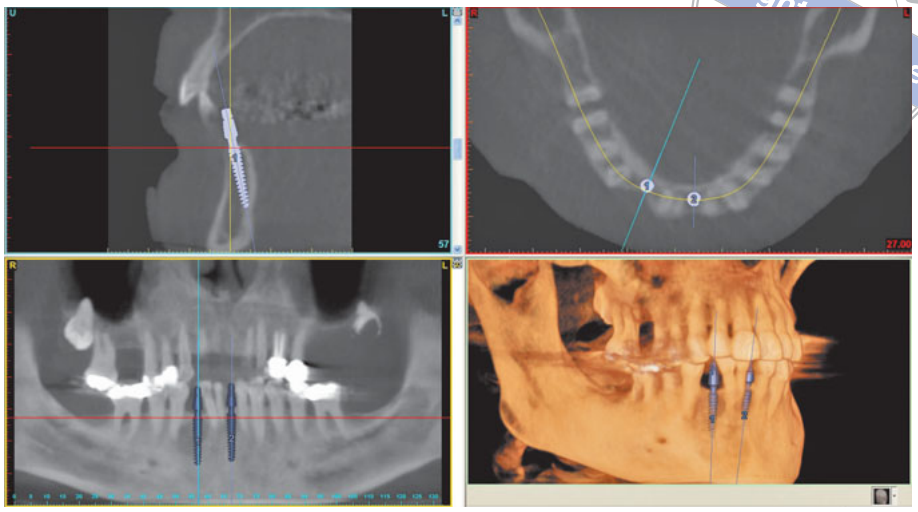


Fig 1-2c SimPlant planning of implants 31 and 43.

Fig 1-2d Inserted implants in the regions of teeth 31 and 43.

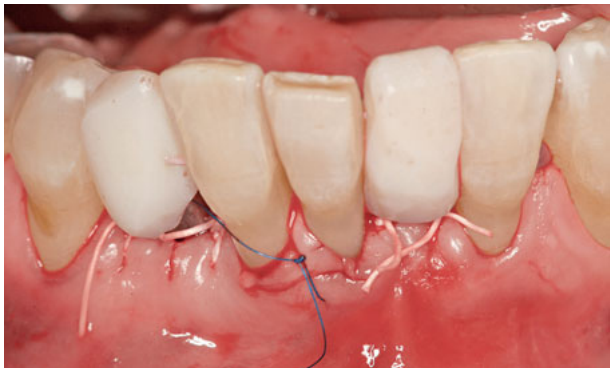


Fig 1-2e Provisional immediate crowns on the implants.

make more space for the crowns. The incision was made centrally over the residual ridge and extended further horizontally below papilla 41,42 to provide a join. A labial flap was constructed, preserving the papilla, and both implants were inserted. The labial atrophy was treated with the harvested bone chips. Alignment of the implant heads was followed by tight closure of the incision with Gore-Tex (W. L. Gore and Associates) and Mopylen 6-0 sutures (Resorba) (Fig 1-2d). The first provisional crowns were manufactured and directly incorporated with the aid of theromoplastic foil. (Fig 1-2e).

Prosthetic loading

One week later, the sutures were removed and the long-term crowns fabricated in the laboratory were incorporated (Fig 1-2f). The labial contour of the residual ridge looks considerably better even after simple augmentation (Fig 1-2g). Implant placement into the maxilla following sinus elevation was planned for 1 year later. The new CBCT image also provided a view of the peri-implant bone in the mandible in all three planes (Fig 1-2h). Comparison of the planned implant 31 (Fig 1-2i) with the implant already in situ (Fig 1-2j) in a cross-sectional view showed slight deviation of the apex of the positioned implant in the labial direction. This has resulted from the considerable resistance offered by the hard lingual cortical bone. The inclination of the implant head (Fig 1-2j) could be corrected by bending it. After 1 year, the bone and gingival situation around the implants continued to be stable. The patient was so happy with the appearance and function of the provisional crowns that she did not even want to have the definitive crowns fitted (Fig 1-2k).

Fig 1-2f Incorporation of the long-term provisional crowns after 1 week.

Fig 1-2g Residual ridge shaped by augmentation.

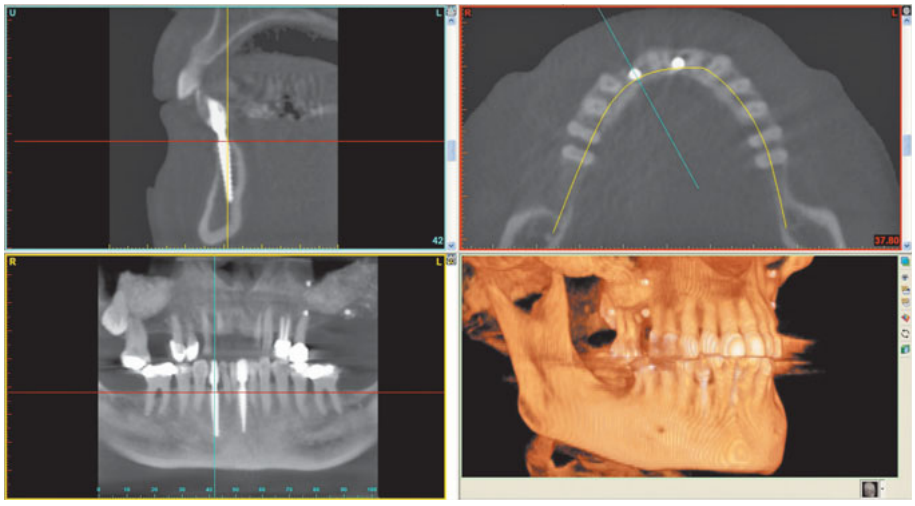


Fig 1-2h CBCT after 1 year and before the implant placement in the maxilla.

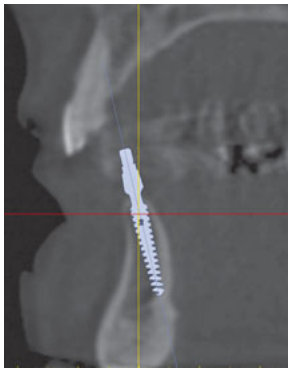


Fig 1-2i Planned position for implant 31.

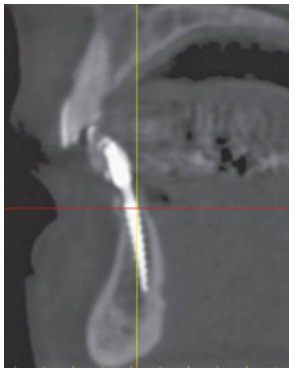


Fig 1-2j Cross-sectional view of implant 31 with a slightly bent head.

Fig 1-2k Provisional crowns (definitive at the patient's request) after 1 year of functional use.

Treatment course

- Implant placement, augmentation and immediate loading (2010)

Treatment

Surgery and prosthetics: Dr Christoph T. Sliwowski, Dominika Sliwowska, DDS

Dental technology: Dental technician Ludger Jansen, DentaLab

Atypical treatment course – problematic baseline situation

Immediate implant placement following extraction

Baseline situation

Tooth 32, which shows little of note clinically but is very loose, can no longer be preserved due to a periodontal bone defect extending to its apex (Figs 1-3a and 1-3b).

Diagnostic tools

- Clinical examination
- Panoramic radiograph
- Single-tooth radiograph
- Dental cast analysis

Treatment plan

1. Extraction, immediate implant placement with augmentation
2. Secondary exposure
3. Cemented ceramic crown on a single-tooth implant

Fig 1-3a Tooth 32, no longer preservable.

Fig 1-3b Periodontal bone defect extending to the apex.

Extraction and implant placement

Extraction of the tooth and creation of a mucoperiosteal flap exposed an extensive bone defect, which had also led to exposure of one root surface of tooth 31 (Fig 1-3c). A regular platform (RP) implant (diameter 3.75 mm), 21-mm long and with a conical neck, was inserted centrally into this defect and the underlying residual ridge (Fig 1-3d).

Fig 1-3c Exposed three-wall bone defect.

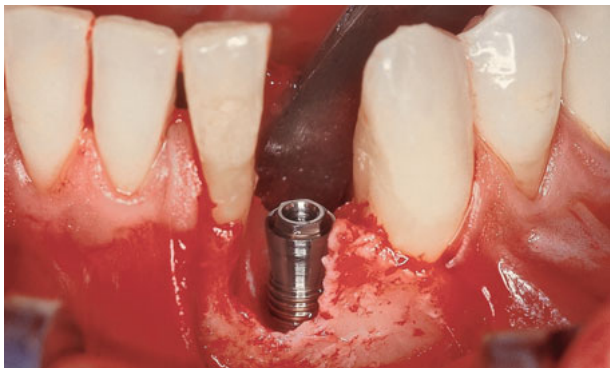


Fig 1-3d Inserted implant.

Fig 1-3e Augmentation with bone chips.

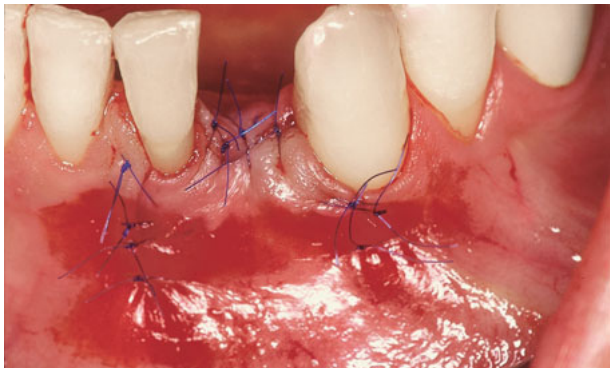


Fig 1-3f Wound closure with 6-0 sutures.

Instead of a cover screw, a 2-mm-high healing abutment was screwed onto the implant to act as a spacer. The remaining crevices in the bone defect were filled with the bone chips harvested during preparation of the implant bed (Fig 1-3e). Saliva-proof wound closure was performed following periosteal slitting and mobilization of a trapezoid flap, using monofilament, microsurgical 6-0 sutures (Fig 1-3f). Use of a membrane was not necessary for this three-wall bone defect.

Attention: ***Implants of reduced diameter (NP, approximately 3 mm) are best suited for replacing a lower incisor. Only narrow implants allow an adequate distance to be maintained from neighboring teeth. At the time (in 1998), the longest NP implant in the Brånemark System was 15 mm long; stable anchoring in the bone was doubtful at this length. The extraordinary implant length of 21 mm is an enormous advantage where a deep defect is present: it ensures stable anchoring in basal bone, which is so important in immediate implant placement, thus resulting in sufficient primary stability.***

Exposure and prosthetic loading

After a 5-month healing period, the implant was exposed and the healing abutment exchanged for a higher one (Fig 1-3g). At this point, the panoramic radiograph showed stable anchoring of the implant in the bone, along with good regeneration of the former bone defect (Fig 1-3h). The implant was fitted with a CeraOne abutment and prosthetically loaded with an all-ceramic crown. In view of the very small distance between the implant and neighboring tooth 31 (one disadvantage of an RP implant) and the lack of bone before implant placement (Fig 1-3d), it was not possible to create an interdental papilla. However, this caused no impairment to the patient, even with his widest smile (Figs 1-3i and 1-3j).

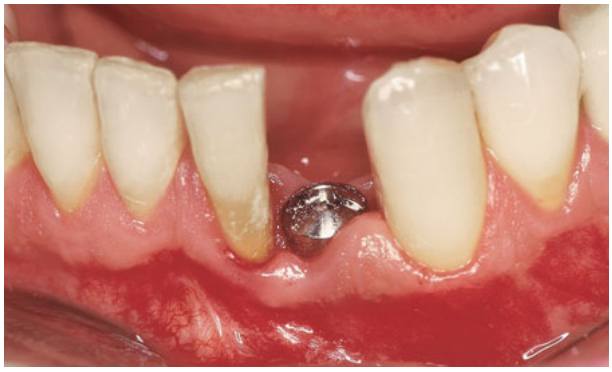


Fig 1-3g Displacement of the gum and interdental papilla 31 to 32.

Fig 1-3h Panoramic radiograph prior to the prosthetic loading.

Fig 1-3i Clinical situation 4 years after the loading.

Fig 1-3j The patient 4 years after the loading.

Treatment course

- Implant placement (1998)
- 5 months to exposure
- 2 weeks to impression taking and fabrication

Treatment

Surgery:	Dr Christoph T. Sliwowski
Prosthetics:	Dr Roland Althoff
Dental technology:	Ivonne Lewik

Note

Narrow and high gap between neighboring teeth

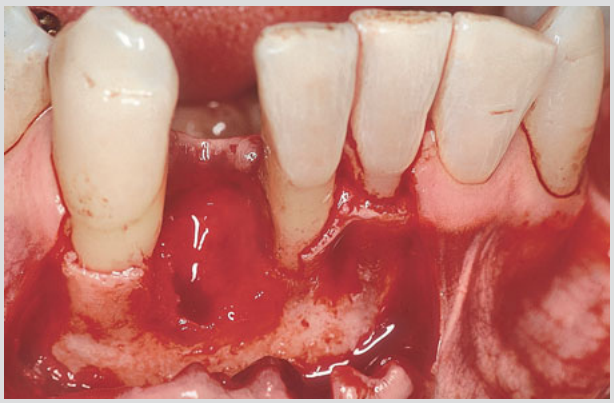


Fig 1-4a Exposure of the three-wall defect.

Fig 1-4b Insertion of the 3i Micro Mini implant with extra-long implant mount.

Fig 1-4c Inserted implant.

Fig 1-4d Provisional abutment.

The single-tooth gap following the loss of an incisor is very narrow at both crown and root (Fig 1-4a). This lack of space means that implants of reduced diameter should be inserted here, reducing the risk of injury to the neighboring teeth. Extra-long drills and thread cutters (possibly with an extension shaft) will need to be used when preparing the implant bed. An extra-long insertion driver or implant mount will also be necessary when placing the implant (Fig 1-4b).

The implant bed is prepared at the midpoint between the neighboring teeth, as an extension of the socket. Here, the gap is wide enough to insert a 3i Micro Mini (Biomet 3i) implant 3.25 mm in diameter with an extra-long implant mount (Fig 1-4b). Following insertion (Fig 1-4c), a cover screw or provisional abutment that will take the immediate crown is screwed onto the implant; this also requires the use of an extra-long screwdriver (Fig 1-4d).

Problems and complications

Horizontal augmentation of a knife-edge residual ridge

This treatment course follows on from the 3D diagnostic investigations on page 2.

Baseline situation

This patient had only three mandibular incisors left following the closure of the gap left by tooth 31 (Fig 1-5a). Moreover, tooth 41 has suffered severe periodontal damage and is being retained only by an adhesive composite resin splint attached to the neighboring teeth (see Fig 1-5a). There is no attached gingiva whatsoever.

Diagnostic tools

- Clinical examination
- CBCT
- SimPlant planning
- Dental cast analysis

Treatment plan

1. Extraction, immediate implant placement, implant-supported single-tooth crown
2. All-ceramic crown on the CeraOne abutment

Fig 1-5a Tooth 41 is being retained only by a ligature splint.

Fig 1-5b Exposure of the one-wall defect.

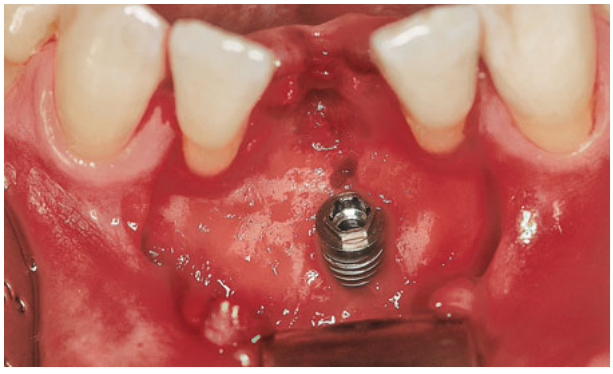


Fig 1-5c Inserted TiUnite implant.

Extraction and implant placement

Once the tooth was removed, a wide mucoperiosteal flap was created between teeth 32 and 42 (Fig 1-5b). The gap was of sufficient width for a Nobel Biocare RP TiUnite implant (diameter 3.75 mm). The 18-mm long implant was inserted and a 5-mm-high CeraOne abutment was screwed on with the required torque of 32 N/cm. Augmentation was necessary to restore the contours of the residual ridge and cover the exposed implant threads (Fig 1-5c).

To encourage revascularization of the augmentation material, the labial cortical bone was perfo-

Fig 1-5d Perforations in the cortical bone for better revascularization; the CeraOne abutment has been screwed into place.

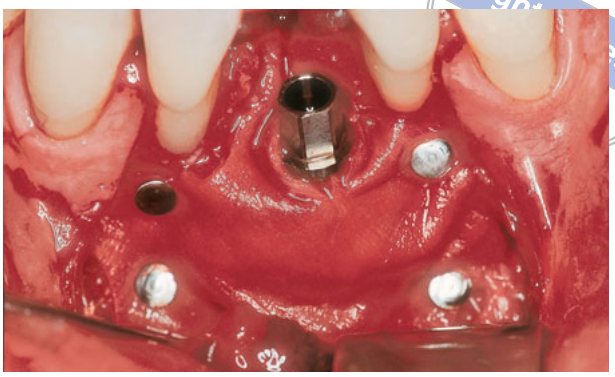


Fig 1-5e The Bio-Gide membrane fixed into place.

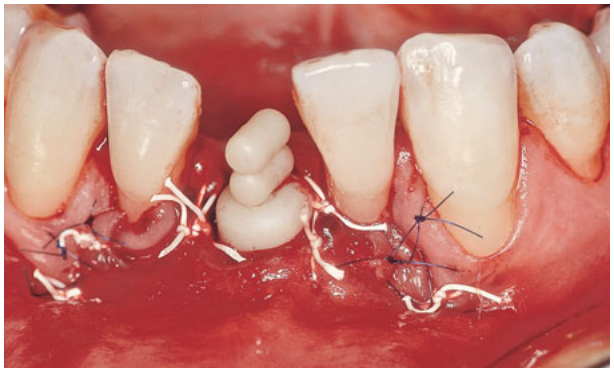


Fig 1-5f Sutured wound and with provisional cap in place.

Fig 1-5g Provisional immediate crown.

rated several times with a fine spiral bur (Fig 1-5d). The bone chips harvested during preparation of the implant bed were mixed with a regenerative bone substitute (Bio-Oss; Geistlich) and filled into the defect. A resorbable collagen membrane (Bio-Gide; Geistlich), fixed with small titanium pins, was used to stabilize the augmentation material (Fig 1-5e). The augmentation was overextended both horizontally and vertically to compensate for subsequent resorptive loss. Following saliva-proof suturing of the operation site, a provisional cap was fitted onto the CeraOne abutment (Fig 1-5f) and a provisional immediate crown with no functional loading prepared (Fig 1-5g).

Prosthetic loading

To achieve an optimal esthetic result when manufacturing the definitive crown, the CeraOne abutment, which was rather too long, should have been exchanged for an all-ceramic CerAdapt (Nobel Biocare) abutment (Fig 1-5h). However, the patient was happy to accept the metal rim that was only just visible, and did not want the abutment to be changed for financial reasons. Therefore, the definitive all-ceramic crown was incorporated on the existing abutment. Figure 1-5i shows the clinical situation 6 years following incorporation of the crown.

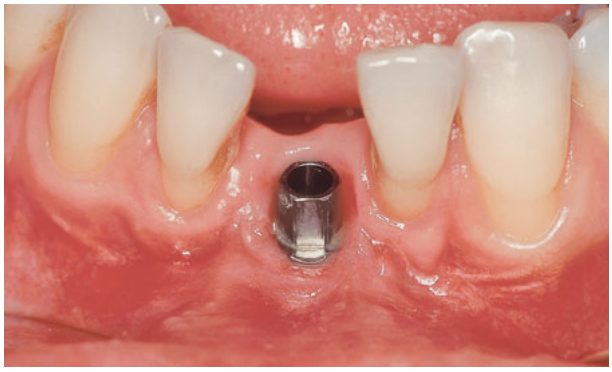


Fig 1-5h CeraOne abutment; the metal rim is visible on the labial side.

Fig 1-5i Cement-retained all-ceramic crown. Situation after 6 years.

Treatment course

- Extraction, implant placement with augmentation
- and immediate loading (2001)
- 6 months to impression taking and fabrication

Treatment

Surgery:	Dr Christoph T. Sliwowski
Prosthetics:	Dr Roland Althoff
Dental technology:	Horst Mosch

Immediate restoration

Immediate implant placement and immediate loading

This treatment course follows on from the 3D diagnostic investigations on page 4.

Baseline situation

In this 24-year-old woman, tooth 31 was not preservable due to painful internal resorption. Therefore, it was due to be extracted and, if possible, replaced by an implant-supported immediate crown in the same session (Fig 1-6a). (See the diagnostic investigationson page 4.) Following extensive radiologic investigations and dental cast analysis, and in view of the extremely small distance between the neighboring teeth, measured at only 5 mm, the plan was to perform immediate implant placement with a NobelDirect implant (diameter 3 mm) and to prepare a provisional crown in the laboratory.

Diagnostic tools

- Clinical examination
- Panoramic radiograph
- Dental radiograph
- CBCT
- SimPlant planning
- Dental cast analysis

Treatment plan

1. Extraction, immediate implant placement, augmentation and immediate loading, implant-supported single-tooth crown

Fig 1-6a Tooth 31, not worth preserving.

Extraction, immediate implant placement, augmentation and immediate loading

Due to the advanced internal resorption, the tooth fractured as soon as the dental forceps were applied. The remaining root was extracted using a periotome and a compression screw (Fig 1-6b) using the non-destructive "corkscrew technique" (see page 294), without damaging the bony socket. Following the non-destructive root extraction, a NobelDirect implant, 16-mm and with the smallest diameter (3 mm), was inserted into the socket (Fig 1-6c). The prepared provisional crown was cemented on with TempBond (Kerr Corporation) (Fig 1-6d).

Since part of the vestibular lamella could no longer be fully preserved, the small defect was augmented with the bone substitute OSTIM (Heraeus Kulzer) (hydroxylapatite; Fig 1-6e). The periosteal flap was repositioned without the use of a membrane and fixed with 6-0 sutures (Fig 1-6f). To ensure that implant healing was not endangered, the crown was placed completely out of occlusion (Fig 1-6g). The gingival situation (Fig 1-6h) stabilized after only a few weeks, and the implant was harmoniously incorporated into the overall situation (Fig 1-6i).

Fig 1-6b Extraction using the corkscrew technique.

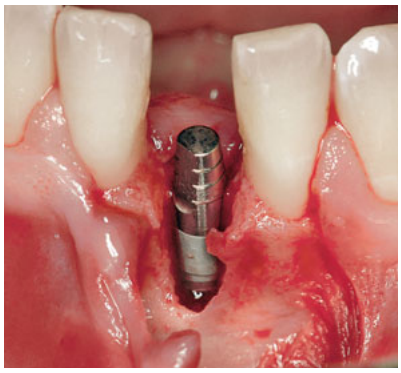


Fig 1-6c Inserted NobelDirect implant.

Fig 1-6d Provisional crown in situ.

Fig 1-6e Augmentation with OSTIM.

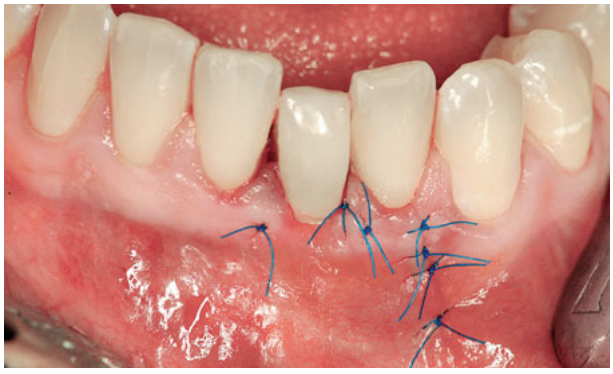


Fig 1-6f Suturing of the wound.

Fig 1-6g Crown placed out of occlusion.

Fig 1-6h Stabilization of the gingival situation.

Treatment course

- Implant placement (2003)
- 6 months to impression taking and definitive loading

Treatment

Surgery and provisional crown:
Dr Christoph T. Sliwowski

Dental technology: Ute Olbers

Fig 1-6i Overall appearance of the implant crown.

Multi-tooth gap

If several teeth have been lost from the anterior mandible, the level of difficulty of the implant treatment depends significantly on the width of the resultant gap. If three or four incisors have been lost, a functionally and esthetically satisfactory restoration can be achieved in most cases using two implants. A situation that presents a much greater therapeutic challenge is when two adjacent incisors have been lost and the gap is too wide for one implant, but too narrow for two. The insertion of a single implant and the subsequent reconstruction of both missing teeth is unfavorable both esthetically and functionally. If the restoration is to be accomplished with the aid of two implants, these should be as narrow as possible.

Typical treatment course

Replacement of three incisors on two implants

Baseline situation

Following the extraction of teeth 31, 32 and 41, this patient was fitted with a provisional removable cast prosthesis (Fig 1-7a).

Diagnostic tools

- Clinical examination
- Panoramic radiograph
- Dental cast analysis

Treatment plan

1. Implant placement of two implants
2. Secondary exposure
3. Prosthetic loading with a three-unit fixed bridge

Fig 1-7a Provisional restoration with a removable cast prosthesis.

Implant placement

Implant placement was performed 6 weeks after extraction (Fig 1-7b). At this point, mobilization of the mucoperiosteal flap revealed that the extraction sockets had not yet healed (Fig 1-7c). Preparation of the implant bed in the regions of teeth 32 and 41 (Fig 1-7d) was followed by the insertion of two Replace Select implants (Nobel Biocare), 3.5 mm in diameter (Fig 1-7e). Vertical augmentation was necessary to enable the correct prosthetic positioning of the implants. Healing abutments 2 mm high were fitted instead of cover screws, to support the augmentation material (Fig 1-7f). The peri-implant bone defects were filled with the bone chips harvested during preparation (Fig 1-7g). The postoperative follow-up radiograph shows the positioning of the implants relative to the roots of the neighboring teeth (Fig 1-7h).

Fig 1-7b Multi-tooth gap, region of teeth 32 to 41.

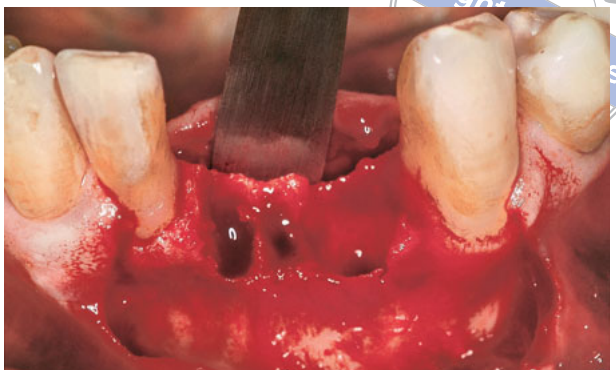


Fig 1-7c Unhealed sockets.

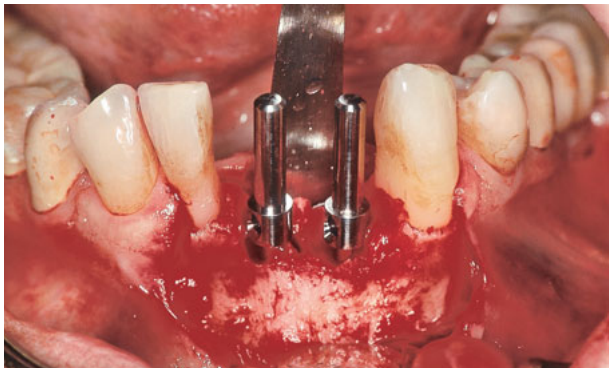


Fig 1-7d Preparation of the implant beds.

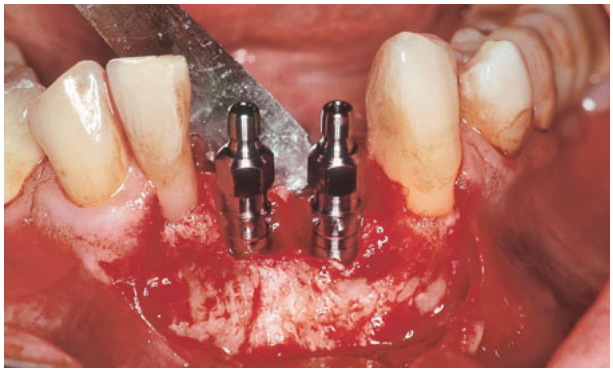


Fig 1-7e Insertion of the Replace Select implants.

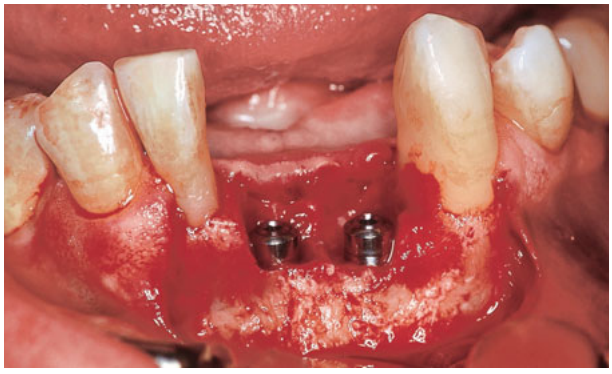


Fig 1-7f The healing abutments have been screwed into place.

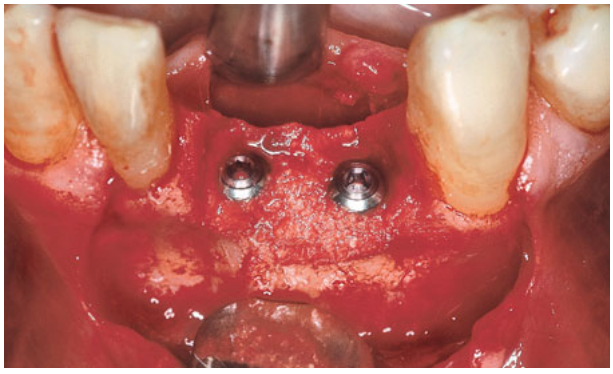


Fig 1-7g Augmentation.

This is already the third implantological procedure undergone by this patient: tooth 36 had been replaced by a crown loaded onto two implants, followed by implant placement and augmentation on both sides of the maxilla.

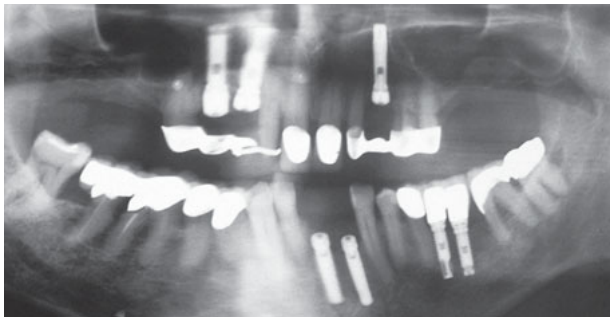


Fig 1-7h Follow-up panoramic radiograph.

Fig 1-7i Situation prior to exposure.

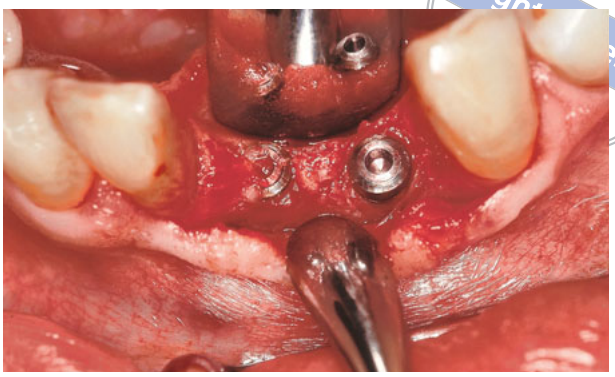


Fig 1-7j Implant 41 overgrown with bone.

Fig 1-7k Implant 41 following modeling osteoplasty.

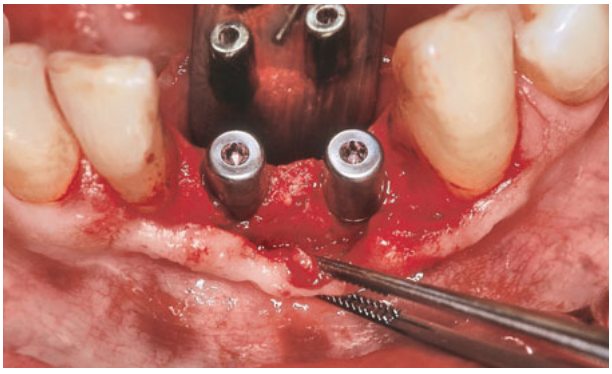


Fig 1-7l Healing abutments (5 mm high).

Fig 1-7m Customized abutments.

Fig 1-7n Metal-ceramic fixed bridge.

Exposure and prosthetic loading

Five months after insertion of the implants (Fig 1-7i), exposure showed good osseous regeneration, particularly in the region of implant 41 (Fig 1-7j). Full exposure of implant 41 also required excess bone to be carefully removed with a reamer (Fig 1-7k). The supporting 2-mm healing abutments were exchanged for 5-mm healing abutments (Fig 1-7l). Once the postoperative gingival swelling had subsided, an impression was taken and the customized abutments were created (Fig 1-7m). The metal-ceramic fixed bridge replacing the missing incisors was cemented on with TempBond (Fig 1-7n).

Fig 1-7o Clinical situation after 13 years.

Fig 1-7p Radiology findings after 13 years. All the "old" implants are in situ along with the new immediate implant in the region of tooth 44.

Continued follow-up

Thirteen years after the anterior tooth implant placement, the patient experienced problems with tooth 44 and required an additional implant at this location. An up-to-date photograph of the fixed bridge replacing the anterior teeth was taken at that time (Fig 1-7o). Tooth 44 had to be extracted, with an implant directly inserted in its place and prosthetically loaded. The follow-up panoramic radiograph shows the patient's overall rehabilitation in all four quadrants and confirms the stable bone situation around all the implants (Fig 1-7p).

Treatment course

- Extraction
- 6 weeks to implant placement (1998)
- 5 months to exposure
- 3 weeks to impression taking and fabrication

Treatment

Surgery:	Dr Christoph T. Sliwowski
Prosthetics:	Dr Roland Althoff
Dental technology:	Horst Mosch

Atypical treatment course – problematic baseline situation

Preventive horizontal augmentation

Baseline situation

Following the loss of all four incisors, the intention was to perform implantological restoration of the resultant multi-tooth gap from 32 to 42 with an implant-supported fixed partial denture (Fig 1-8a). Clinical assessment revealed horizontal atrophy within the gap, which would probably necessitate augmentation.

Diagnostic tools

- Clinical examination
- Panoramic radiograph
- Dental cast analysis

Treatment plan

1. Insertion of two implants with simultaneous augmentation
2. Secondary exposure
3. Prosthetic loading with a screw-retained fixed bridge

Fig 1-8a Baseline clinical situation.

Implant placement and augmentation

Exposure of the bony residual ridge was followed by preparation of the two implant beds in the regions of teeth 32 and 42 with the subsequent insertion of two Brånemark System RP implants (diameter 3.75 mm) (Fig 1-8b). As a result of retraction of the labial alveolar process, the bony lamella lining it is so thin in places that a few screw threads can be seen shimmering through (Fig 1-8c). Augmentation was performed in this area to prevent subsequent resorption of the thin bony lamella. Small perforations in the cortical bone facilitated revascularization of the augmentation material (Fig 1-8d). A resorbable Bio-Gide membrane was first secured in the apical region with three titanium pins, and the harvested bone chips were applied directly onto the bone to form the first layer (Fig 1-8e). An alloplastic regenerative bone substitute (Cerasorb; curasan) was layered on to protect against resorption and to increase the volume of augmentation (Fig 1-8f). The membrane was adapted over the augmentation material and pushed under the periosteum on the lingual side for further fixation (Fig 1-8g). Due to the increase in volume, periosteal slitting was necessary to allow tension-free wound closure.

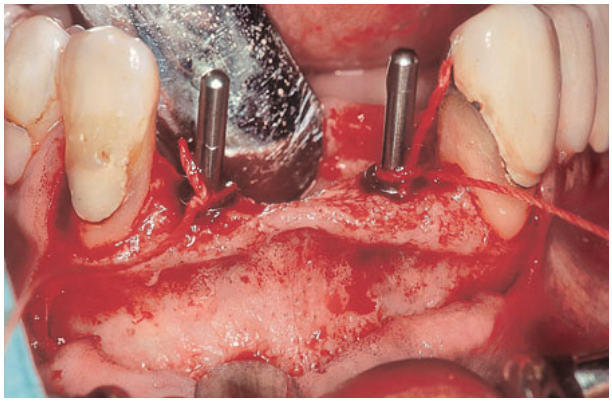


Fig 1-8b Preparation of the implant beds.

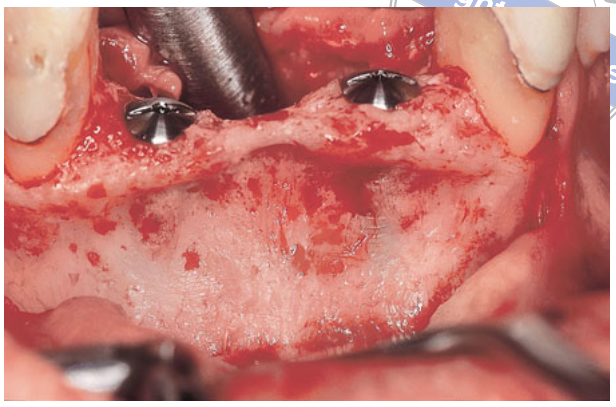


Fig 1-8c Implants shimmering through.

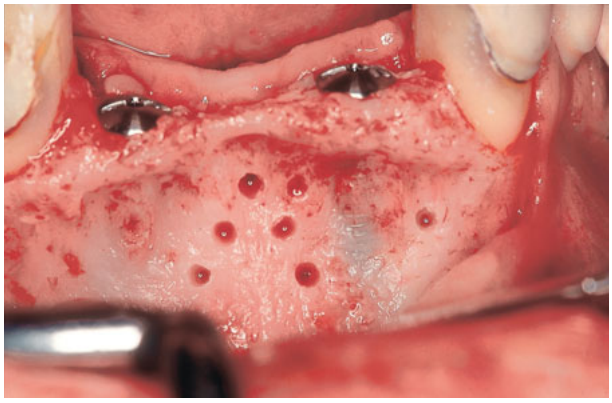


Fig 1-8d Perforations in the cortical bone to encourage revascularization.

Fig 1-8e Bone chips applied to the bone to form the first layer.

Fig 1-8f Regenerative bone substitute as a spacer.

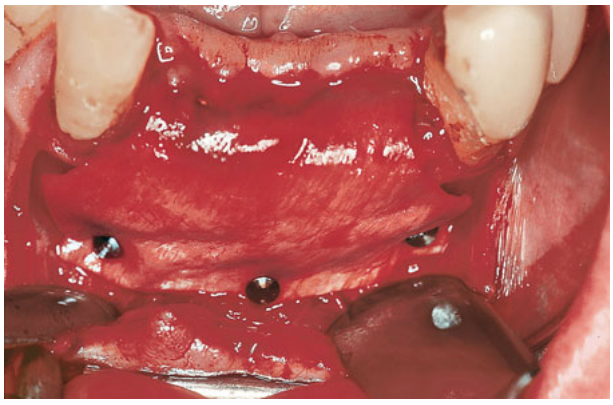


Fig 1-8g Membrane fixed into place with small pins.

Fig 1-8h Clinical situation prior to exposure.

Fig 1-8i Tissue-sparing incision using the "cosine curve" technique.

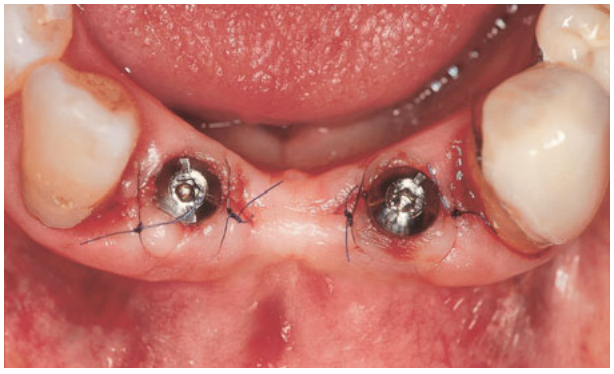


Fig 1-8j Reduced-diameter healing abutments.

Fig 1-8k Prosthetic loading.

Fig 1-8l The happy patient.

Fig 1-8m Panoramic radiograph after 7 years.

Fig 1-8n Clinical situation after 7 years.

Exposure and prosthetic loading

Following an uncomplicated 5-month healing period (Fig 1-8h), a tissue-sparing incision using the "cosine curve" technique (see page 330) was selected for exposure of the implants (Fig 1-8i). Following insertion of reduced-diameter healing abutments (diameter 4.1 mm) for gradual contouring of the peri-implant soft tissue, the wound was closed with microsurgical 6-0 single sutures (Fig 1-8j).

The implants were then prosthetically loaded with a screw-retained partial denture with bridging units 31 and 41 (Fig 1-8k). Figure 1-8l shows the happy patient following incorporation of the superstructure. The final photographs show the stable gingival and bone situation 7 years later (Fig 1-8m and 1-8n). To date, the patient has not asked for the esthetically unsatisfactory prosthesis in the posterior region of the third quadrant to be replaced.

Treatment course

- Implant placement (1999)
- 5 months to exposure
- 2 weeks to impression taking and fabrication

Treatment

Surgery:	Dr Christoph T. Sliwowski
Prosthetics:	Dr Michael Weber
Dental technology:	Fernando Abrantes

Problems and complications

Implant placement in an extensive bone defect

Baseline situation

This patient had a fairly extensive multi-tooth gap extending from the region of tooth 34 to the region of tooth 42 (Fig 1-9a). An extensive vertical bone defect, which required augmentation, was clinically and radiologically apparent particularly in the region of teeth 31 to 34, (Figs 1-9a and 1-9b).

Diagnostic tools

- Clinical examination
- Panoramic radiograph with template
- Dental cast analysis

Treatment plan

1. Insertion of four implants with simultaneous augmentation
2. Secondary exposure
3. Prosthetic loading with a transocclusal screw-retained fixed partial denture

Fig 1-9a Multi-tooth gap in the region of teeth 34 to 42.

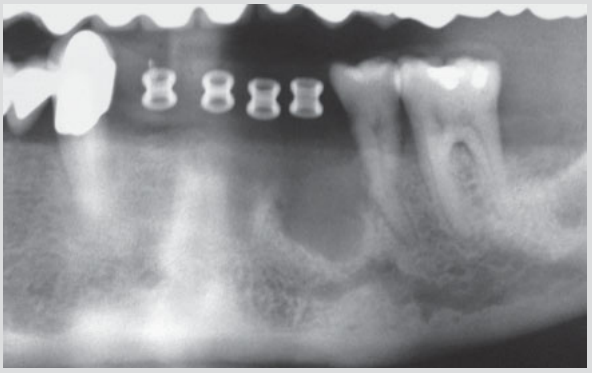


Fig 1-9b Large bone defect in the region of teeth 31 to 34.

Implant placement and augmentation

A crestal incision with a vertical relieving incision at tooth 35 was followed by preparation of the mucoperiosteal flap to reveal the defect (Fig 1-9c). The preparation of the four implant beds was performed according to plan, with the bone chips harvested for the subsequent augmentation. Direction indicators were used to check the correct positioning and orientation of the implant axes (Fig 1-9d). The implants were inserted, with those in the regions of teeth 33 and 32 positioned slightly deeper because of the bone defect, to avoid excessive vertical augmentation with an increased risk of complications (Fig 1-9e). Since the bone chips alone were not sufficient to fill the 3D defect, a regenerative bone substitute (Bio-Oss) was also used for its augmenta-

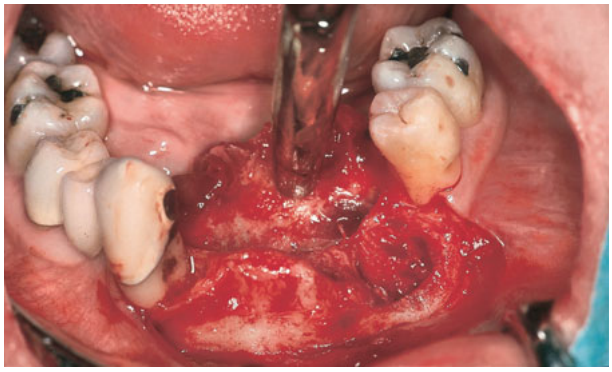


Fig 1-9c Exposure of the bone defect.

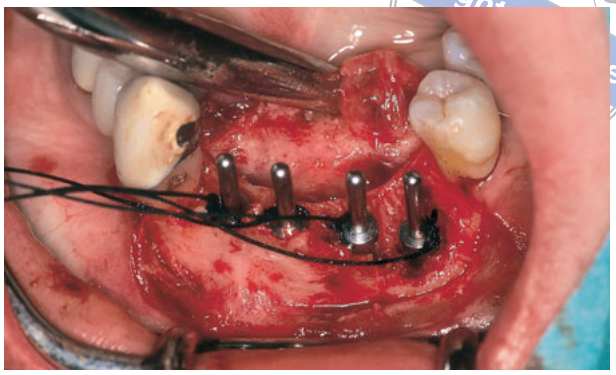


Fig 1-9d Preparation of the implant beds.

Fig 1-9e Insertion of the implants.

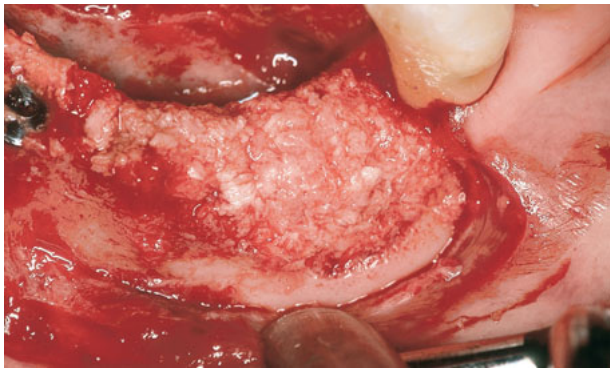


Fig 1-9f Augmentation with harvested bone chips.

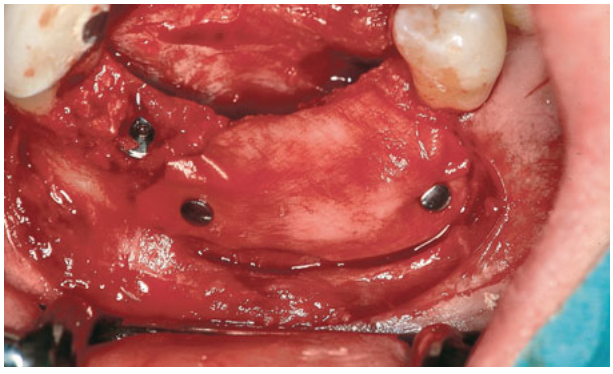


Fig 1-9g Fixation of the Bio-Gide membrane with pins.

tion (Fig 1-9f). In view of the expected resorption, the augmentation was overcontoured, so that implants 33, 32 and 41 were completely covered by the augmentation material. To ensure stabilization of the augmentation material, it was covered with a resorbable Bio-Gide collagen membrane. This was fixed into place with small titanium pins (Fig 1-9g).

Exposure and prosthetic loading

After 6 months' healing (Fig 1-9h), the implants were exposed with a residual ridge incision. This revealed that the implants in the regions of teeth 33 and 32 were completely covered by the augmentation (Fig 1-9i). This regenerated bone needed to be carefully removed with a reamer prior to full ex-

Fig 1-9h Situation prior to exposure.

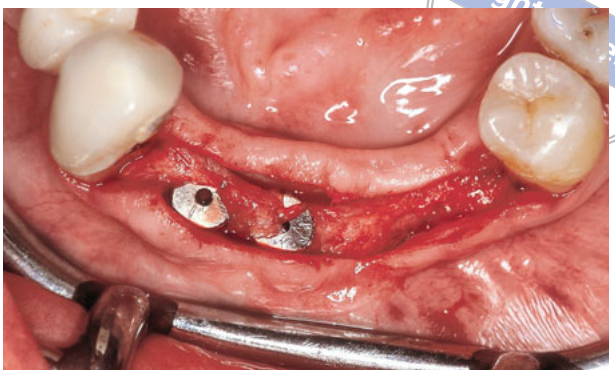


Fig 1-9i Implants 32 and 33 overgrown with bone.

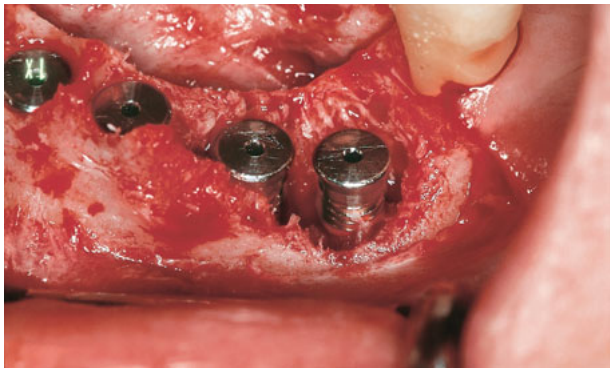


Fig 1-9j Comparison: situation at the time of implant placement.

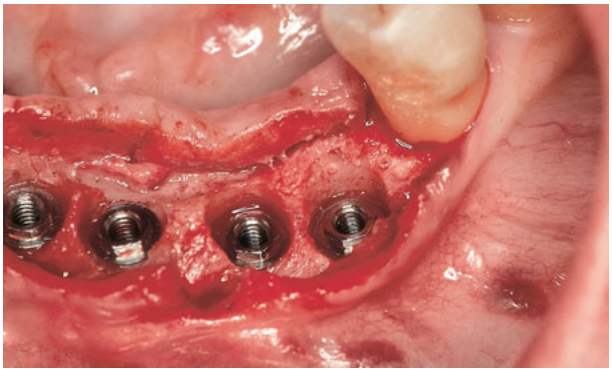


Fig 1-9k Exposure reveals massive bone regeneration.

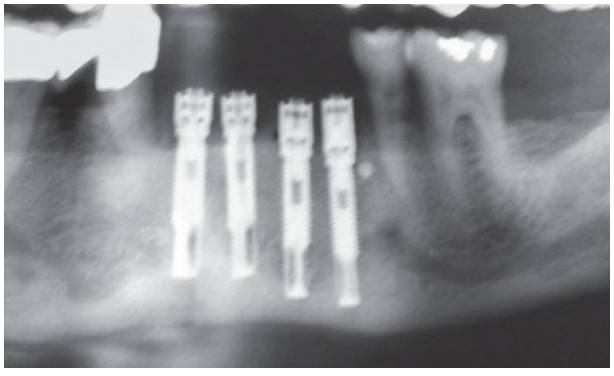


Fig 1-9l Standard abutments screwed into place.

Fig 1-9m Clinical situation 8 years after the superstructure was fitted.

posure. Comparison of Figs 1-9j (taken at the time of implant placement) and 1-9k (exposure) clearly shows the extent of the successful augmentation.

The differences in vertical implant insertion depths were compensated by using standard abutments 4, 5.5 and 7 mm long. Correct positioning of the abutments and the extent of the successful augmentation are clearly apparent on the follow-up radiograph (Fig 1-9l). The final photograph shows prosthetic loading with a transocclusal screw-retained fixed partial denture 8 years following placement of the implants (Fig 1-9m).

Continued follow-up

The clinical situation was checked and photographed at a follow-up examination 14 years after the implant placement (Fig 1-9n). A panoramic radiograph was taken at the same time (Fig 1-9o).

Fig 1-9n Clinical situation after 14 years.

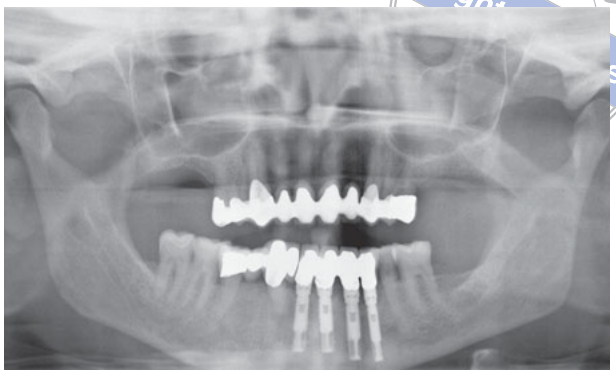


Fig 1-9o Radiologic findings after 14 years.

Treatment course

- Implant placement (1996)
- 6 months to exposure
- 3 weeks to impression taking and fabrication

Treatment

Surgery: Dr Christoph T. Sliwowski
Prosthetics: Dr Michael Weber
Dental technology: Horst Mosch

Immediate loading

Immediate fixed partial denture loaded onto definitive implants

Baseline situation

This 48-year-old patient had already lost tooth 31, while teeth 32, 41 and 42 suffered severe periodontal damage and could no longer be preserved. The root of tooth 31 was removed and the available natural crown fixed to the neighboring teeth with composite resin (Fig 1-10a). The available bone volume visible on the panoramic radiograph allows long, stable implants to be inserted (Fig 1-10b).

Diagnostic tools

- Clinical examination
- Panoramic radiograph
- Dental cast analysis

Treatment plan

1. Extraction and insertion of two definitive implants with provisional immediate loading
2. Definitive prosthetic loading with a transocclusal screw-retained, metal-ceramic fixed partial denture

Fig 1-10a Non-preservable anterior teeth.

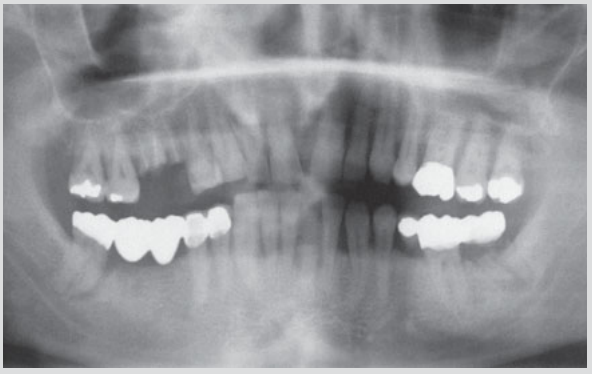


Fig 1-10b Panoramic radiograph taken for planning purposes.

Extraction, implant placement and provisional loading

Working under local anesthesia, the incisors were first separated from one another, any hard and soft deposits removed and the teeth then gently extracted without tissue destruction. Exposure of the operation site was achieved by means of an incision made to expose the residual ridge. One releasing incision extended mesially from tooth 33 and the other distally from tooth 43 (Fig 1-10c). The implant beds in the regions of teeth 32 and 42 were prepared and checked using direction indicators (Fig 1-10d). Two implants (Neoss) (length 17 mm and diameter 4 mm) were inserted (Fig 1-10e). The prepared thermoplastic foil reproduce the positions of the dental crowns and can be helpful when checking the insertion depth (approximately 2 mm subgingivally (Fig 1-10f).

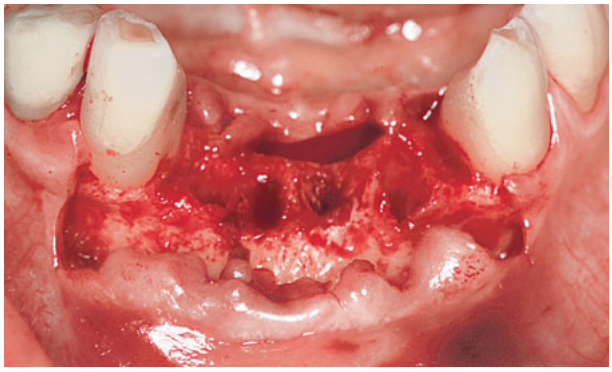


Fig 1-10c Creation of the mucoperiosteal flap.

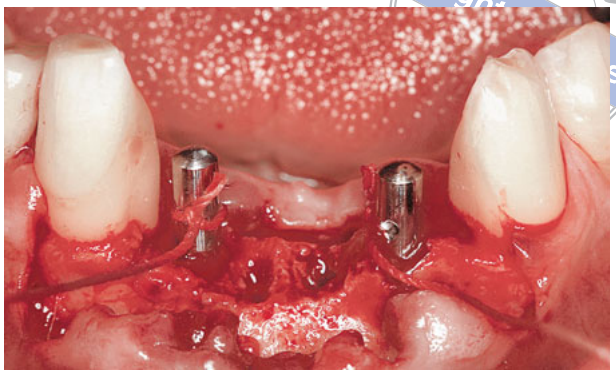


Fig 1-10d Preparation of the implant beds.

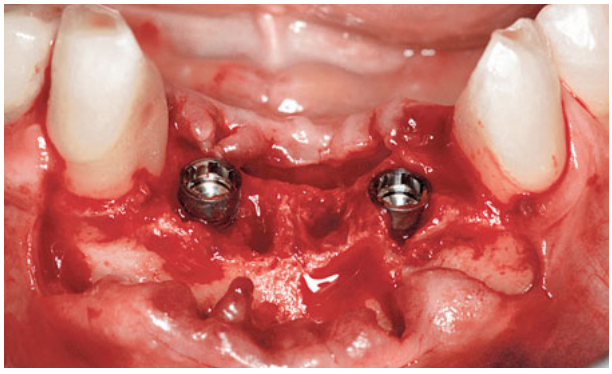


Fig 1-10e Inserted Neoss implants.

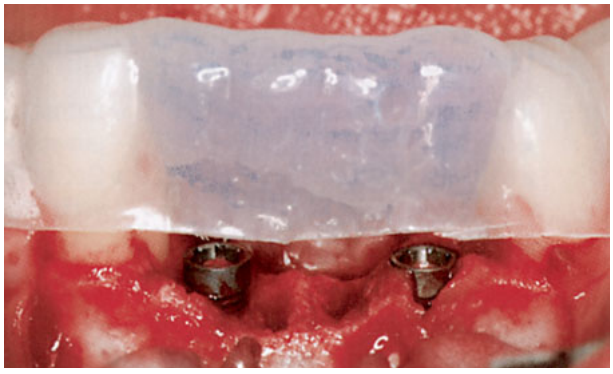


Fig 1-10f Checking the insertion depth.

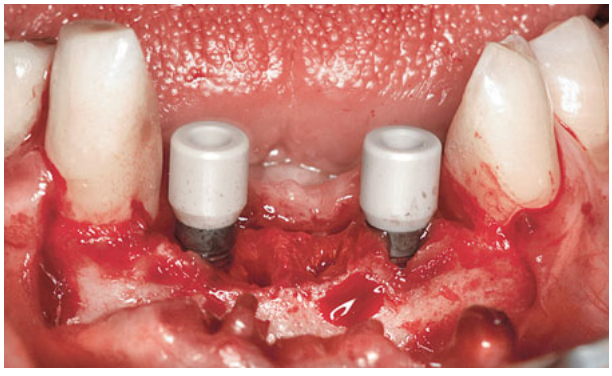


Fig 1-10g The healing abutments have been screwed into place.

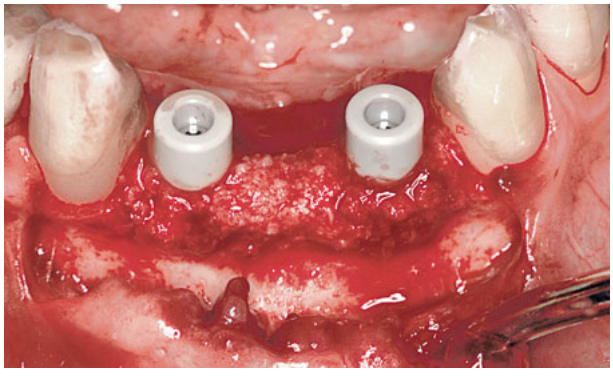


Fig 1-10h Augmentation.

Once the implant positions were accepted, the healing abutments were screwed onto the implants (Fig 1-10g). The bone defects were augmented with the harvested bone chips (Fig 1-10h). The augmentation material was covered with the mucoperiosteal flap without using a membrane and the flap fixed into place with Gore-Tex and microsurgical sutures (Fig 1-10i). The provisional immediate loading was performed via a prepared thermoplastic foil, filled with Protemp (3M ESPE) and repositioned onto the teeth over the healing abutments (Fig 1-10j). Before it hardened, the splint was briefly removed, and then replaced, and autopolymerization of the material awaited. Once it had hardened, the provisional restoration was removed and the healing abutments exchanged for impression posts (Fig 1-10k). Casting for the long-term provisional restoration was performed with the impression copings, using a custom molding tray filled with Impregum (3M ESPE). The time needed to take the impression can be used

Fig 1-10i Suturing the incision.

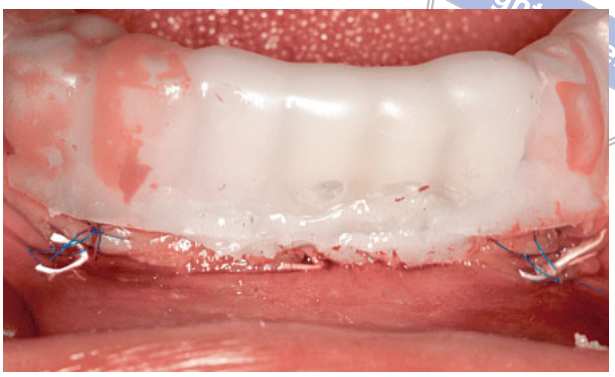


Fig 1-10j Building the first provisional restoration.

Fig 1-10k Preparation for the impression taking.

Fig 1-10l Retention grooves in the provisional restoration.

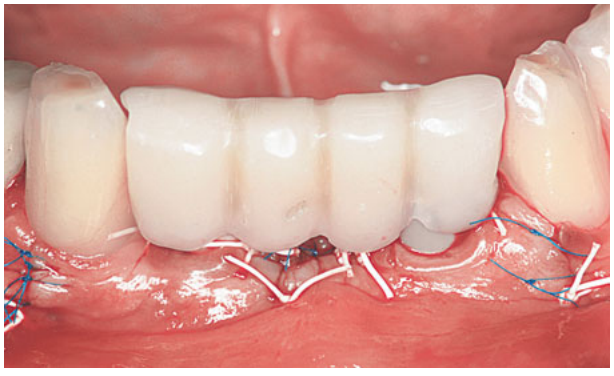


Fig 1-10m Placement of the first provisional restoration.

Fig 1-10n Long-term provisional prepared in the laboratory.

Fig 1-10o Fitting the long-term provisional.

Fig 1-10p Follow-up panoramic radiograph.

Fig 1-10q Definitive bridge.

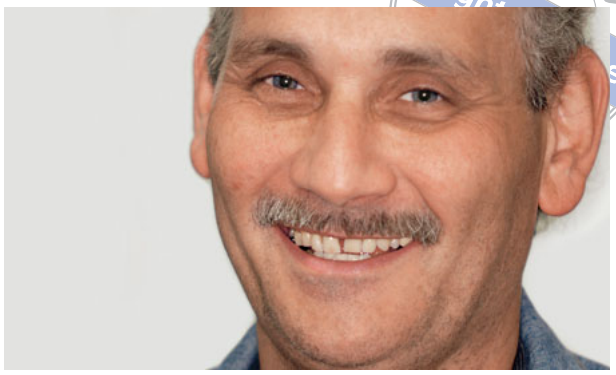


Fig 1-10r Patient after the treatment.

Fig 1-10s Clinical situation after 7 years.

to shape the provisional restoration (Fig 1-10l). After removing the mold, the healing abutments were screwed back onto the implants and the first provisional restoration fitted onto them (Fig 1-10 m). Normally, the anchoring that is achieved is so good that no provisional cement is necessary. In the laboratory, a metal-reinforced, long-term provisional restoration was fabricated on the provisional cylinders (Fig 1-10n).

The long-term provisional restoration was fitted a few days later (Fig 1-10o). It was important for it to be placed completely out of static and dynamic occlusion. The postoperative panoramic follow-up radiograph shows favorably positioned implants solidly anchored in the mandibular bone (Fig 1-10p). The patient was very satisfied with the quick and, according to him, pain-free treatment and was happy to have been spared the need for a removable prosthesis (Figs 1-10q and 1-10r).

Continued follow-up

The patient was clinically examined 7 years after implant placement and an up-to-date photograph was taken (Fig 1-10s). This showed that a monofilament 6-0 suture had remained in place under the left canine, without causing any irritation.

Treatment course

- Implant placement and provisional loading of the definitive implants (2004)
- 4 months to impression taking and fabrication

Treatment

Surgery:	Dr Christoph T. Sliwowski
Prosthetics:	Dentist Markus Peters
Dental technology:	Fernando Abrantes

Immediate loading

Flapless implant placement and augmentation with immediate loading

Baseline situation

Ten years ago, this patient was fitted with an implant-supported, maxillary fixed full denture supported on seven implants, which he has been wearing to date with total satisfaction. His current issue is the anterior fixed partial denture on the loosened lateral incisors (Fig 1-11a). Both the height and width of the residual ridge in the planned implant placement zones is adequate for transgingival implant placement through the sockets (Figs 1-11b to 1-11d).

Diagnostic tools

- Clinical examination
- CBCT
- Planning with the SimPlant program
- Dental cast analysis

Treatment plan

1. Extraction; insertion of the implants through the sockets; augmentation; provisional immediate loading
2. Prosthetic loading with a metal-ceramic, transocclusal screw-retained, fixed partial denture

Fig 1-11a Dental bridge supported by the loosened lateral incisors.

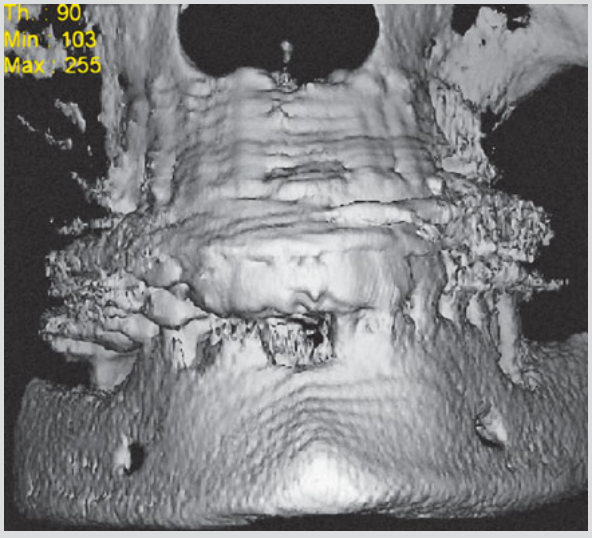


Fig 1-11b 3D reconstruction.

Fig 1-11c Cross-sectional view of the tooth 42 region.

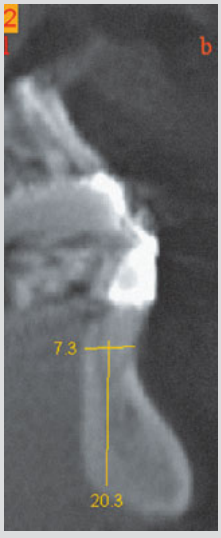


Fig 1-11d Cross-sectional view of the tooth 32 region.

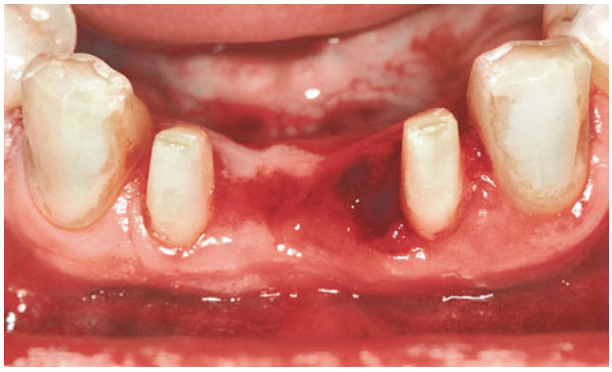


Fig 1-11e Vertical and horizontal residual ridge atrophy.

Fig 1-11f Preparation of the implant beds.

Fig 1-11g The impression copings screwed into place.

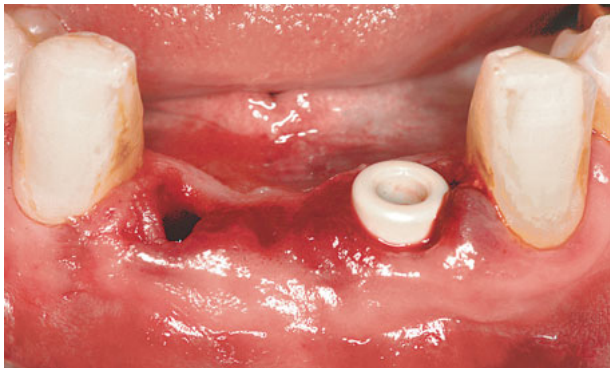


Fig 1-11h Healing abutment fitted onto implant 32, cover screw screwed onto implant 42.

Extraction, implant placement with augmentation, immediate loading

Removal of the fixed partial denture bridging teeth 32 and 42 revealed the vertical and horizontal bone loss that had occurred following loss of the central incisors (Fig 1-11e). Teeth 32 and 42 were extracted and the implant beds prepared through the resultant sockets. The patient was spared an incision and creation of a mucoperiosteal flap. The implants' position, inclination and depth, as planned with the SimPlant program, were checked using direction indicators (Fig 1-11f).

Once the implants were placed, the impression copings were screwed onto them (Fig 1-11g), and an impression was taken for the long-term provisional restoration. Since the impression taking took place even before the augmentation, the technician needed to take the latter into account when creating the cast. For the flapless augmentation, a healing abutment was fitted onto implant 32 and a cover screw was screwed onto implant 42 (Fig 1-11h). Working through the perforation left by tooth 42, the soft tissue in the region of teeth 31 and 41 was dissected off the bone with the periosteum and the resultant space filled with the harvested bone chips. One advantage of the Neoss system is the fact that both the cover screw and the healing abutment are supplied with the implant, so that no additional components are needed. The cover screw on implant 42 protected the implant during the periosteal dissection and stopped bone particles from getting into it during augmentation. After augmentation, the cover screw was unscrewed and the healing abutment fitted into its place (Fig 1-11i). Because augmentation needed overcontouring due to the subsequent resorption, external retention on the healing abutments was lost. However, it was possible to retain the provisional prosthesis on the internal channels of the healing abutments (Fig 1-11j). The retention provided by the "root posts" and the

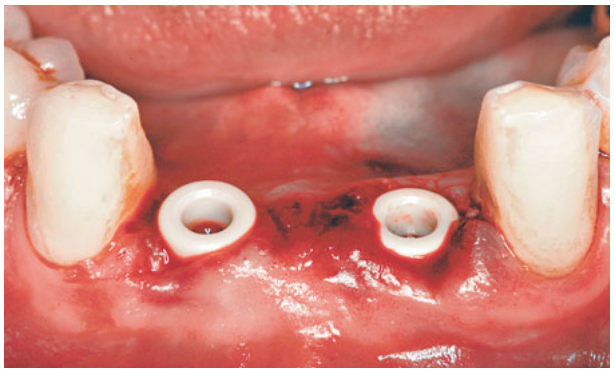


Fig 1-11i Healing abutments on both implants after augmentation.

Fig 1-11j Retention for the immediate provisional prosthesis provided by the internal channels of the abutments.

Fig 1-11k Inserted immediate provisional restoration.

Fig 1-11l Long-term provisional prosthesis.

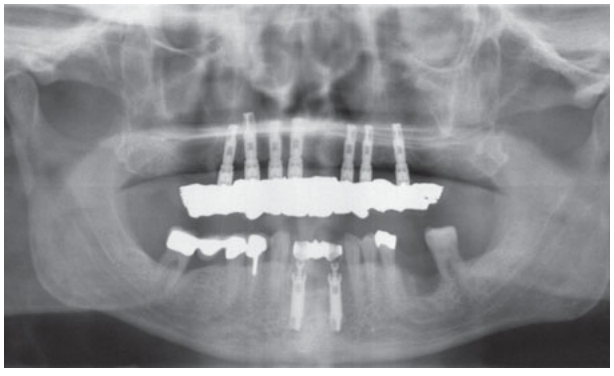


Fig 1-11m Follow-up panoramic radiograph.

Fig 1-11n Definitive implant bridge 8 months after it was loaded onto the implants. Stable peri-implant soft tissue situation.

adaptation to the canines was so good that no provisional cement was required (Fig 1-11k). Ten days later, although the gingival situation was not yet stable and no sutures needed removing, it was already possible to fit the patient with the long-term provisional bridge (Fig 1-11l). The postoperative panoramic radiograph shows not only the location of the implants in the mandible, but also the stable bone situation of the maxillary implants after 10 years (Fig 1-11m). The definitive prosthesis, in the form of a metal-ceramic fixed implant bridge fitted onto customized abutments, was incorporated 4 months after implant placement. After 8 months in functional use, the clinical situation was stable, although the patient's oral hygiene left something to be desired (Fig 1-11n).

Fig 1-11o Clinical situation in the mandible after 4 years.

Fig 1-11p Clinical situation in the maxilla after 14 years, showing neglected oral hygiene.

Fig 1-11q Heavy deposits on the superstructure and teeth after 7 years.

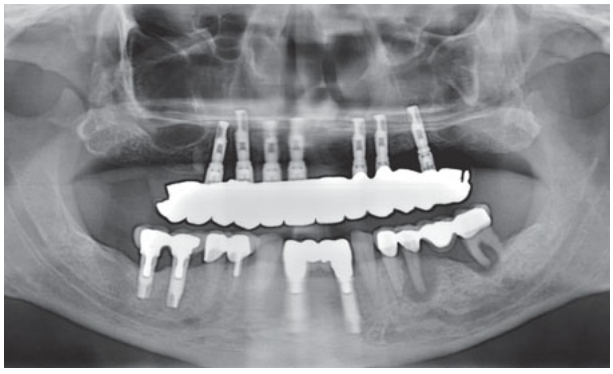


Fig 1-11r Panoramic radiograph after 7 and 17 years.

Continued follow-up

Four years after the implant treatment in the mandible, the gingival situation around the implants was stable (Fig 1-11o). The poor fit of the superstructure was now clearly visible as a result of the mild gingival displacement around implant 42. The clinical examination of the maxilla 14 years after implant placement also showed neglected oral hygiene (Fig 1-11p). However, the implants in the maxilla were in relatively good condition, despite the poor oral hygiene and hardly any attached gingiva.

After another 3 years, the oral hygiene, rather than improving, had deteriorated, making professional cleaning of the teeth imperative (Fig 1-11q). The panoramic radiograph after 7 and 17 years, respectively, shows a stable osseous situation in the anterior mandible, but also a few problems in other areas (Fig 1-11r). Implant 47, inserted 2 years following implant placement of the anterior teeth, shows considerable bone loss requiring treatment after another 5 years in functional use. Tooth abutments 35 and 47 need urgent extraction due to severe loosening and pain. The extraction, augmentation and further implant placement in the third quadrant are currently being planned. In the interim, it should be possible to make some changes to the connecting bar in the maxilla, as the standard abutment on implant 25 is not correctly positioned and a gap is visible between the implants and superstructure.

Treatment course

- Extraction, implant placement and augmentation, with provisional loading of the definitive implants (2005)
- 4 months to impression taking and fabrication

Treatment

Surgery: Dr Christoph T. Sliwowski
Prosthetics: Dentist Markus Peters
Dental technology: Ute Olbers

References

Aalam AA, Nowzari H, Krivitsky A. Functional restoration of implants on the day of surgical placement in the fully edentulous mandible: a case series. Clin Implant Dent Relat Res 2005;7(1):10-6.

Atieh MA, Payne AG, Duncan WJ, de Silva RK, Cullinan MP. Immediate placement or immediate restoration/loading of single implants for molar tooth replacement: a systematic review and meta-analysis. Int J Oral Maxillofac Implants 2010;25(2):401-15.

Bäumer D, Zuhr O, Hansen K, Hürzeler, M. Das Einzelzahnimplantat in der ästhetischen Zone. Entwicklungen nach 20 Jahren. Implantologie2013;21(1):7-16.

Bayer G, Kistler F, Kistler S, Adler S, Neugebauer J. Sofortversorgung mit reduzierter Implantatanzahl. Wissenschaftliche Konzeption und klinische Ergebnisse. Berlin: Quintessenz; 2011.

Brånemark P-I, Chien S, Gröndahl H-G, Robinson K. The Osseointegration Book: From Calvarium To Calcaneus. Berlin: Quintessenz; 2005.

Cacaci C, Neugebauer J, Schlegel A, Seidel F. Fachbuch Orale Implantologie. Stuttgart: Thieme 2006.

Casap N, Tarazi E, Wexler A, Sonnenfeld U, LustmannJ. Intraoperative computerized navigation for flapless implant surgery and immediate loading in the edentulous mandible. Int J Oral Maxillofac Implants 2005;20(1):92-8.

Cassetta M, Stefanelli LV, Giansanti M, Calasso S. Accuracy of implant placement with a stereolithographic surgical template. Int J Oral Maxillofac Implants 2012;27(3):655-63.

Chiapasco M. Early and immediate restoration and loading of implants in completely edentulous patients. Int J Oral Maxillofac Implants 2004;19 Suppl:76-91.

Choi B-H, Jeong, S-M, KimJ, Engelke W. Flapless Implantology. London: Quintessence; 2010.

Crespi R, Capparè P, Gherlone E, Romanos G. Immediate provisionalization of dental implants placed in fresh extraction sockets using a flapless technique. Int J Periodontics Restorative Dent 2012;32(1):29-37.

de Jong MH, Wright PS, Meijer HJ, Tymstra N. Posterior mandibular residual ridge resorption in patients with overdentures supported by two or four endosseous implants in a 10-year prospective comparative study. IntJ Oral Maxillofac Implants 2010;25(6):1168-74.

Di Giacomo GA, Cury PR, de Araujo NS, Sendyk WR, Sendyk CL. Clinical application of stereolithographic surgical guides for implant placement: preliminary results. J Periodontol 2005;76(4):503-7.

Ercoli C, Geminiani A, Lee H, Feng C, Poggio CE. Restoration of immediately loaded implants in a minimal number of appointments: a retrospective study of clinical effectiveness. Int J Oral Maxillofac Implants 2012;27(6):1527-33.

Farley NE, Kennedy K, McGlumphy EA, Clelland NL. Split-mouth comparison of the accuracy of computer-generated and conventional surgical guides. IntJ Oral Maxillofac Implants 2013;28(2): 563-72.

Francischone CE, Vasconcelos LW, Branemark PI. Osseointegration and Esthetics in Single Tooth Rehabilitation. Chicago: Quintessenz 2004.

Friberg B, Henningsson C, Jemt T. Rehabilitation of edentulous mandibles by means of turned Brånemark System implants after one-stage surgery: a 1-year retrospective study of 152 patients. Clin Implant Dent Relat Res 2005;7(1):1-9.

Grunder U, Wenz B, Schupbach P. Guided bone regeneration around single-tooth implants in the esthetic zone: a case series. IntJ Periodontics Restorative Dent 2011;31(6):613-20.

Hartmann HJ, Deppe H, Knofler W, Weischer T, Zentai S. Praktisches Komplikationsmanagement in der Implantologie. Gefahrenquellen, Handlungsempfehlungen, prophylaktische Maßnahmen. Balingen: Spitta; 2012.

Jiménez-López V. Sofortbelastung von Dentalimplantaten. Chirurgische, prothetische, okklusale und labortechnische Aspekte. Berlin: Quintessenz; 2005.

Khoury F. Augmentative Verfahren in der Implantologie. Berlin: Quintessenz: 2009.

Koeck B, Wagner W. Implantologie. Praxis der Zahnheilkunde Bd. 13. München: Urban & Fischer: 2004.

Moy PK, Palacci P, Ericsson I. Immediate Function & Esthetics in Implant Dentistry. London: Quintessence; 2008.

Romanos GE. Sofortbelastung von enossalen Implantaten. Berlin: Quintessenz; 2005.

Rutten L, Rutten P. Crown - Bridge & Implants. The Art of Harmony. Fuchstal: Teamwork Media; 2006.

Sclar AG. Weichgewebe und Ästhetik in der Implantologie. Berlin: Quintessenz; 2004.

Sethi A, Kaus T. Practical Implant Dentistry. The Science and Art. London: Quintessence; 2012.

Sliwowski CT, Zagalak R. Bezzebna zuchwa - nowa koncepcja leczenia implantoprotetycznego. Quintessence Periodontologia Implanty 2008;7(2):152-162.

Sliwowski CT, Zagalak R. Bezzuba niznaja szczieliena - nowa koncepcja implantologiczno-ortopiedicznowo likuwannia. Implantologia, Parodontologia, Osteologia 2008;4(12):25-32.

Sliwowski CT, Zagalak R. Ein neues Versorgungskonzept für den zahnlosen Unterkiefer - präzise, schnell und kostengünstig. BDIZ EDI Konkret 2009;13(2):82-90.

Stricker A, Gutwald R, Schmelzeisen R, Gellrich NG. Immediate loading of 2 interforaminal dental implants supporting an overdenture: clinical and radiographic results after 24 months. Int J Oral Maxillofac Implants 2004;19(6):868-72.

Strietzel FP, Karmon B, Lorean A, Fischer PP. Implant-prosthetic rehabilitation of the edentulous maxilla and mandible with immediately loaded implants: preliminary data from a retrospective study, considering time of implantation. Int J Oral Maxillofac Implants 2011;26(1): 139-47.

Tardieu PB, Rosenfeld, AL. The Art of Computer-Guided Implantology. Chicago: Quintessence; 2009.

Testori T, Galli F, del Fabbro M. Sofortbelastung. Eine neue Ära der dentalen Implantologie. Berlin: Quintessenz; 2012.

Uludag B, Polat S. Retention characteristics of different attachment systems of mandibular overdentures retained by two or three implants. IntJ Oral Maxillofac Implants 2012;27(6):1509-13.

Wagenberg BD, Froum SJ, Eckert SE. Long-term bone stability assessment around 1,187 immediately placed implants with 1- to 22-year follow-up. IntJ Oral Maxillofac Implants 2013;28(2):605-12.

Wojtowicz A. Stomatologia geriatryczna-mozliwosci leczenia implantologicznego. Implants DTI 2006;1:24.

Wolfmger GJ, Balshi TJ, Wulc DA, Balshi SF. A retrospective analysis of 125 single molar crowns supported by two implants: long-term follow-up from 3 to 12 years. IntJ Oral Maxillofac Implants 2011;26(1): 148-53.

Wolfram H, Stephan K, Rudolf MG. Knochenaufbau in der zahnärztlichen Implantologie, Band 2. Balingen: Spitta; 2008.

Yamashita J, Wang Q, Dechow PC. Biomechanical effects of fixed partial denture therapy on strain patterns of the mandible. J Prosthet Dent 2006;95(1):55-62.

Zablocki J. Implantacja - uzupelnienia stale. Lwow: Galdent; 2006.

Zarb GA, Albrektsson T, Baker G, Eckert SE, Stanford C, Tarnow DP, Wennerberg A. Osseointegration: On Continuing Synergies in Surgery, Prosthodontics, and Biomaterials. Chicago: Quintessence 2008.

Zuhr O, Hürzeler M. Plastisch-ästhetische Parodontal- und Implantatchirurgie. Ein Mikrochirurgisches Konzept. Berlin: Quintessenz; 2011.

List of materials

Surgery

Medicines
Amoxicillin, Ratiopharm, Ulm, Germany
Arnica D 12, Deutsche Homöopathie-Union, Karlsruhe, Germany
Bromelain, Ursapharm, Saarbrücken, Germany
Dormicum, Roche, Grenzach, Switzerland
Fortecortin Inject, Merck Serono, Darmstadt, Germany
Gentamicin, Ratiopharm, Ulm, Germany
Gelonida, Gödecke, Berlin, Germany
Solcoseryl Dental Adhesive Paste, Solco, Grenzach-Wyhlen, Switzerland

Bone filters
Autogenous Tissue Collector, Biomet 3i, Palm Beach, USA
Bone Collector, Anthogyr Implants, Sallanches, France
Bone Collector, Imtec, Ardmore, USA

Nails and tacks
Bone Tack - 3 und 5 mm, Imtec, Ardmore, USA
Frios Nails, Friatec, Mannheim, Germany
Membrane Nails, JMP Dental, Heiligenhaus, Germany

Implants
Brånemark System, Nobel Biocare, Kloten, Switzerland
Neoss Implant System, Neoss Ltd., Harrogate, United Kingdom
Nobel Replace Select Straight, Nobel Biocare, Kloten, Switzerland
NobelActive, Nobel Biocare, Kloten, Switzerland
3i Implant System, Biomet 3i, Palm Beach, USA
SOS Implant, Osteoplant, Posen, Poland

Provisional Implants
Arrow Titanium Implant, Alpha-Bio, Tikva, Israel
Immediate Provisional Implant (IPI), Nobel Biocare, Kloten, Switzerland
K.S.I. Bauer screws, Bad Nauheim, Germany

Regenerative bone substitutes
Biogran, Biomet 3i, Palm Beach, USA
Bio-Oss, Geistlich, Wolhusen, Switzerland
Cerasorb, curasan, Kleinostheim, Germany
OSTIM, Heraeus Kulzer, Hanau, Germany
NanoBone, Dentaurum, Ispring, Germany
Tutodent microchips, Tutogen Medical, Neunkirchen am Brand, Germany
Tutoplast cancellous bone, Tutogen Medical, Neunkirchen am Brand, Germany
BioSeed, BioTissue Technologies, Freiburg, Germany
Puros, Zimmer Dental, Freiburg, Germany

Membranes
Atrisorb, TOLMAR, Fort Collins, USA
Bio-Gide, Geistlich, Wolhusen, Switzerland
Bio-Tape, Geistlich, Wolhusen, Switzerland
Gore-Tex, Gore, Flagstaff, USA
OsseoQuest, Gore, Flagstaff, USA
Ossix, Biomet 3i, Palm Beach, USA
Parasorb Resodont, Resorba Medical, Nürnberg, Germany
Resolut membrane, Gore, Flagstaff, USA
Tutodent Membrane, Zimmer Dental, Freiburg, Germany
Vicryl Mesh, Johnson & Johnson/Ethicon, Norderstedt, Germany
Mucograft, Geistlich, Wolhusen, Switzerland

Suturing material
Gore-Tex sutures CV-6, Gore, Flagstaff, USA
Mopylen 6-0, Resorba Medical, Nürnberg, Germany
Surgipro, Covidien, Mansfield, USA

Surgical and prosthetic devices
Osseocare, Nobel Biocare, Kloten, Switzerland
Osstell Mentor, Osstell, Göteborg, Sweden
Torque Controller, Nobel Biocare, Kloten, Switzerland
PACT, Cumdente, Tübingen, Germany
Osseoset 200, Nobel Biocare, Kloten, Switzerland

Prosthetics

Cements (definitive and provisional)
AGC Cem, Wieland Dental, Pforzheim, Germany
Cavit G, Espe, Seefeld, Germany
Roeko Gutta-percha white, Coltene/Whaledent, Langenau, Germany
Harvard Cement, Harvard Dental International, Hoppegarten, Germany
ImProv, Nobel Biocare, Kloten, Switzerland
TempBond, Kerr, Rastatt, Germany

Dental impression materials
Exabite II NDS, GC, Bad Homburg, Germany
Exaflex, GC, Bad Homburg, Germany
Examix, GC, Bad Homburg, Germany
Impregum, 3M ESPE, Seefeld, Germany
Imprint SBR, 3M ESPE, Seefeld, Germany
Permadyne, 3M ESPE, Seefeld, Germany
Silicone putty, Orbis dental, Offenbach, Germany

Self-polymerizing resins
Pattern Resin, GC, Bad Homburg, Germany
Trim, Bosworth Company, Skokie, USA
Visco-gel, Dentsply/De Trey, Konstanz, Germany
Protemp, 3M ESPE, Neuss, Germany

Dental technology

Articulators
SAM 2, SAM Präzisionstechnik, Munich, Germany
Artex Typ TK, Girrbach, Pforzheim, Germany

Deep-drawn foils
Erkodur deep-drawn foils and base plates 1.5 mm (hard), Erkodent, Pfalzgrafenweiler, Germany
Erkolen 1.0 mm (elastic), Erkodent, Pfalzgrafenweiler, Germany

Abutments
CeraOne, Nobel Biocare, Kloten, Switzerland
CerAdapt, Nobel Biocare, Kloten, Switzerland
EsthetiCone, Nobel Biocare, Kloten, Switzerland
Micro Mini, Biomet 3i, Palm Beach, USA
Neolink, Neoss, Harrogate, United Kingdom
Standard, Nobel Biocare, Kloten, Switzerland
TiAdapt, Nobel Biocare, Kloten, Switzerland
PEEK abutments, Neoss, Harrogate, United Kingdom
SOS-EBF (Eccentric Bar Fixation) Abutment, Osteoplant, Posen, Poland

Individual trays
Gebdi tray material, light-curing, Gebdi Dental, Engen, Germany
LC-Tray, Roos Dental, Mönchengladbach, Germany
Gematray-LC, Gema Dental, Breisach, Germany

Gingival masks
Gi-Mask, Coltene/Whaledent, Langenau, Germany
Gingitech, Ivoclar Vivadent, Schaan, Liechtenstein
Vestogum, 3M ESPE, Seefeld, Germany

Acrylate plastics
Formatray (for bite plates), Kerr, Rastatt, Germany
Metalprimer II (bonding), GC, Bad Homburg, Germany
Palapress colorless (for surgical templates), Heraeus Kulzer, Hanau, Germany
Ropak UV P (pink), Bredent, Senden, Germany
Selectaplus (for prostheses), Dentsply/Degudent, Hanau, Germany

Ceramics
AllCeram, Dentsply/Degudent, Hanau, Germany
Finesse All-Ceramic, Dentsply/De Trey, Konstanz, Germany
Procera, Nobel Biocare, Kloten, Switzerland

Microscrews
Pontilock, ZL, Breckerfeld, Germany

Technical water-cooled turbine handpiece
Shape-Air, Nobel Biocare, Kloten, Switzerland

Locking attachments
Degusafe, Degussa, Hanau, Germany
MK1, MK1 Dental Attachment, Bockhorn, Germany

3D planning programs
SimPlant, Dentsply/De Trey, Konstanz, Germany
co-DiagnostiX, Straumann, Basel, Switzerland
Med3D, Med3D Implantology, Heidelberg, Germany
NobelClinician, Nobel Biocare, Kloten, Switzerland

Surgical 3D templates
SurgiGuide, Dentsply/De Trey, Konstanz, Germany
NobelGuide/NobelClinician,, Nobel Biocare, Kloten, Switzerland
GonyX, Straumann, Basel, Switzerland