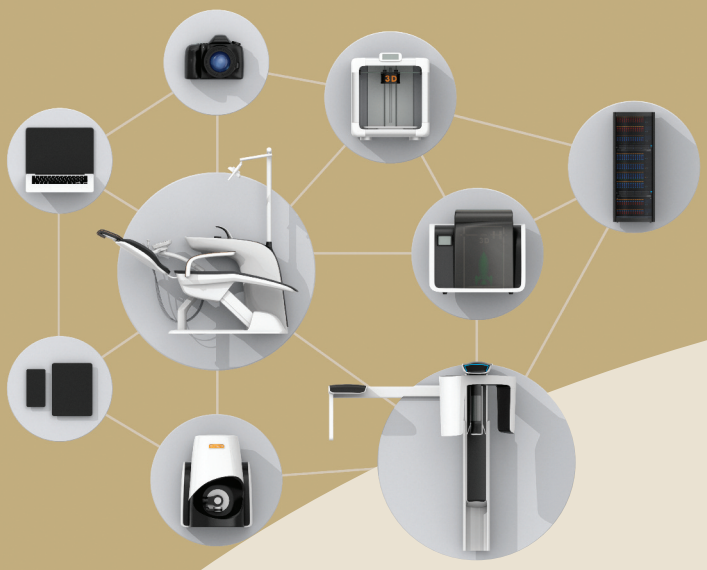

DIGITAL TECHNOLOGY

Leading to new paradigms of dental care

by Tina Cauller

Computer-aided design and manufacturing, or CAD/CAM, has transformed the way many dental restorations are created. Thanks to sophisticated new digital scanning technology, CAD/CAM systems can be used to mill crowns, veneers, inlays and fixed bridges.

With improvements in materials and technology over the past two decades, today's CAD/CAM restorations are more durable and more natural than the first machined restorations. It is now possible to machine advanced materials like high performance ceramics and titanium with high accuracy.

Dentists can now use a 3D intraoral scanner to scan patients' teeth and create a virtual replica with speed and efficiency, instead of taking a traditional impression. The digital information is then sent to a machine to mill the crown from a porcelain block, or to a 3D printer which can print it from resin with tremendous precision. Eliminating the impression procedure is appealing to patients, who almost universally dislike the experience. For the dentist, the digital impression reduces chair time since a scan of both the teeth and occlusion can be completed in about three minutes. Digital impressions are more accurate and less subject to distortion and error, so restorations seat faster and more reliably.

Three-dimensional digital images can also be created by scanning a model obtained from conventional impressions of the preparations. Digital scanning technology replaces the time-consuming process of mailing an impression or stone model to the lab for processing.

Digital implant planning

Digital scans can also be used for fabricating surgical guides for the placement of dental implants. The digital file is sent to the lab where a virtual tooth is added and a guide is fabricated and sent back to the office. This eliminates the additional costs of a model. Digitally scanning an abutment in the patient's mouth reduces the number of steps in the implant process and gives more consistent results. For custom abutments, the dentist can place a scanning body, the digital equivalent of a fixture-level impression coping.

Prosthetically-driven implant placement is made possible by guided surgery techniques. The conventional implant process begins with impressions and models to plan cases. The model is sent to the guided surgery facility along with a CBCT scan, where guides are fabricated for implant placement. The process can be shortened by using an intraoral scanner to scan patients instead of using the analog model technique. The resulting STL file is then merged with the DICOM file of the cone beam scan into the planning software to plan implant cases.

Educating for digital dentistry

Although dentists have had access to scanning technology and even desktop milling machines for years, only 8-10% have on site CAD/CAM systems. There is a steep learning curve and many experienced dentists who own scanning equipment still send anterior or complex posterior cases to external labs. New dental school graduates are typically more comfortable with digital scanning technology, but are unlikely to have the capital to invest in their own on-site systems.

Digital technology is still not a replacement for human talent. Whether restorations are milled in-house or by an external lab, meticulous artisanry by a skilled technician or dentist is still key to delivering the best possible outcomes.

Introducing CAD/CAM technology to the preclinical curriculum

New technologies like digital impressions and CAD/CAM restorations are dramatically changing the delivery of dental services and leading to new paradigms of dental care. Keeping up with these developments necessitates expanding the curriculum in dental schools and TAMBCD is at the leading edge of this change in education and training the dentists of the future. A $500,000 endowment for the James S. Cole Professorship will enable TAMBCD to begin incorporating CAD/CAM technology into its preclinical curriculum.

Digital dentistry is still in its infancy, but its exciting applications in dentistry provide more predictable treatment planning, decreased chairtimes, as well as greater convenience and patient comfort.