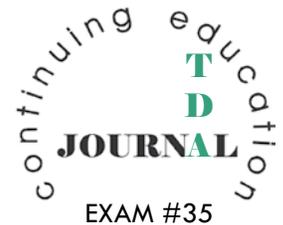


Integrating the CEREC Technology at UT College of Dentistry

Mojdeh Dehghan, D.D.S., James F. Simon, D.D.S., M.Ed., Janet Harrison, D.D.S.



Introduction

According to the *Journal of the American Dental Association*, the impact of information technology on dentistry has transformed modern oral healthcare, enabling dentists to use digital technology in order to create practice possibilities that were rare ten years ago.¹ The University of Tennessee College of Dentistry has established as its mission to incorporate this advancing technology in its curriculum in order to give students the training and knowledge necessary to flourish in their dental careers.

The Division of Esthetic Dentistry at the University of Tennessee College of Dentistry is one of the first dental schools in the United States to embrace the CEREC 3D, CAD/CAM technology into the undergraduate curriculum. CEREC (Sirona Dental Systems, Bensheim, Germany) is an acronym for "Ceramic Reconstruction."² It is one of the CAD/CAM systems available to dentists worldwide. The in-office application of computer-aided design/computer-aided manufacturing (CAD/CAM) has evolved over the past 25 years. With this evolution, it has provided material enhancement and improved speed and precision allowing the dentist to place high-quality restorations in one visit. When CEREC was originally introduced in 1987, there were doubts about the accuracy and the marginal integrity of this ceramic restoration; however, the evolution and improvements in software and hardware have significantly improved the longevity of these restorations.^{3,4,5,6}

In the fall of 2000, UT Dental College received five CEREC 2 units from Sirona (Sirona Dental Systems, USA LLC, Charlotte, NC). In 2001, the dental school purchased a CEREC 3 unit and has been able to incorporate this chair-side "Ceramic Reconstruction" technology in the undergraduate curriculum since then. In 2011, Sirona provided ten additional CEREC 3 units as part of their Gifting Program to the dental schools. This has

ABSTRACT

The Computer-aided design/Computer-aided manufacturing (CAD/CAM) has evolved during the past 25 years, and this evolution has improved the speed and precision in which dentists can deliver high quality esthetic restorations. CEREC is an acronym for "Ceramic Reconstruction" and is one of the CAD/CAM systems available to dentists in private practice. The University of Tennessee College of Dentistry was one of the first dental schools in the United States to embrace this technology and integrate it into the four-year curriculum. In a dental school setting, this technology can prove to be an educational tool for the dental students, cost effective for the University and provide exceptional service for the patients.

allowed the Esthetic Division to expand this technology into the curriculum of the entire four-year program, starting with the DI class.

As many of us are aware, the younger generation is extremely technology savvy and eager to implement any new computer-aided device into their academic training. Since the CEREC technology has proven to be accurate and effective, it is imperative that dental schools take the initiative to teach the next generation of dentists the basic rules and technology associated with these ceramic restorations.

Currently, there are 12,000 CEREC units in the United States and over 34,000 units worldwide. Thirty-seven dental schools have at least one or more units, and eight dental assisting schools are using them for imaging and design training.⁷ Military bases, VA hospital clinics and Indian Reservation dental clinics are using this technology in order to optimize one appointment delivery time and enhance the quality of care for their patient population.⁸ As a result of this technology, these public health organizations are able to deliver superior quality intracoronal or extracoronal restorations at a more economical cost in one dental appointment. The ability to reduce the patient's chair time by imaging, designing and milling the restoration chair side in one visit, versus two appointments, is extremely

important for the special needs of these organizations' patient population.

At the University of Tennessee College of Dentistry, the CEREC technology has been integrated into the curriculum at different stages since its first purchase of a CEREC unit in 2001. In 2008, the first-year dental students were required to purchase a laptop and were given the Sirona CEREC 3D software as part of their Dental Morphology course. They were introduced to this 3D computer imaging and were able to navigate through the design process by manipulating the anatomy and contours of the teeth, therefore seeing how it impacts the occlusion and the shape of the teeth. The students were delighted to visually watch their 3D creation unfold after minutes, something that would take many lab sessions of waxing to create (**Figure 1**). This reinforced all the basic dental anatomy principles that were emphasized in the Dental Morphology course.

One of the recurrent complaints from our clinical faculty about third-year students entering the clinic was their lack of experience and knowledge in the steps necessary to check the fit and the cementation process of a porcelain crown. The primary reason for this lack of exposure was the high cost involved in the fabrication of a porcelain crown by a dental laboratory in the pre-clinical setting. In the fall of 2008, Sirona Dental loaned the dental school a second CEREC

unit for the pre-clinical laboratory. The availability of this CEREC unit allowed the laboratory technician to design, image and mill an anterior and posterior crown prepared from a typodont tooth. The students were then able to go through the process of staining, glazing and final delivery of two crowns on typodont teeth prior to entering the clinic. Currently, since there are four additional units in the laboratory for the students to use, every second-year dental student has prepared, powdered, imaged, designed and milled an all-ceramic crown for a premolar in the Fixed Prosthodontics Laboratory Course and have prepared an MOD onlay for a molar tooth which they will picture, design, mill and bond as part of their third-year Esthetic Dentistry course.

Previously, senior dental students had an option to sign up for the senior CEREC elective in order to have more hands-on experience with the CEREC technology. This year, with the three additional units available in clinic, the students are able to have more clinical cases in which the students have prepared, imaged, milled and delivered approximately 20 crowns to their patients in clinic. This has been a financial cost savings for the University, since it has not accrued the laboratory expenses normally needed for these crowns. The patients have benefited from this technology by receiving quality restorations in a more efficient manner.

Since 2001, the Esthetics Dentistry Division at UTHSC has been located in a separate section of the clinic with storage cabinets for the CEREC chair side system, milling unit, other instruments and materials necessary for cementation. The students come to this area for their patient's complicated esthetic needs

Figure 1: Students Learning to use the CEREC System



including, but not limited to, CEREC restorations where they are able to receive one-on-one instruction from faculty. This clinic has averaged 75 to 85 restorations per year since 2001 (Figure 2 & 3). The majority of these restorations are porcelain inlays and onlays which provide the patients with conservative, tooth-colored restorations. Due to the constraints of time and the student's lack of experience and speed, most dental students cannot complete the CEREC restoration in one appointment. The protocol for CEREC restorations has been to complete the preparation, take an impression and then place a provisional restoration on the tooth. The restoration is then imaged and designed

from the models at a time when the student and faculty have more time to discuss and fabricate the restoration. During this time, the instructor will have the opportunity to look at the preparation in magnification and point out possible preparation pitfalls, which is a great learning experience for the dental students. Then the instructor will have to approve the design and mill the restoration. The patient then returns to have the final restoration bonded and delivered. Currently, with the extra units in clinic and the student's additional training, we expect to be able to fabricate more restorations in an efficient way.

Additional CEREC units are also available in the AEGD clinic and the Graduate Prosthodontics Clinic. All the residents in these two disciplines have had exposure and experience with using the CAD/CAM technology.

The computer-aided design/computer-aided manufacturing (CAD/CAM) has evolved during the past 25 years,⁹ and this evolution has improved the speed and precision in

Figure 2: Student Clinical Case - Old amalgam restoration.



Figure 3: Student Clinical Case - The post-operative results.



which dentists can deliver high quality esthetic restorations. In a dental school setting, this technology can prove to be an educational tool for the dental students, cost effective for the University and exceptional service for the patients. The goal is to provide every dental student at the University of Tennessee the opportunity to learn this new proven technology.

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- The acronym for ceramic reconstruction is:
 - CR
 - CCR
 - CEREC
 - CAD/CAM
- CEREC is manufactured by:
 - 3-M
 - Schein
 - Sirona Dental Solutions
 - Sedona Systems
- Use of CEREC in the Dental Morphology Course:
 - Encourage flat-plane morphology
 - Present conflicting paradigms of morphology
 - Reinforces basic dental anatomy principles
 - Has no intrinsic value
- 3D computer imaging software enables students to navigate through the design process demonstrating how manipulating _____ affects occlusion and shape of teeth:
 - Anatomy
 - Contour
 - Shade
 - Answers a. and b.
- Computer-aided design/computer-aided manufacturing (CAD/CAM) has evolved over the past:
 - 10 years
 - 30 years
 - 5 years
 - 25 years

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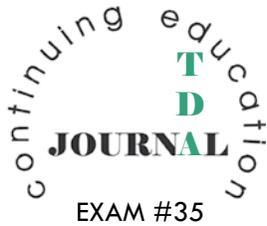
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