

Technological Innovations in the Restorative Department at the University of Tennessee College of Dentistry

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Introduction

Technology is changing the way the dental office interacts with patients, keeping their records and financial information, and even the way patients receive treatment. Digital technologies now have applications in all areas of dental treatment, from orthodontics up to and including complete dentures,¹ but it is most commonly used in restorative dentistry.

The most common digital imaging used in treating dental patients involves some type of CAD/CAM unit. Many new units are coming to the marketplace that can only take the digital image and send it to the laboratory or which can make the final restoration in the dental office and deliver it to the patient in a single appointment. The University of Tennessee College of Dentistry first became involved with this technology in 2001, and the only chairside unit available at that time was the CEREC unit made by Sirona (Sirona Dental Systems, USA LLC, Charlotte, North Carolina) and marketed by Patterson Dental Supply.

There are now over 50,000 units in use around the world with approximately 15% of the dentists in the United States owning a CEREC unit. More than three-fourths of the United States dental schools now have at least one unit with many having five to ten units. Boston University Dental School recently announced that it was going entirely digital in its training of impression making. Several dental assisting programs are beginning to use them for imaging and design training as a number of states are making it a legal function of the trained dental assistant. This means that there are over 500 units in dental education facilities in the United States.²

Many military bases (Army, Navy, and Air Force), VA hospitals, and Public Health dental clinics are also using this technology in order to enhance the quality

ABSTRACT

The UT College of Dentistry has been one of the leaders in the introduction of the CAD/CAM delivery of dentistry to the dental students. The integration of technology into a dental school curriculum requires a change in thinking and a modification of the curriculum in order to introduce it to the present day students. This article updates the integration of the CEREC system into the UT Dental School curriculum, discussing the changes in equipment and teaching techniques since the last article in 2012.

of care for their patients. Because of the special circumstances of the patients of these governmental facilities, it is extremely desirable for them to be able to deliver a restoration in one appointment.

The University of Tennessee College of Dentistry, due to a decision made by one of the former deans, Dr. William Slagle, was one of the first dental schools in the United States to incorporate the CEREC 3D (CAD/CAM) technology into the undergraduate curriculum. In the fall of 2000, the Dental School was given five CEREC 2 units from Sirona. Then in 2001, the Dental School purchased a CEREC 3D unit and started to integrate this technology into the curriculum.

It was difficult to incorporate this technology into the curriculum when there was only one unit available for use. Therefore, the dental school purchased an additional ten CEREC 3 RedCam units and ten Compact milling units as part of the Sirona Gifting Program to the dental schools. The initial integration of this technology into the curriculum has been described in previous articles.^{3,4}

In 2013 the Dental School was able to exchange the ten RedCam units for ten BlueCam units, and, at the same time, purchase an Omnicam, a MCXL Lab milling unit, and an InFire Zirconia oven for the undergraduate clinics. The addition of this new equipment has increased the ability of the students to use the latest technology and to offer the Dental School patients the newest, most

updated treatment.

As a result, changes in the undergraduate curriculum have been made to expand the use of this technology. The first-year dental students are still introduced to the software as a part of their Dental Morphology course. They spend an afternoon becoming acquainted with this software, as they design a free-form figure using all of the available tools.

The second-year dental students begin to use the technology as part of their Fixed Prosthodontic course during their spring semester. They learn to design, prepare and mill two all-ceramic crowns. One crown is stained and glazed. In the summer of 2015, the plan is to start the fixed course with the all-ceramic crown preparation and have the student's mill crowns early in their second year. At least two all-ceramic crowns will be done during the second year laboratory, and the gold preparation will be moved to later in the year, as it is the same preparation as that for a zirconia crown.

During the second-year esthetics course, which starts later in the spring semester, the students prepare, design, and mill a MODF onlay for a molar. During another session in the Esthetic Dentistry pre-clinical lab, all of these milled restorations are then bonded in place to simulate a clinical situation.

As students begin clinical practice during their third and fourth years, they are able to do as many CAD/CAM crowns as possible on posterior teeth. An

area has been set aside in the general patient clinic for the Esthetics Clinic. (Figure 1) The first fifteen crowns prepared must involve making an impression, which is either sent to the laboratory, if it is to be a PFM, PFZ, gold, or an anterior crown; or is imaged and designed by the students on stone models, with faculty help, if it is a porcelain, eMax CAD or Zirconia posterior crown. It is also possible for them to do implant crowns, either screw retained or with a custom abutment. After these 15 impressions, they can then make the impression digitally with the Omnicam or BlueCam intra-orally (Figure 2).

Since the first CEREC restoration, done in 2002, there have been an increasing number of them done in the clinic by the students. During the 2012-2013 school year, there were 172 restorations made in the clinic with the CEREC units.

Another area that has been addressed with technology is the teaching of composite light curing. In the past, there was no way available to properly teach the correct way to cure a composite restoration. About the only instructions given were: "...and then you cure but don't look at the light." In 2013 the Dental School purchased a mannequin (Marc® Patient Simulator, BlueLight Analytics Inc., Halifax, Nova Scotia), (Figure 3) which allows the student to see how to properly cure composite and how thoroughly they have cured the composite. This mannequin has a sensor in the anterior and a sensor in the posterior that records the amount of energy that is being delivered to a composite in that position on the laptop program. This gives the student feedback on how small movements of the tip of the curing light can affect the ability to deliver enough energy to actually cure the composite. It also allows for some research on the different curing lights and different composite materials.

The application of digital imaging and chairside milling technology in dentistry provides an innovative, best practices service to the patients and is also beneficial for general practitioners.⁵ CAD/CAM systems are continually improving and will continue to change the way that dentistry is provided to the patient. Each individual dentist must determine their involvement in this technology and have a plan to put it into their practice. The University of Tennessee has been at the forefront of introducing this technology that is the future of dentistry, and the students receive practical exposure to it as part of their education. This and many other technology additions at the College of Dentistry allow

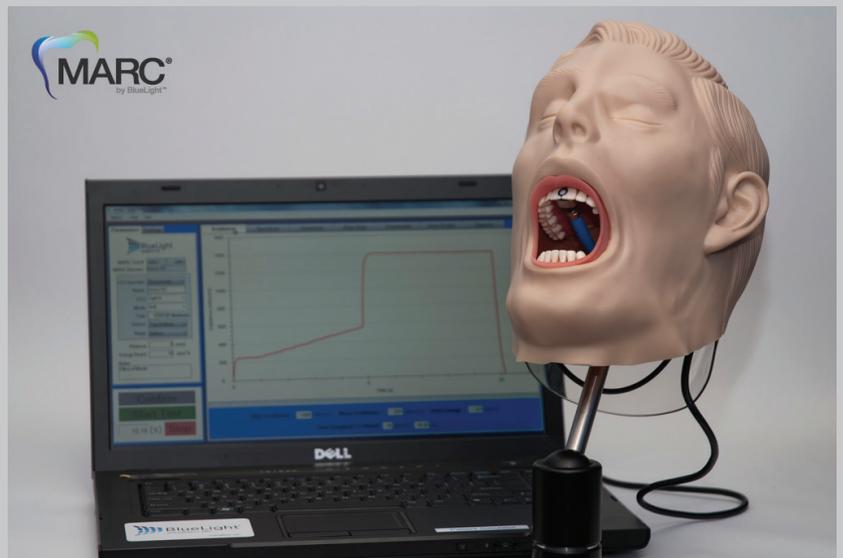
Figure 1: Equipment in the Esthetic Clinic



Figure 2: Using the Omnicam in the Student Clinic



Figure 3: Marc Simulator



students to receive one of the most advanced dental educations in the United States. 

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