

PURELY DIGITAL

Merging digital technologies improves precision, aesthetics, and efficiency in implant dentistry

by Anita Daniels

Dental laboratory owner Jerry Ragle likes to compare the recent breakthroughs in digital dentistry to the creation of the 3-in-1 photocopier. “Before they came out, you had to buy a fax, a scanner, and a printer – three separate machines,” he says. “Now a single piece of equipment does everything.”

Like printers, fax machines, and scanners, digital dental technology has been transforming aspects of the way dentistry is practiced. Computer-numerically controlled (CNC) milling machines are being used for milling crowns and bridges. Computer-aided design and computer-aided manufacturing (CAD/CAM) technologies also have made it possible to fabricate customized implant abutments that can improve aesthetic results by providing better peri-implant soft-tissue support and allow for restorative adjustments relative to implants that have not been optimally placed.

Digital intraoral scanning systems have given restorative dentists an alternative to making time-consuming elastomeric impressions of tooth preparations; such impressions are known to have material challenges. Laboratories can now use the data from such scans to fabricate accurate rapid-prototype models.

Ragle and his laboratory have been deeply involved with such developments. After beginning his dental laboratory career in 1973,



Jerry Ragle, Owner
Ragle Dental Laboratory

Ragle started his own company based in Champaign, Illinois, in 1979. He is certified in ceramics and crown-and-bridge with the National Board for Certification (NBC). Ragle Dental Laboratory began in-house milling of restorations in 2005. It started working with intraoral scanning data in 2006. In 2008 they began using rapid prototype print technology, and in 2009 their CNC model milling operations began. Recently they have purchased their second rapid prototype printer, which will be used exclusively for model printing from a digitized traditional impression.

“For a long time, however, none of those processes really worked together,” Ragle says. “Now for the first time we’re able to integrate several different processes.”

The recent merging of digital intraoral scanning with coded implant healing abutments has made an all-digital work flow possible.

In March, 2011, the U.S. Food and Drug Administration granted 510(K) Approval to market the use of the Lava™ Chairside Oral Scanner C.O.S. (3M™ ESPE™, www.3mespe.com) and iTero™ (Cadent, www.cadentinc.com) systems to be used for capturing digital impressions of coded implant healing abutments. Such abutments, first introduced in 2004 (BellaTek™ Encode® Healing Abutments, BIOMET 3i, Palm Beach Gardens, Florida), eliminate the need for implant impression copings. Instead, various arrangements of facets (codes) on the occlusal surfaces of the abutments identify the implant-platform diameter, the healing abutment height, the hex position of the implant, and the diameter of the healing abutment emergence profile from a supra-gingival elastomeric impression (BellaTek™ Encode® Impression System).

Ragle offered this example of one recent case in which the work flow was entirely digital due to the dental team’s ability to combine intra-oral scanning technology with the coded BellaTek™ Encode® Impression System.

This patient had presented with a cracked left mandibular second bicuspid. After unsuccessful treatment with endodontic therapy and a crown, a decision was made to extract the tooth and place an implant to support a single porcelain-fused-to-metal crown.

The implant was placed in a traditional two-stage procedure. At the time of implant uncovering, the

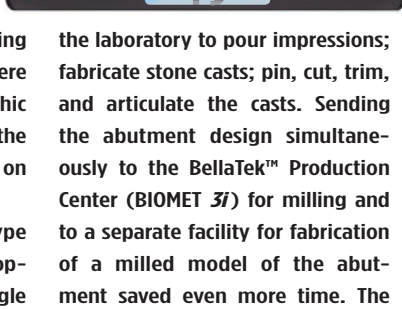
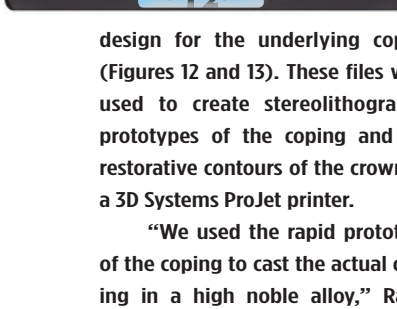
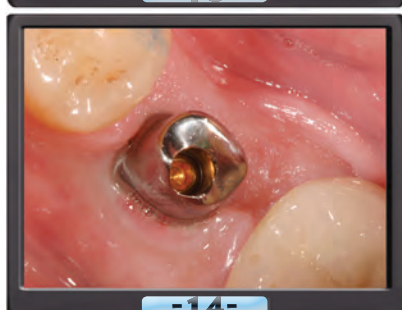
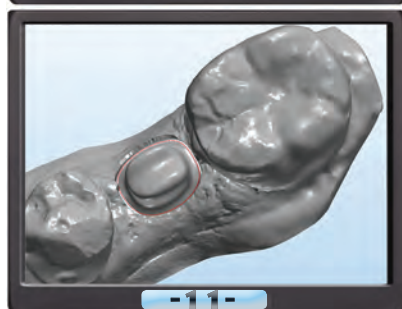
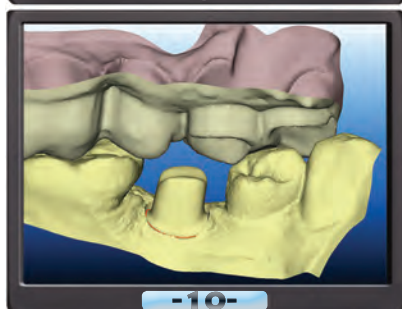
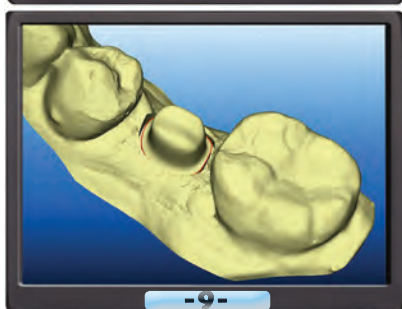
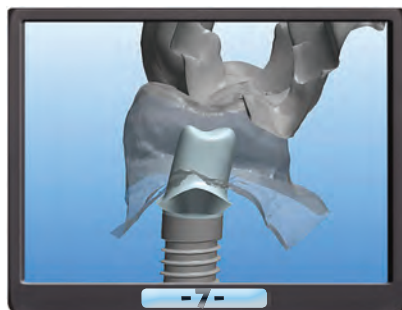
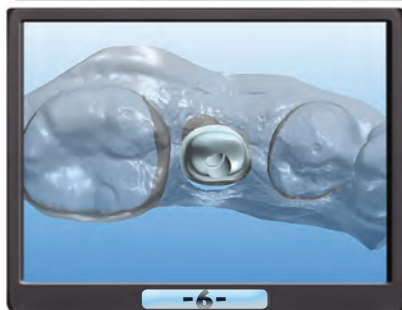
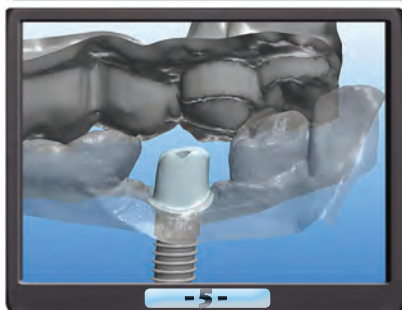
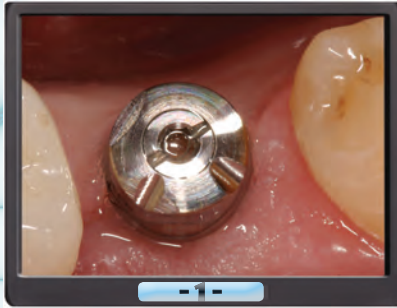
surgeon placed a BellaTek™ Encode® Healing Abutment. After soft-tissue maturation, the patient presented to the restorative clinician’s office to begin the restorative phase of treatment (Figure 1).

A digital impression (scan/photo) was obtained using the Cadent iTero Impression System. The scanning process took less than three minutes. At the same time, information about the restorative material to be used for the definitive BellaTek™ Abutment (in this case, titanium) was entered into the software, along with a shade selection for the crown.

The data file (Figures 2 and 3) was transmitted electronically to the BellaTek™ Production Center (BIOMET 3i). After importing the data into 3Shape Abutment Designer CAD software, a technician designed the BellaTek™ Abutment (Figures 4-11).

This design file was used to drive the production center’s CNC milling machine, which milled the abutment from a blank of titanium alloy. The file also was sent to Ragle’s laboratory, which handles all the milling operations for Cadent in the western half of the United States. “We used the BIOMET 3i design to mill a polyurethane model of the arch segment containing the BellaTek™ Abutment,” Ragle explains.

Lab technicians also imported the same file of the abutment design into their 3Shape Modeling Software. The crown contours were designed digitally; the 3Shape Software automatically supplied the optimal



design for the underlying coping (Figures 12 and 13). These files were used to create stereolithographic prototypes of the coping and the restorative contours of the crown on a 3D Systems ProJet printer.

"We used the rapid prototype of the coping to cast the actual coping in a high noble alloy," Ragle says. This was tried on the milled model to verify fit. The secondary or "top half" was sealed to the coping, sprued, and ceramic was pressed onto the coping. The BellaTek™ Abutment and definitive crown were sent to the restorative dentist's office. The BellaTek™ Healing Abutment was removed and the definitive abutment and restoration were delivered in a single visit (Figures 14-17).

Fully digitizing the work flow in this manner eliminated the need for

the laboratory to pour impressions; fabricate stone casts; pin, cut, trim, and articulate the casts. Sending the abutment design simultaneously to the BellaTek™ Production Center (BIOMET 3i) for milling and to a separate facility for fabrication of a milled model of the abutment saved even more time. The milled model is sent to the laboratory for use in fabricating the definitive restoration at the same time that the definitive abutment or abutments are being milled. Alternatively, with some systems, as seen in this case example with the Cadent i7ero System, CAD/CAM copings and crown fabrication can be done directly from the CAD design of the BellaTek™ Abutment. The abutments are patient-specific. "The real savings is time – but that equates to dollars," Ragle says. "You're able to

produce a restoration that's much more accurate and economical."

He adds, "We've gone from a labor-intensive business to a capital-intensive one." As the changes continue to come along, the challenge for dental laboratory owners will be to keep up with these changes. For now, he says, "With the digital BellaTek™ Encode® Impression System, BIOMET 3i has set the bar very high. Every one of the cases we have done using this process has fit perfectly."

About the Author:

Anita Hingle Daniels, RDH, is Editor of the *Journal of Implant and Reconstructive Dentistry*, the official publication of the Institute of Implant and Reconstructive Dentistry, and educational and training entity of BIOMET 3i.

