Clinical Dental Medicine 2020

Edited by

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Preface

This book was commissioned as one of the initiatives to mark 60 years of publishing by Quintessence. It provides authoritative commentaries by international opinion leaders on the state of the art and science of dentistry, and looks forward, scoping anticipated developments in the major areas of clinical practice. The essence of many of these developments is captured in the title of the book – ***Clinical Dental Medicine 2020***; dentists and other members of the dental team of the future are anticipated to be as much oral physicians as dental surgeons.

Not all aspects of the present or anticipated future clinical practice of dentistry can be covered in this book. The areas collectively considered constitute the majority of the clinical practice of dentistry, both currently and, it is predicted, for the foreseeable future, specifically through to 2020. While developments in other aspects of dentistry will be as exciting and important as those discussed in this book, ***Clinical Dental Medicine 2020*** sets the scene for the major elements of the clinical practice of dentistry over the second decade of the 21st century.

Predicting the future is not an exact science. Unforeseen events and ground-breaking scientific discoveries, and the way society responds to an ever-changing world will, as in the past, fashion the future as much as, if not more than, predictable developments and trends. But envisioning the future, based on what is known and can be expected, is important: better to have a vision to revise and refine than to be blind to what probably lies ahead. To think only of today and the past is two- rather than three-dimensional thinking.

By looking to the future, it is hoped that this book will inspire the next generation of practitioners, students, teachers, researchers, opinion leaders and authors in dentistry. In this way, it is hoped that ***Clinical Dental Medicine 2020*** will be an inspirational insight into what should transpire in dentistry between now and 2020. If you think the last ten years has been a time of unprecedented change and development, prepare yourself for the impact of an increasing number and range of even greater life-changing innovations in the next ten years. Whatever happens, dentistry in 2020 will be very different from what it is today.

Working with the illustrious teams of contributors to this book has been a pleasure and an honour. I have learnt a great deal from the authoritative insights and predictions of the renowned authors. Indeed, editing this book has given me a new perspective of the priorities and enormous opportunities to be grasped in the further development of dentistry and oral healthcare provision. ***Clinical Dental Medicine 2020*** looks beyond the present horizons at the next 10 years of new, practice-changing frontiers in dentistry.

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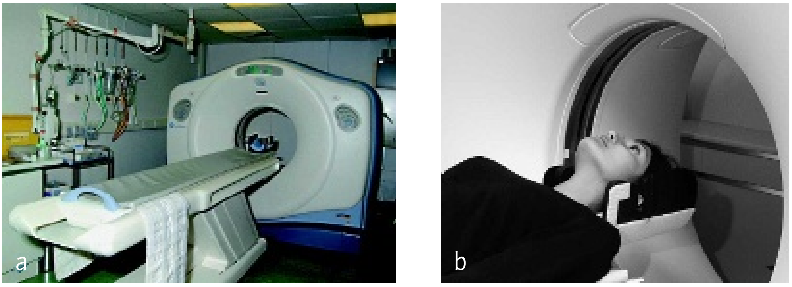

Fig. 3-21 (a) A computerized tomographic scanner. (b) The patient is positioned here for a maxillary scan. (From Horner et al. [2007][15] with permission.)

intensifying screens. Indeed, compared with the recommended film/screen speed rating for panoramic radiography, digital imaging may mean higher exposure factors must be used. It is, however, sometimes possible to reduce the radiation exposure factors with digital panoramic radiography at the expense of some increase in image noise.[22]

Further details on the technology underlying digital imaging are given by Horner and co-workers.[15]

Cross-sectional and volumetric imaging

For 100 years and more, dental imaging has been two dimensional, with subject depth reduced to subtle or imperceptible variations in image density. Thus, the 'skiagraph' (shadow picture) produced by the radiographic pioneers has remained the same. The ideal image, however, is one that accurately represents the true three-dimensional nature of the subject. In medical radiology, this ideal was finally achieved by the development of CT in the early 1970s. The basic principle of CT is that thin, cross-sectional images, usually in or close to the axial plane of the body, can be produced by complex mathematical analysis of X-rays transmitted through the body from multiple directions. In the original CT scanner, this was a lengthy process of taking 160 parallel readings over a 180 degree rotation at 1 degree intervals, followed by several hours of computer time in analyzing the data. In the subsequent 30 years, CT scanning has passed through four 'generations' of development, leading to the current 'state-of-the-art' spiral scanners, in which a continuous spiral rotation of the X-ray source and detectors is possible, synchronized with a uniform movement of the patient through the scanner aperture. Using such systems, scan times are extremely short, leading to fewer motion artefacts.

Although CT (Fig. 3-21) has been used by researchers for a variety of dental applications, principally in oral surgery, the main use of CT in everyday dentistry is in implant imaging.[23] When a dental implant is planned, dental clinicians must consider both the quality and quantity of bone at the proposed implant site. Most conventional dental images (periapical and panoramic radiographs) provide excellent information only in the plane of the dental arch, with no indication of buccolingual bone characteristics. Ingenious use of lateral cephalometric and occlusal radiographs can provide some of this missing information, but still in two-dimensions. CT scans of the jaws can be reconstructed from their native axial format into cross-sections that are perpendicular to the line of the dental arches (Fig. 3-22). An additional advantage of these images is that they can be displayed in 'life-size' form, whereas conventional radiographs are always magnified. Measurement of alveolar height, width and external contour are straightforward. As far as bone quality is concerned, it is also simple for the dental clinician to examine the images for the internal trabecular bone architecture at the implant site and the cortical bone thickness. In addition, anatomical relationships with important structures, such as the inferior dental canal, the maxillary sinus and the submandibular fossa, can be understood. CT is not, however, without

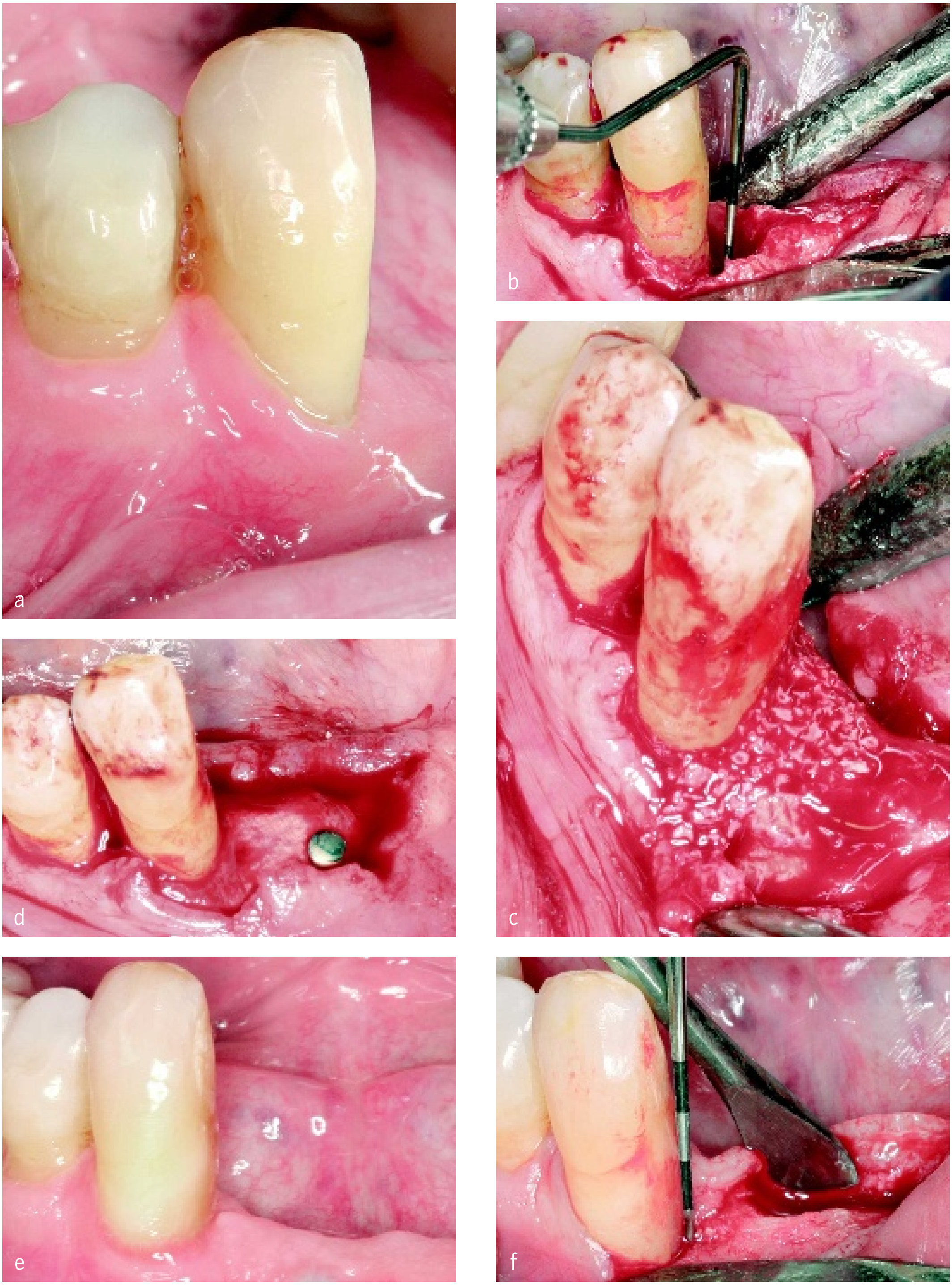
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Fig. 6-8 (a to g) The combination of barrier membranes and grafting materials has been used in the treatment of periodontal osseous defects to overcome problems related to the collapse of the barrier membrane, specifically in defects with a complicated, non-contained morphology. **(h)** At a one year re-examination, complete regeneration of the defect is seen.

specific biomaterials as bone replacement grafts have indicated that both bone grafts and bone substitutes are significantly more effective than open flap debridement in improving attachment levels and reducing probing depths. Differences in clinical attachment level gains, however, vary considerably according to the biomaterials used. It is, therefore, difficult to draw conclusions on the use of specific graft biomaterials.[36]

The combination of barrier membranes and grafting materials has been used to overcome problems related to the collapse of the barrier membrane. Specifically, the treatment of intra-osseus defects with complicated, non-contained morphology using a combination of barrier membranes and grafting materials results in superior clinical outcomes compared with treatment with barrier membranes alone (Fig. 6-8).[35,37]

The biologic rationale for using grafting materials is based on the assumption that such materials may facilitate formation of alveolar bone, periodontal ligament and root cementum by serving as a scaffold and, when combined with barrier membranes, provide space under the membrane for the accumulation and retention of bone forming osteogenic cells.[36]

The third most used regenerative material is EMD, which has been available since 1997. Clinically, EMD is used for periodontal regeneration in teeth affected by periodontitis, root coverage procedures and replantation. The material used consists of the EMD, water and a carrier (propylene glycol alginate). EMDs are naturally derived proteins from porcine tooth buds that have the capacity to attract and stimulate differentiation of connective tissue cells into cementoblasts, thereby stimulating the formation of new cementum, connective tissue attachment and bone. The biologic rationale for using EMDs is to replicate the embryologic events that occur during the formation of the root in tooth development: biomimetic regeneration. EMDs have a wide variety of biologic activities, stimulating different cell types, both directly and indirectly, by increasing cell attachment of gingival and periodontal ligament fibroblasts; favoring cell proliferation of periodontal ligament fibroblasts; downregulating expression of genes involved in early inflammatory events of wound healing; and