General technical developments, especially in the area of computers, have led to new and fascinating tools becoming available for medicine and dentistry.

Contemporary methods within radiology, such as computerized tomography and medical imaging, have made patient information available for diagnosis in a totally new way. Furthermore, ongoing development has made these technologies less costly and therefore more readily available for doctors and patients.

Guided surgery is an example of a technology that has developed in this way. The utilization of new powerful technologies has to be conducted in close consultation with experienced clinicians. The technology is just a tool, no matter how powerful.

This book describes and documents how to use NobelGuide™ in various clinical situations. It is based on long-term clinical ambitions, thorough knowledge of the development of this technology, and the ambition to strive for what is the best for the patient.

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Professor Per Ingvar Brånemark first introduced the concept and principles of osseointegration to North America during the Toronto Conference in 1982 after years of research and clinical trials. The protocol presented at that time recommended a non-loaded healing period of between 3 and 6 months for dental implants. These recommendations were made from experience using a machine-smoothed-surface titanium implant. Publications by other investigators reported very high implant success rates in completely edentulous jaws, as well as predictable prosthetic reconstruction when the delayed loading protocol as advocated by Prof. Brånemark was followed. These articles were followed by publications indicating similar success rates with partially dentate cases.

The demands and expectations of patients to complete dental implant treatment sooner and faster have forced clinicians to find new clinical solutions. Fortunately, improvements in technology and understanding have provided the means for clinicians to meet these demands. Thus, with improvements in implant surfaces, thread patterns and implant body designs, loading concepts have evolved into the early loading of implants. Early loading is the application of load on implants sooner than the 3- to 6-month healing period, and immediate loading is the application of load within 48 hours. Early and immediate loading of dental implants requires clinicians to change their procedural protocols and patient management. To optimize treatment for their patients, clinicians must take advantage of all available improved technologies and clinical techniques, including CAD/CAM-generated surgical templates and prosthetic restorations, computer software programs that permit accurate diagnosis and treatment planning, and the use of minimally invasive surgical and prosthodontic techniques.

This textbook introduces the concept of NobelGuide, a complete and practical approach to managing the implant patient who expects immediate loading and function. The authors take the reader through the diagnostic process, with a detailed description of the necessary workup and generation of the radiographic guide for a CAT scan. This allows the clinician to complete the workup using a specialized computer software program that shows the available hard and soft tissues, vital anatomic structures and ideal locations for tooth/implant positions based on the prosthetic design. From this planning stage, a surgical template is generated for implant placement, allowing minimally invasive surgical techniques while assuring accuracy of implant placement without the reflection of a soft tissue flap. With knowledge of implant positions prior to the surgical placement, the prosthodontic specialist can fabricate the desired prosthesis before the actual surgery, thus providing the patient with a functioning prosthesis immediately after the implants are placed.

These new concepts and protocols are presented in a manner that allows clinicians to provide their patients with practical and predictable immediate function.
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Fig 2-12  A mapping guide fabricated on the master model showing seven sites of measurement: three on buccal area, three on palatal and one mid-crestal site.

Fig 2-13 (a)  Use of a sharp probe placed through the mapping guide to determine the thickness of gingival tissue in one of the three sites on the buccal area. (b) Three mapping sites on the palate for two implants.

Fig 2-14 (a–c)  Seven measurement points per implant site are transferred and marked on master model.

points are connected and the exact thickness of the gingival tissue is removed from the stone model (Fig 2-14). Once the stone is reduced, the indexed segment is replaced back on the base and a gingival tissue mask is poured onto the trimmed model to duplicate the exact condition of the patient’s edentulous ridge (Fig 2-15).

**Computer-based planning**

Computer-based planning requires an accurate radiographic guide, duplicating the dimensions of the definitive prosthesis as closely as possible. This diagnostic approach employs a dual computerized-tomography (CT) technique where the
scanned images are taken at half-a-millimetre cuts to create a highly accurate, computerized model of the patient’s oral anatomy. The first scan is taken with the patient wearing the radiographic guide with an occlusal index to place the guide in the ideal vertical dimension of occlusion during scanning (Fig 2-16). It is important to establish and maintain the proper vertical dimension of occlusion because the surgical template, which is essentially a duplication of the radiographic guide, generated from the software planning will be seated intraoperatively to this vertical dimension. A proprietary software program, Procera, converts the CT data by superimposing the two scans, aligning the radiopaque markers so that the prosthesis will be visible over the available osseous anatomy (Fig 2-17). This permits the clinician to plan the appropriate implant position and angulation in the available bone (Fig 2-18).
computer-based planning is failure to inspect the completed plan from a 3D perspective using features of the software program. This special feature permits inspection of the implant positions, as well as positions of all surgical components. Performing this inspection in 3D is an absolute requirement. Using two dimensions on the scans during implant positioning does not permit evaluation of proximity of components, especially at the apical regions of the implants. The separation of implants at the coronal aspect is guided by the pontics on the radiographic guide and easily visualized. However, the relative positions of the apical part of the implants are determined by mesial/distal and buccal-palatal/lingual inclinations of the implant. Even though the coronal aspects of the implants may have adequate separation, the apical portion may be contacting owing to converging angulations of adjacent implants (Fig 7-9).

Complications during surgical procedure

Surgical access in the posterior quadrants, especially in the mandible, may be difficult when treating patients with limited opening. Owing to the additional thickness of the surgical template and constant length of the guide sleeves (10 mm), all drills are 10 mm longer. This requires the patient to be able to open 42 mm or more inter-incisally to permit access when surgery is performed in the posterior regions of the mouth (Fig 7-10).

Improper seating of the surgical template will result in the improper positioning of all implants, as well as affecting the occlusion provided by the prosthesis. It is imperative that the surgeon inserts the surgical template in the proper 3D position and vertical dimension of occlusion (Fig 7-11).

Incomplete seating of drills and implant mounts
Fig 7-9  (a) The surgical template indicates adequate separation of the implant positions and cylinders at the occlusal surface. (b) Removing the outline of the surgical template, occlusal aspects of the guide cylinders appear to have adequate spacing between the cylinders. (c) Opposite view of the same workup, showing that apical aspects of the implants are in contact. This highlights the need for reviewing, at planning stage, the entire implant positions in three-dimensions, with the bone and radiographic guides removed.

Fig 7-10  Use of extended drills and other components makes it extremely difficult to prepare molar sites.

Fig 7-11  Insertion of the surgical template must be accurate in three-dimensions, especially in re-establishing the proper vertical dimension of occlusion. Note the surgical index, which aligns the surgical template with the opposing dentition or prosthesis.

on to the guide sleeves will result in underpreparation of the implant site and leads to incomplete vertical seating of the implant (Fig 7-12), leaving the head of the implant super-crestal or outside of the alveolar ridge contours. This will place the prosthesis in the improper vertical plane and in hyperocclusion.

When alveolar ridges in either jaw are significantly resorbed, it will be difficult to retain the surgical template and maintain an accurate position during the surgical procedure (Figs 7-13 and 7-14). There are also vital structures on the lingual aspect of the mandibular ridge, as well as the floor of the nose and maxillary sinuses that may be at greater risk for injury (Fig 7-14).

Flapless procedures do not permit visualization of the surgical sites, thus making it difficult to correct