Practical Implant Dentistry
The Science and Art

Second edition

By
Ashok Sethi
BDS, DGDP (UK), MGDSRCS (Eng), DUI (Lille), FFGDP (UK)

Thomas Kaus
Dr Med Dent (FRG), Dip Impl Dent (RCS Eng)

Forewords by Prof Dr H Weber and Raj K Raja Rayan OBE

QUINTESENCE PUBLISHING

London, Berlin, Chicago, Tokyo, Barcelona, Beijing, Istanbul, Milan,
Moscow, New Delhi, Paris, Prague, São Paulo, Seoul, Singapore and Warsaw
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.

British Library Cataloguing in Publication Data
Sethi, Ashok.
Practical implant dentistry. -- 2nd ed.
1. Dental implants.
   I. Title II. Kaus, Thomas.

617.6’93-dc23

QUINTESSENCE PUBLISHING
Quintessence Publishing Co. Ltd,
Grafton Road, New Malden, Surrey KT3 3AB,
United Kingdom
www.quintpub.co.uk
Copyright © 2012 Quintessence Publishing Co. Ltd

All rights reserved. This book or any part thereof may
not be reproduced, stored in a retrieval system, or
transmitted in any form or by any means, electronic,
mechanical, photocopying, or otherwise, without prior
written permission of the publisher.
Layout and Production: Quintessenz Verlags-GmbH,
Berlin, Germany
Printed and bound in Germany

IV
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.
Holland\textsuperscript{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.

I Introduction and Assessment

**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.
Additional Diagnostic Procedures

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).
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).
Immediate Placement and Computer-guided Surgery

**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.
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 17-31 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.

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).
Index

A
abutment connection 85
abutments
attachment 66–73, 162–164
direct impressions of 173–178
fabrication 186–187
indexed 57
modification 186–187
position transfer 178–182, 196–199
selection 66–73, 186–187
aesthetically critical zone, immediate placement 75–76
aesthetics, and augmentation 207
allogenic grafts 210, 211
alloplastic materials 211
amalgam tattoo, elimination 378–380
anaesthesia 17–18
anatomical variations 31–42
anterior mandible 37–38
anterior maxilla 32–34
reconstruction following trauma 274–280
anti-rotation 158, 164
atrophy 31
classification of degree of 262–264
augmentation categories 208–211
clinical cases 280–285, 287–294, 295–300
decision-making process 218
indications 207–208
see also bone expansion; grafting of tissues; manipulation of tissues; posterior mandible; posterior maxilla
autogenous grafts 209–210
see also block bone grafts; extensive bone grafts; localised onlay bone grafts
B
biomaterials 75–76
biomechanics, and augmentation 207
block bone grafts 210, 218
see also localised onlay bone grafts
bone condensers 228, 233, 310
bone deficiencies
assessment of localised 239–240
causes 206–207
measurement 246
bone expanders 225–227, 232
bone expansion 219–237
clinical cases 230–237
labial plate re-contouring 230–231
multiple implants 236–237
single implant 231–235
healing phase 230
implant insertion 228
impressions at first-stage surgery 229
restorative phase 230
surgical protocol 223–229
bone manipulation 77, 124
bone quality 31–32
manipulation 84–85
bone spreaders 307–308
bridgework 110
'C'-shaped incision 162
CAD/CAM technology, in restoration design 196–199
Caldwell–Luc procedure 302, 306
closed tray technique 182, 186, 187
composite grafts 358
computed tomography (CT) 10, 20–22, 23, 52–53, 222, 303–304, 334–337
computer-guided surgery 85–87
clinical cases using 87–102
complex restorative case 95–98
full arch immediate placement and loading 87–95
immediate full mouth rehabilitation 98–102
restorative phase 87
cone beam CT 22–23, 334
congenital deficiencies 206
connective tissue grafts 357–358
clinical cases 373–380
containment 248, 250, 329
continuous full-thickness incision 159–162
conventional tomography 20
corrective soft tissue surgery 353–380
see also composite grafts; frenectomy; pedicle flaps; subepithelial connective tissue grafts; vestibuloplasty
crestal ridge
height 221–222
morphology 222
width 222
see also ridge mapping
abutment selection and attachment 66–73
restorative phase 73–75
transitional restoration 73
considerations specific to 118
incision for 118–119
primary stability principles 84–85
immediate placement
assessment checklist 54
clinical assessment 50–52
clinical variations 75–85
aesthetically critical zone 75–76
multiple adjacent implants 83–84
posterior mandible 78–82
posterior maxilla 76–77
radiographic assessment 52–53
treatment sequence 53–64
extraction 54–58
implant insertion 60–64
implant placement 58
impressions at first-stage surgery 64
osteotomy preparation 58–60
preoperative stage 54
see also computer-guided surgery; delayed loading; immediate loading
implant design 85
implant exposure 153–165
abutment attachment 162–164
chairside fabrication 165
continuous full-thickness incision 159–162
localised bone grafts 252
minimal exposure incision 154–159
preoperative planning 154
transitional restoration 165
implant failure 331
implant position transfer 182, 184
infection 331
as bone loss cause 206
infectivity, of grafts 211
inferior alveolar nerve 333
repositioning
with onlay bone graft 348–351
with simultaneous implant placement 342–348
informed consent 8, 306
interdental papillae, creating 359
intermaxillary relationship, recording 177
intraoral examination 10–12
J
jaw registration blocks 177
L
labial soft tissue bulk, creating 359
lateral cephalography 20, 21
lateral fixation screws 168, 176, 192–195
lip line 13
load, and augmentation 207–208
localised onlay bone grafts 239–259
bone deficiency assessment 239–240
bone healing assessment 249–250
clinical cases 253–259
bone graft from ramus 254, 255–256
bone graft from symphysis 253–254, 256–259
corrective soft tissue surgery 252
donor site assessment 241
implant exposure 252
implant insertion 250
posterior mandible 339–342, 348–351
restorative phase 252–253
surgical protocol 242–249
donor site access 246
graft fitting 247–248
graft harvesting 246–247
recipient site access 242–246
wound closure 248–249
treatment sequence 242
M
magnetic resonance imaging (MRI) 27
manipulation of tissues 208–209
medical evaluation 15–16
mucoceles 305
multiple units 176–177, 182, 186, 192–195
N
neoplasm 206
non-vascularised grafts 66
O
occlusal load 84
occlusive membranes 66, 250
onlay bone grafts see extensive bone grafts; localised onlay bone grafts
open tray technique 182, 185–186
oro-antral fistulas 331, 358–359
orthopantomography (OPG) see dental panoramic tomograph
osteotomy probe 228
P
patient assessment 9–13
patient expectations 7–8
patient management 17–18
pedicle flaps 160–161, 358–360
inverted 360
clinical case 369–373
lateral 359–360
clinical case 366–369
periapical bone loss 206
periapical radiography 20, 52, 108, 222, 249, 334
peri-implant bone loss 207
periodontal bone loss 206–207
piezosurgery 346
pilot bone condenser 227–228
pilot osteotomy bur 228
polyps 305
position marker 58, 122, 224–225
posterior mandible 38–42, 333–352
assessment 334–337
clinical assessment 337
immediate placement 78–82
insufficient bone, treatment options 339–342
nerve repositioning with onlay bone graft 348–351
nerve repositioning with simultaneous implant placement 342–348
surgical protocol, adequate bone 337–339
posterior maxilla 34–37, 301–332
anatomy 302
assessment of available bone and maxillary sinus 303–304
assessment of load 306
assessment of pathology 304–306
bone quality 34, 301
clinical cases 323–327
subantral augmentation with intraoral block graft 323–324
subantral augmentation with onlay bone graft 324–327
clinical protocols 306–318
increasing available bone 310–318
manipulating bone of low density 307–310
using available bone 306–307
complications 327–331
features characterising 301
immediate placement 76–77
planning of treatment 306
sequence for implant insertion and sinus lift 318–323
prefabricated angled ceramic abutments 73
prefabricated angled titanium abutments 67–72
prosthetic protocols 167–199
abutment position transfer 178–182, 196–199
abutment selection, modification or fabrication 186–187
clinical cases 187–199
direct impressions of abutment 173–178
implant position transfer 182–186, 196
impressions at first-stage surgery 64, 127–128, 169–173, 187
restoration finishing 187

R
ramus
access to 246
assessment 241
graft harvesting 247
wound closure 249
rapid prototyping 23–27
record keeping 8
remote palatal incision 224
restorative phase
bone expansion 230
computer-guided surgery 87
delayed placement 131
immediate loading 73–75
localised bone grafts 252–253
procedures and sequences 174
prostheses see prosthetic protocols
rib, as donor site 262
ridge mapping 27–29, 222
risk classification 9
Rochette bridge 110–116, 274

S
'S'-shaped incision 160–162
scalpel, scoring with 224
sedation 17–18
sensory tests 348
sinus floor manipulation 310–312
sinus lift
lateral approach 312–318
one-stage approach 322–323
two-stage approach 318–322
see also posterior maxilla
skull, as donor site 261
socket integrity 52
soft tissue, preserving architecture 64
soft-tissue health 52
specialist referral 16–17
spring cantilever bridges 112, 113, 115
study casts 29, 334, 337
subepithelial connective tissue grafts 357–358
clinical cases 373–380
sulcus formers 64, 128–131, 182, 338
support, and augmentation 208
symphysis
access to 246
assessment 241
graft harvesting 246–247
wound closure 249
synthetic materials 211

T
tele-medicine 8
three-dimensional interactive software 23–27
tibia, as donor site 261
tooth wear 12–13
transfer caps, multiple-purpose 182
transgingival healing 118–119, 130–131, 144
transmucosal approach 338
trauma 206

V
vascularised pedicled flaps 64–66
vestibuloplasty 353–356
clinical cases 360–363, 363–366

W

X
xenogeneic grafts 210–211