Practical Implant Dentistry
The Science and Art

Second edition

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This book is dedicated to friends and family –
past, present and future.
In appreciation of those who made us who we are.
In gratitude to those whose support we have now.
In anticipation of those whose paths we may touch.

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Forewords

Prof Dr H Weber Chairman and Medical Director, Clinic for Dental, Oral and Maxillary Medicine, Tübingen, Germany

It was a desirable expectation that this comprehensive, outstanding book on 'Practical Implant Dentistry – The Science and Art' would be published in a second edition, for several reasons:

- The sold-out first edition, written by practitioners for practitioners, represents a rare combination of practical guidelines for encompassing clinical implant dentistry. Founded on a sound and solid personal clinical experience of the authors on one side, the scientific basis is also provided with an analysis of the relevant literature on the other side. Such a well accepted book must have another edition.
- Implant dentistry has dramatically evolved in past years due to digitalisation in both fields i.e., computer based diagnostics and therapy and restorative laboratory procedures – a state-of-the-art book must include all of this.
- Another edition would enable the authors to utilise the unique chance of presenting follow-ups of patients shown in the first edition, and by doing so shall reflect the value and the reliability of treatment concepts.

The second edition meets all of these three reasons/expectations in an unsurpassed way by reflecting marvellously the developments in our clinical understanding and technology:

- Clinically, we all – by gaining experience – are moving our indications for certain treatments to other levels of complexity and difficulty. In implant dentistry, bone grafts have become more frequent and important because of our personal demands as well as our patients' with regard to what can be, or rather must be achieved aesthetically and functionally by such a treatment.
- Technically, digitalisation has a tremendous impact in both fields – clinically and in the dental laboratory:
  - In diagnostics/therapy, advanced CBT/CT-scans with improved software enhanced our understanding of the individually appropriate treatment, on our surgical possibilities in terms of computer guided surgery, and, last, but not least, by all of this on the safety of our patients.
  - In the dental lab, sophisticated CAD/CAM-technology is steadily widening/enlarging our possibilities with regard to materials, design, and precision. This book introduces these new technologies.

Furthermore, the new edition does not only cover the modern topics mentioned above in a state-of-the-art manner, but by presenting follow-ups of some of the cases shown in the first edition, it confirms the efficacy of the treatment principles described.

In the field of implant dentistry, this book is again a must for beginners as well as for advanced colleagues. Having been involved in surgical as well as restorative implant dentistry clinically and scientifically myself for more than three decades, I do appreciate the enormous input of the authors in this field resulting in an equivalent impact of their book on our profession. I would like to thank the authors for the very successful efforts they invested into this book. Together with my appreciation, congratulations, and my thanks, I would like to state that this book will be another milestone in our University Medical Library.

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Past Dean, Faculty of General Dental Practice, Royal College of Surgeons of England

Holland[1] suggested that healthcare career preferences could be mapped in six broad types (RIASEC model) for vocational career choices. They were surgery (realistic), hospital medicine (investigative), psychiatry (artistic), public health (social), administrative medicine (enterprising) and laboratory medicine (conventional).

The greatest innovation in dental treatment and the biggest growth area in dentistry at the beginning of this millennium is the field of implantology. A clinician who embarks upon it will need to embrace all six disciplines of healthcare choices. A clinician who practises implantology is the complete practitioner. The concept of the scientist practitioner (investigative) is now at the core of all dental treatment planning. Evidence-based healthcare, where evidence is based on audit and clinical governance interacting with clinical pathways, makes the professional accountable to the public. Quality assurance is then used to ensure that untoward outcomes are kept to a minimum. Therefore, public health dentistry (social) and practice management (enterprising) have evolved prominently. Those who embark upon dental implantology are engineers of medicine, solving problems at high levels of mechanical and technical excellence, emphasising practical skills and craftsmanship, with immediate and effective results (realistic). Implantology spans almost all aspects of clinical dentistry to include complex surgery and advanced prosthodontics. These practitioners need to have an artistic approach to the subject, seeing, interpreting and responding imaginatively to a range of dental, medical, social, ethical and other problems, including responding to ideas expressed by patients. Evidence-based medicine, where it exists, must be balanced with treatment specific to that unique individual (artistic). Precision technology and attention to detail at the micrometre level in the laboratory will crown the eventual result (conventional).

The authors have mapped this publication to encompass all disciplines required for advancing the complete implant practitioner. Their in-depth understanding of general dental practice and their wide experience in teaching have lent themselves well to their well-rehearsed and structured methodology. This book is a practical and sensible approach to excellence in implantology. It is written in an easy style and is full of beautiful illustrations to help guide the practitioner of implantology through the myriad of choices. I have learnt much from it. This publication is a benchmark in our modern approach to implant dentistry.

1 Holland JL. Making vocational choices: a theory of careers. New York: Prentice Hall, 1973.

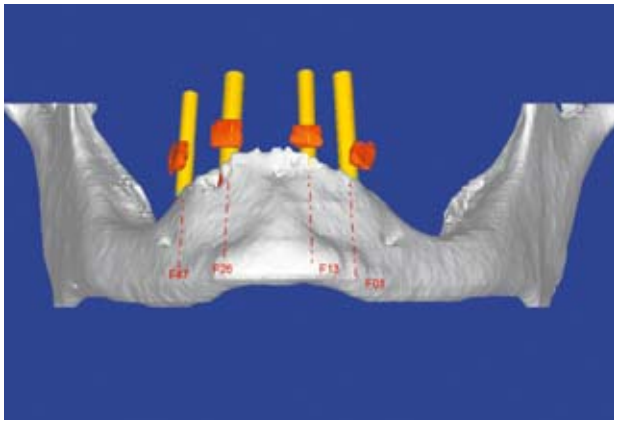


Fig 5-10 Three-dimensional view of the mandible from the anterior aspect with four implants placed interactively in the interforaminal region (yellow bars). The red markers represent radiopaque markers placed within the patient's denture in the region of the lateral incisors and first premolars. This information will be transferred to a surgical guide (Simplant).

Fig 5-11 Three-dimensional model of jaw and CT data-based surgical template fabricated by means of stereolithography. The pilot bur is directed by the titanium tubes positioned from the treatment planned on the computer, positioning the implants precisely in the ideal position. (Same patient as in Fig 5-10.)

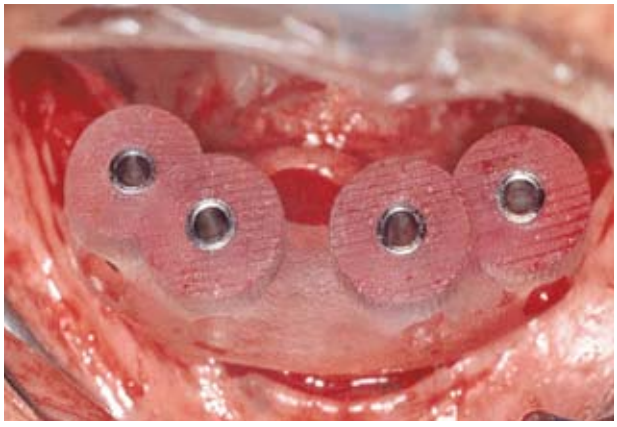


Fig 5-12 Surgical template constructed from the treatment planning data fits precisely onto the bony ridge to enable implants to be placed accurately as planned. (Same patient as in Fig 5-10.)

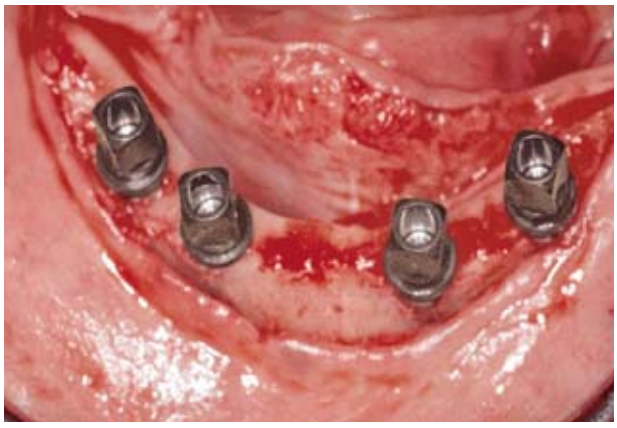


Fig 5-13 Implants after placement, using CT data-based surgical template. (Same patient as in Fig 5-10.)

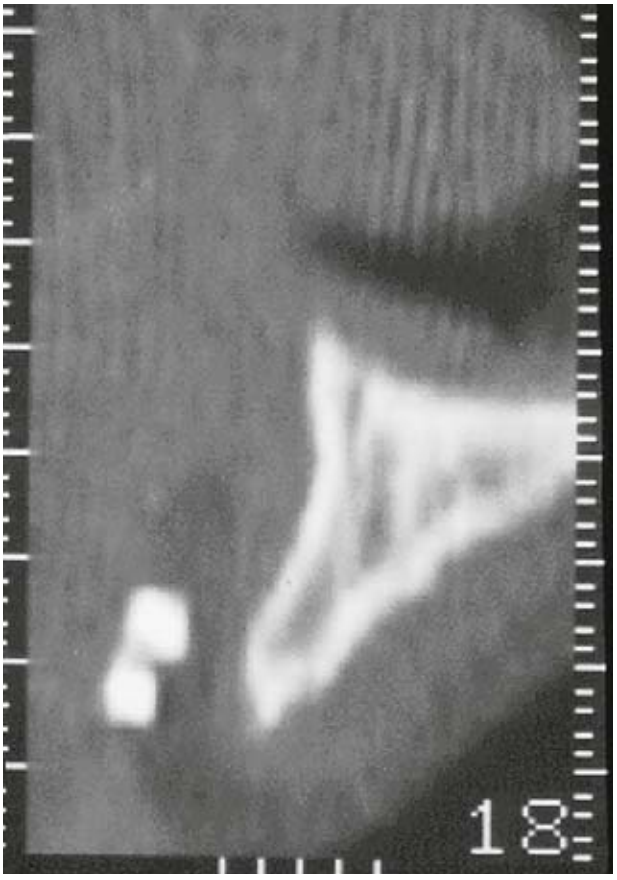


Fig 5-14 CT scan with radiopaque markers in denture flange indicating tooth position. The two markers denote the lateral incisor position adjacent to a narrow ridge.

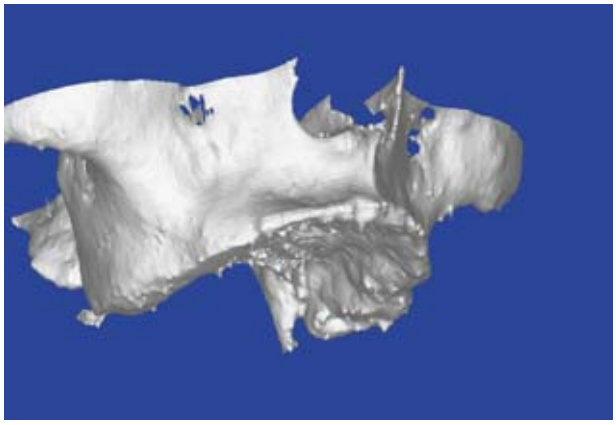


Fig 5-15 Preoperative 3D reconstruction of maxilla. The severe resorption of the anterior maxilla is evident.

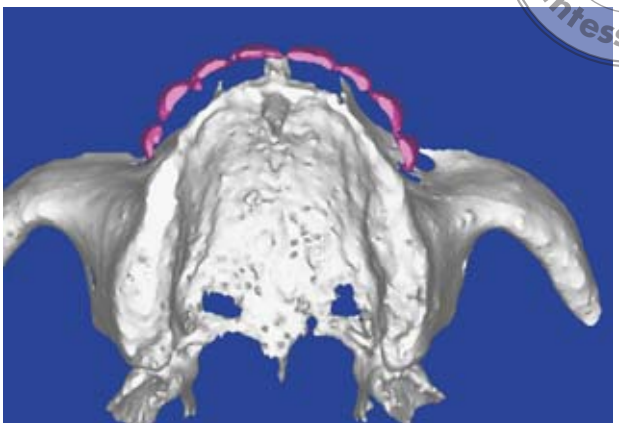


Fig 5-16 Occlusal view of the 3D reconstruction in Fig 5-15 with the radiopaque markers defining the labial surfaces of the planned teeth. The bucco-lingual discrepancy is evident, clearly demonstrating the labial resorption.

Fig 5-17 Resin model constructed from CT scan data using stereolithography, with a silicone template fabricated to provide the information about the size and shape of the bone graft required for reconstruction to enable implants to be inserted according to the planned tooth position.

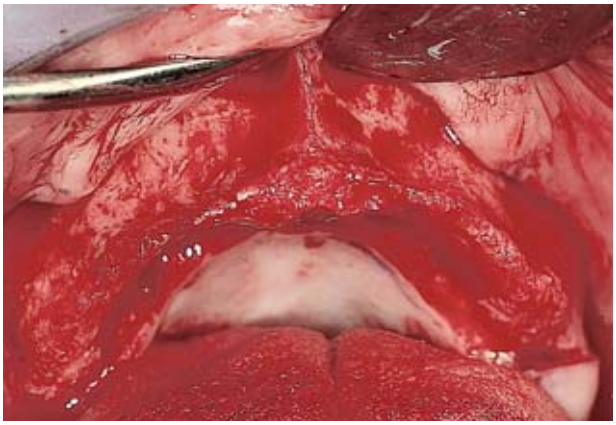


Fig 5-18 Clinical view of the exposed ridge at augmentation surgery which can be related to the preoperative 3D reconstruction (see Fig 5-15).

The use of radiopaque markers enables the clinician to relate the diagnostic tooth position to the available bone (Fig 5-14).[44]

The advent of interactive planning in conjunction with 3D visualisation further refines treatment planning, particularly in being able to relate tooth position to the implant–abutment complex, as well as the available bone, which may need to be augmented. The software is sophisticated enough to be able to distinguish between the bone graft and the original bone as well as any markers of distinct radiopacity (Figs 5-15–5-25).

Software to assess the consequences of treatment and proposed treatment on the soft tissue contours of the face is available and being refined further.

The evolving process of prefabricating prostheses to be fitted onto implants planned interactively will be addressed in greater detail in the appropriate section (Chapter 7).

Fig 7-185 Intraoral view of abutments emerging from contoured soft tissues.

Fig 7-186 Definitive restorations in situ showing excellent aesthetic outcome.

Case 3: Immediate Full Mouth Rehabilitation with Substantial Changes in the Intermaxillary Relationship

This case describes the management of a patient with failing teeth and non-functional occlusion. The patient's medical condition required general anaesthesia for treatment and, consequently, treatment of both jaws was carried out simultaneously to minimise the number of anaesthetics. Extraction of all failing teeth with simultaneous implant placement in conjunction with implants placed into healed sites with immediate loading was planned to provide the patient with functional restorations in both jaws at the same time.

Changes to the occlusion were planned by careful observation of the speech patterns to predict the adaptation to the change in the occlusal scheme. Guided surgery provided an ideal mechanism for producing a predictable outcome with minimum risk of failure of implants or restorations.

Considerable planning is required with close collaboration between dental surgeon, dental technician and the imaging and rapid prototyping company.

This case depicts effective treatment carried out in one session that provided the patient with immediate improvement in the quality of life (Figs 7-187–7-210).

Fig 7-187 Preoperative view of patient.

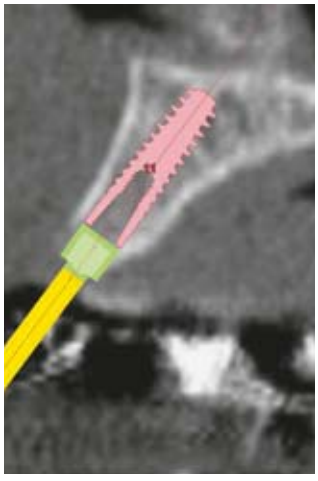
Fig 7-188 Preoperative panoral radiograph showing the oral status.

Fig 7-189 Labial view showing non functional occlusion with mandibular remaining teeth biting directly into the palatal soft tissues.

Fig 7-190 Lateral view depicting the occlusal relationship.

Fig 7-191 Study casts mounted on a semi-adjustable articulator for assessment and planning of transitional restoration.

Fig 7-192 Interactive planning ensuring that the position, depth and angulation of the implant will translate effectively to the clinical situation. Artefacts caused by heavy metal restorations can be seen at the level of the clinical crowns (sporadic black and white areas which are indicative of loss of image). Therefore, accurate representation of the tooth form for stereolithographic reconstruction would not be possible and a tooth-supported guide is contraindicated.



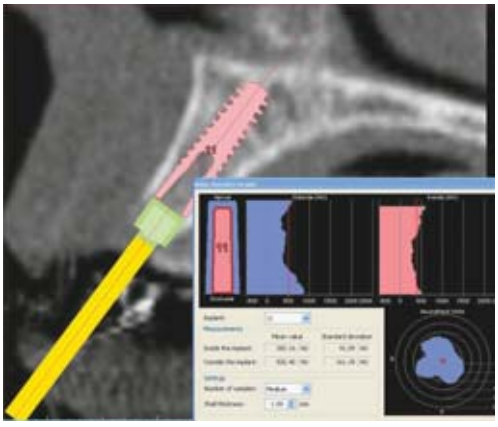


Fig 7-193 Bone density assessment of each proposed implant site to evaluate the clinical procedures required to ensure adequate primary stability.

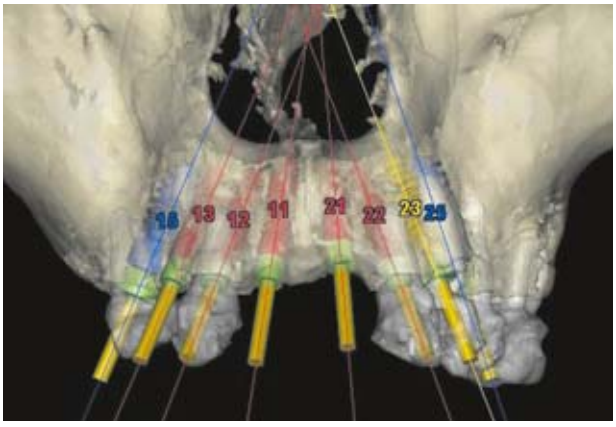


Fig 7-194 Three-dimensional reconstruction of the maxilla with proposed implants in situ, which is critical to ensure translation to the clinical treatment phase to ensure an aesthetic result. All refinements of implant positions are made here.

Fig 8-135 Occlusal view of an edentulous lateral incisor region showing the labial depression following natural postextraction atrophy.

Fig 8-136 Periapical radiograph showing adequate bone height. The radiolucent appearance is indicative of low-density bone in view of the adequate width as measured by ridge mapping.

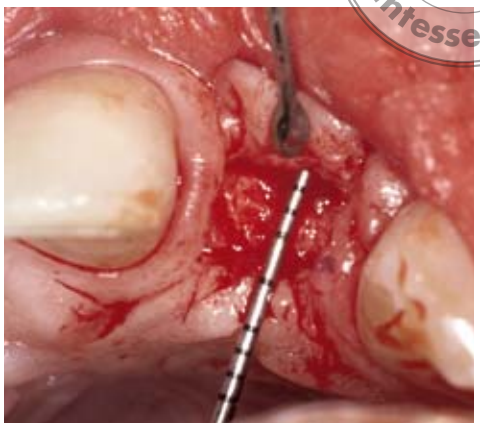


Fig 8-137 Access to the bony ridge is obtained by means of an 'H'-shaped incision and designed towards the palatal aspect of the ridge, with the deflection of the tissues labially to increase the bulk in order to compensate for the atrophy.

Fig 8-138 The osteotomy was prepared using a pilot bur, followed by a round bur to penetrate the crest and a bone condenser to complete the osteotomy to the depth and diameter required.

Fig 8-139 The implant was inserted, the angle of the abutment selected as described above using direction indicators and the definitive abutment inserted and attached to the implant. The abutment is visible with the access hole for the fixation screw sealed with wax and glass-ionomer cement.

Fig 8-140 The accurate adaptation of the transitional restoration is carried out by connecting the hollow acrylic transitional restoration (seen to the right of the abutment) to the acrylic sleeve (seen left of the abutment), which has been constructed to fit accurately onto the abutment. This is done using self-curing resin.

Fig 8-141 The fit surface of the transitional restoration loaded with a thin smear of temporary cement prior to cementation. A prudent amount of temporary cement prevents any excess and, therefore, any adverse soft or hard tissue response.

Fig 8-142 The transitional restoration fitted on the abutment. The deflected tissues are visible and have been sutured using a fine (6-0 Vicryl; Ethicon, Somerville, NJ, USA) suture.

Fig 8-143 Post-operative radiograph showing the implant and abutment relationship.

Fig 8-144 Healing of the soft tissues at one week.

Fig 8-145 Definitive restoration in situ, constructed three months after implant insertion.

Fig 8-146 Postrestorative radiograph showing the level of bone in relationship to the implant.

Fig 8-147 Labial view of the definitive restoration seven years after the procedure. Stable gingival contours are evident.

Fig 8-148 Periapical radiograph taken seven years after the procedure showing stable bone levels compared with the postrestorative radiograph.

Fig 17-31 The definitive restoration emerging from the naturally contoured attached keratinised tissue.

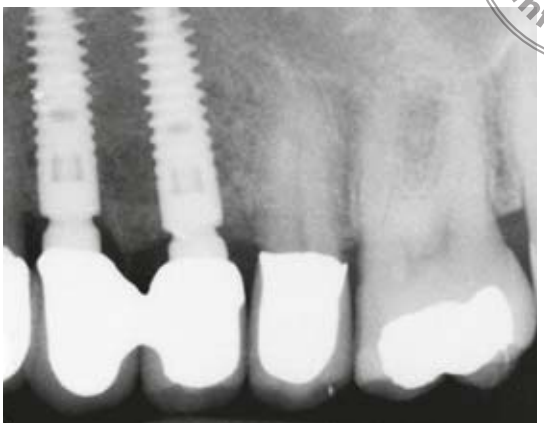


Fig 17-32 Post-operative radiograph of the implants, showing the stable bone levels that will be responsible for providing soft tissue support.

Case 3: Lateral Pedicle Flap

This case study demonstrates the use of a rotational pedicle flap to close an oro-antral fistula created by the loss of a hydroxyapatite-coated implant 10 years after insertion through uncontrollable peri-implantitis (Figs 17-33–17-43).

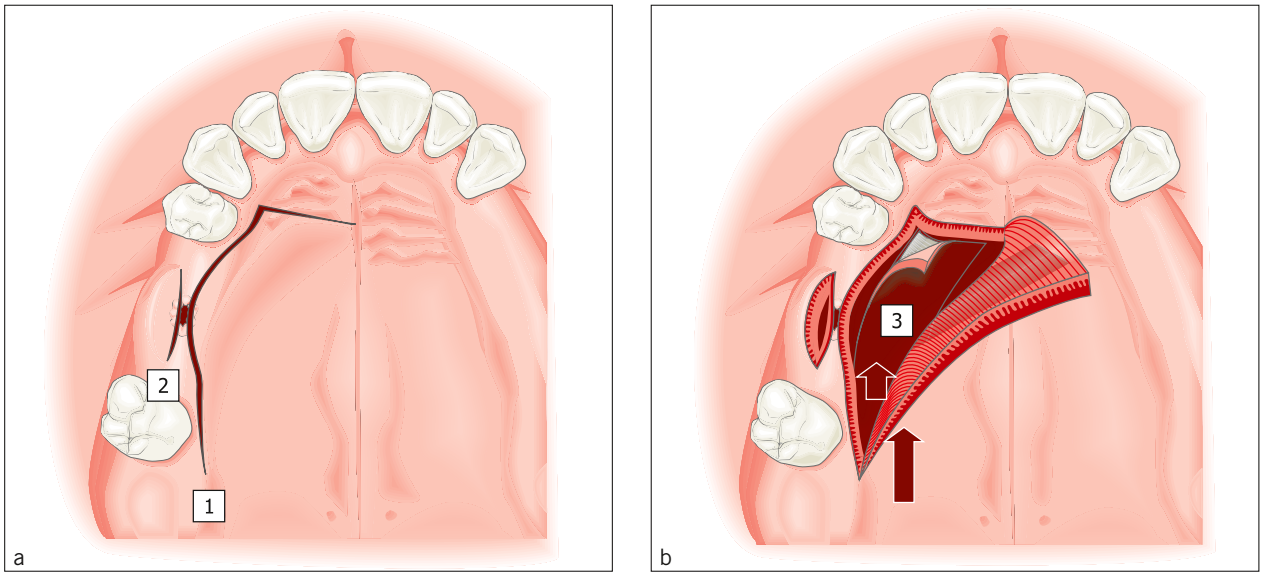


Fig 17-33 The four stages for creation of a lateral or rotational pedicle flap to repair a fistula in the maxillary molar region.
(a) Stage 1. A split-thickness incision is made in the palate and an epithelial flap is elevated to expose the underlying subepithelial mucosal and periosteal layer. Stage 2. A split-thickness incision is made on the labial aspect of the fistula creating a pocket into which the subepithelial flap will be secured.
(b) Stage 3. A full-thickness incision is made down to the periosteum to create a subepithelial connective tissue flap. Consideration must be given to the blood supply to the pedicle, which is indicated in this illustration by means of an arrow.

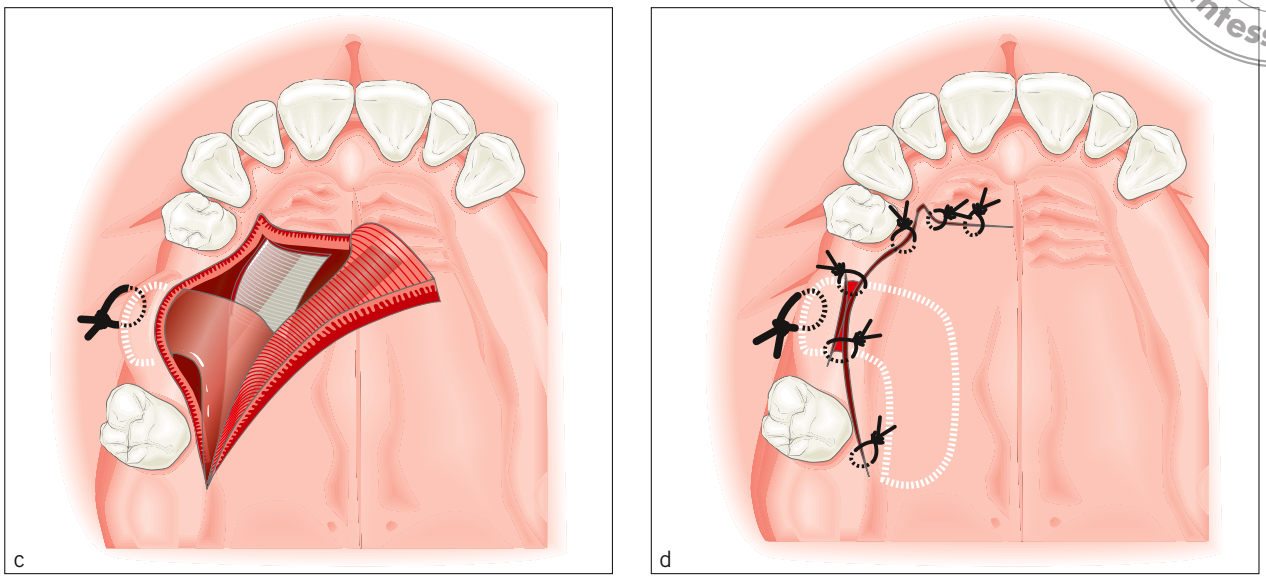


Fig 17-33 The four stages for creation of a lateral or rotational pedicle flap to repair a fistula in the maxillary molar region.
(c) Stage 4. The pedicle flap can be seen mobilised and inserted into the pocket on the labial aspect of the fistula by means of a suture. The vascularised and viable pedicle thus closes the fistula.
(d) The epithelial flap is then sutured (using 6-0 Vicryl sutures). Closure of the epithelium over the fistula provides two-layer closure.

Fig 17-34 Occlusal view of the oro-antral fistula in the first molar region.

Fig 17-35 Occlusal view of the outline of the palatal partial-thickness flap, which is designed to include the marginal tissue of the fistula. The labial subepithelial pocket is also commenced at the margin of the fistula (see Fig 17-33).

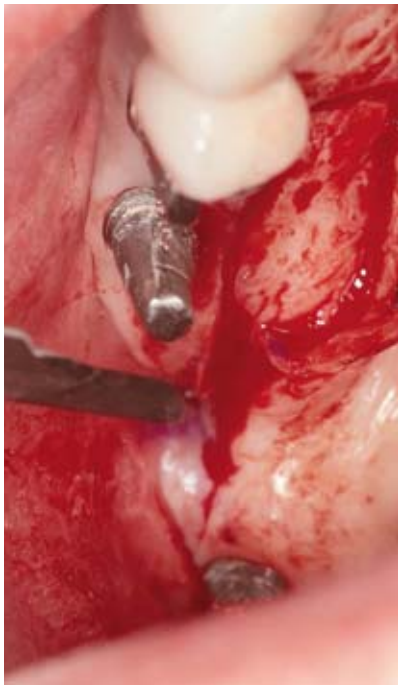


Fig 17-36 The split-thickness epithelial flap can be seen reflected. This exposes the underlying connective tissue (see Fig 17-33).

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