Implant dentistry in the United States is growing exponentially for several reasons. The convergence of large numbers of mature patients with a high degree of dental awareness and sufficient disposable income has contributed to high levels of growth in implant dentistry.

In 2014, it was estimated that U.S. general dentists surgically placed about 25 percent of the 2.5 million dental implants. This number is poised to swell much higher with the availability of quality dental education in implant dentistry, a marketplace that presents many affordable choices for implant systems and instrumentation and digital technologies that streamline the entire implant process — from diagnosis to treatment planning, surgical implant placement and prosthesis completion.

The term “digital dentistry” refers to the use of computer-acquired and computer-driven information. Furthermore, it describes electronic technology used in dental care that generates, stores and processes data in strings or bytes of information that a computer, tablet or even a cellular device can assemble, store, access and convert to physical processes that facilitate patient care. In implant dental care, digital dentistry refers to technologies that assist in the process of dental implant placement and restoration.

The most commonly understood and used forms of digital dentistry are intra-oral camera images and sensor-based radiographic images. These technologies are used by a high percentage of dentists. More advanced digital technologies are 3-D cone-beam CBCT images, CAD/CAM (computer-aided design) and milling processes for restorations. Imaging software such as Planmeca Romexis® allows for processing, manipulating, storing and sharing digital imagery and information.

Digital dentistry elevates the standard of care through:
- Superior diagnostic ability
- Improved patient comfort and convenience
- Enhanced patient compliance
- Time savings
- Cost savings
- Consistent quality and esthetics of restorations
- Inherent educational benefits for patients
- Elevation of the practice’s perceived value
- Complete control over the entire process

Digital dentistry is not the future. Digital dentistry is today’s reality for the benefit of the patients treated, for the benefit of the dentists who treat them and for the manufacturers and distributors who make these technologies available.

That reality allows for a seamless workflow for the dental practitioner to deliver implant dentistry in a consistent and economic fashion that allows patients a higher degree of comfort and results that are of high quality.
Sensor-based digital X-rays and digital panoramic radiographs are often the first digital diagnostic instruments used for a patient during a routine, emergency or need-based examination. The resulting images give the provider a sense of the area of concern, showing surrounding hard-tissue structures and anatomy and an overview of the areas in question.

When combined with a physical visual examination, much information is revealed. Up until approximately a decade ago, two-dimensional images such as these were the only imagery available to achieve a diagnosis. The diagnostic and treatment workflow could be described as in figure 1.

With the introduction, and now routine use, of cone-beam imaging in dentistry, the workflow has dramatically changed.

In addition to traditional two-dimensional PA, bitewing and panoramic images, three-dimensional cone-beam images can safely and effectively be used to yield exponentially higher amounts of diagnostic information. Planmeca’s ProMax® 3D technology can deliver highly accurate and diagnostic images using proprietary Planmeca Ultra-Low Dose™ Imaging protocols (Fig. 2) with comparable radiation yields to conventional digital PA, BW and panoramic studies.

The impact of Planmeca’s Ultra-Low Dose 3-D imaging is that practitioners can choose to utilize 3-D cone-beam studies without concern for excessive radiation exposure to the patient. The 3-D images allow for visualization of structures in all dimensions, showing height and width of hard tissue structures as well as a clear 1:1 view of all pertinent anatomy. These images can be used for the virtual placement of implants, planning the prosthetic end result with a library of abutments and correlating images derived from CAD/CAM designs to overlay implant prosthesis that are in proper occlusal form.

An example of the superior diagnostic ability of 3-D over 2-D is shown in Fig. 3.

The workflow for the diagnosis and treatment planning of implants today begins with digital 3-D CBCT imaging (Fig. 4).

Once imaged, implants may be placed virtually in the exact position desired, with full awareness of anatomical structures such as the mandibular nerve, the mental foramina, maxillary sinuses and lingual mandibular concavities, to name a few.

With the implant placed virtually, the study can be emailed in a secure and compliant fashion to a laboratory for the production of a surgical guide, if desired. This same 3-D image can be correlated or matched to a CAD/CAM scan of the same area, allowing the dentist to properly plan the restoration while...
taking into account considerations such as occlusal factors and vectors of force.

The CAD/CAM scans are easily acquired with Planmeca FIT technology, which allows for accurate digital models and streamlined planning of restorations. The digital models, acquired as .stl files, are easily imported into Romexis’ cone-beam .dicom files to facilitate planning.

The digital workflow is exemplified in the following case involving a 45-year-old patient who was distraught over losing tooth #12. She presented to my office after an oral surgeon extracted the tooth in an emergency. She requested a temporary replacement that was not removable.

A composite bonded provisional was fabricated, and the provisional stayed in place for three months prior to implant placement.

A cone-beam study is made, and the case is planned virtually (Fig. 5). The intended implant is positioned in the available bone in a desired axis, taking into account occlusal forces, using, in this case, the outline of the provisional tooth as a guide.

The file was emailed to a laboratory to fabricate a tooth-borne surgical guide. In this case, a Nobel Replace-Select 4.3 x 11.5 mm implant was selected, and a guide was made to allow for guided placement of the implant (Fig. 6).

On the date of surgery, the guide was tried-in to assure an accurate, stable and intimate fit. The windows provided by the guide allow for visualization of the proper fit (Fig. 7).

With the guide in place, the tissue is marked, and a tissue punch is used to gain flawless access to the osteotomy site, with full confidence of the intended position (Fig. 8).

Surgery is performed using the guide and associated instrumentation (Fig. 9). The process is simple and straightforward.

The implant is fully seated, with the entire process completed in a relatively atraumatic fashion with
minimal bleeding and no need for sutures (Fig. 10).

A transmucosal healing abutment was used, and the patient was temporized with a composite provisional bonded to the adjacent teeth. After four months, the patient returned for a digital impression. The provisional was removed, and removal of the transmucosal abutment showed excellent tissue healing and contour (Fig. 11).

A stock implant abutment was prepared extraorally and seated to 20 ncm torque. Teflon tape and Firmit™ were used and cured to seal the screw access of the abutment (Fig. 12).

The abutment was then scanned intramurally with the Planmeca Fit™ Scanner to obtain a digital impression of the abutment, the opposing arch and the occlusion. From these scans, an IPS e.max crown was milled in the PlanMill 40, shade A1.

Within 12 minutes time, the mill was completed. The IPS e.max restoration was tried in the mouth on the abutment, contacts and occlusion were adjusted, stain and glaze were nucapped, and the restoration was placed in the Ivoclar Programat™ oven for crystallization and glazing. The entire restorative visit was less than 1.5 hours.

Digital workflow in implant dentistry facilitates care by allowing for a concise and accurate diagnosis in a simple manner. Planmeca Romexis® software allows for implant planning, fully taking into account anatomical constraints and considerations while also allowing for prosthetic planning. The images are easily transmitted to a laboratory for guide fabrication.

With this workflow, patient acceptance is increased. The patient is fully involved in the planning process while watching the initial plan and can more easily understand the three-dimensional images presented to them. Patients also appreciate seeing a virtual representation of the final restoration, which is the reason for an implant in the first place.

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