The integration of CAD/CAM into dental school curricula

By Brendan Day, DTI

By this point, the benefits of employing digital technologies in the dental practice and laboratory have been well documented. CAD/CAM was developed for commercial use in the 1980s at the University of Zurich in Switzerland by Prof. Werner H. Mörmann and Dr Marco Brandestini, and its usefulness for creating dental restorations and orthodontic appliances has grown in the decades since, as has its reputation. FDI World Dental Federation, the principal representative body for more than one million dentists worldwide, went so far as to issue a policy statement in 2017 declaring that it supports “the research and development of CAD/CAM dentistry to improve the quality of the final product and allow for cost reduction”.

What has been less covered, however, is the role that CAD/CAM can play in tertiary dental education as both a teaching aid and a tool for future dentists to experience in a preclinical setting. In contrast to older dentists who may have had to learn how to use these technologies from scratch, today’s dental students are frequently digital natives, already well versed in using computers by the time they reach university. As a result, they often have an increased affinity for the incorporation of CAD/CAM into their learning experiences.

A 2015 article in Inside Dentistry asserted that 76 per cent of American dental schools have at least one CEREC unit from Dentsply Sirona, perhaps the piece of CAD/CAM equipment most commonly found in dental practices. However, this level of access to such technology is nowhere near guaranteed, according to a survey that was the subject of a report by Dental Tribune International in 2017. Most British dentists stated that they did not use any CAD/CAM equipment in their practices, even though 89 per cent of them admitted that it had a major role to play in the future of dentistry.

So how has CAD/CAM been integrated into dental school curricula to this point?

The University of Tennessee College of Dentistry—a trendsetting school

One of the first dental schools to incorporate CAD/CAM into its undergraduate curriculum was the College of Dentistry at the University of Tennessee Health Science Center in the US. In 2001, the school invested in a CEREC 3 unit from Sirona—having tested five CEREC 2 units the summer before—and, slowly but surely, let its students experience at first hand the potential of this digital technology.

Dr Mojdeh Dehghan, an associate professor and Chair of the Department of General Dentistry, was one of the chief drivers of this technological shift. She outlined to Dental Tribune how the dental school’s curriculum integrates CAD/CAM technology from the very first day of students’ preclinical studies, which allows them to gain a better understanding of what their eventual clinical study will entail.

“Before the end of their first year, our undergraduate students have not only been introduced to CAD/CAM in their dental morphology course, they have also undertaken an ‘Introduction to CAD/CAM Dentistry’ course, where they get to work directly with mannequin teeth that are already prepared for an onlay and a crown, going through the whole process of scanning, designing and milling,” Dehghan says.
“When they’re exposed to technology like this early on in their education, especially for this tech-savvy generation, they not only often really enjoy being given the opportunity to see what they’ll be doing later on but also are able to reinforce their knowledge of tooth morphology and anatomy that they’ve learned in prior courses,” adds Dehghan. “It’s the optimal way to integrate technology into the basic science courses and has been a really successful programme for us.”

Maryland’s father of digital dentistry

Dr Gary Hack is an associate professor at the University of Maryland School of Dentistry, where he teaches in the Department of Advanced Oral Sciences and Therapeutics. Having instructed dental students for more than three decades now, Hack might be forgiven for not having stayed up to date with all of the technological developments in dentistry. This, however, couldn’t be further from the truth, since he was one of the first dental educators in the nation to integrate CAD/CAM devices into his teaching. At Maryland, Hack’s enthusiasm for modern dental technology is such that many of his colleagues call him the university’s father of digital dentistry.

“In the early 2000s, there were some representatives from Sirona who came to conduct a demonstration at our dental school,” Hack explains. “At that time, they had the CEREC Red Cam. I had been teaching a crown and bridge course for many years at that point, but when I saw this technology at first hand, I was overwhelmed. I knew that this was the future of dentistry. I knew that this would introduce an incredible level of excitement for the dental students. And I knew about the students’ passion for computers and technology.”

By 2006, Hack had set up ten CEREC Red Cams in the school’s so-called Dream Room and began integrating digital dentistry into his classes with immediate effect.

“I was teaching a freshman course on amalgams and composites, and the general thinking was that you couldn’t gain any value from scanning amalgam and composite preparations because they have undercuts,” he says.

“What I quickly learned, however, was that it was very easy to scan these. Instead of ten or 15 students gathered around me and a typodont, failing to really see anything while I tried to explain about the walls of an intracoronal preparation, a single scan allowed for me to show everybody all the different elements in a way that was much easier for them to understand,” Hack adds.

Somewhat surprisingly, Hack asserts that the software available on certain CAD/CAM devices comes with an added benefit for students: the provision of unbiased feedback regarding site preparation. “After 35 years of teaching, I can tell you that it’s almost impossible to get ten dentists to look at the same dental preparation and each come up with the same grade,” he declares.

“Everyone has his or her own bias, his or her own way of looking at things. However, the computer has no such bias.”

The era of digital natives

When it comes to understanding how to use dental CAD/CAM technologies, it is clear to educators like Dehghan and Dr Selim Pamuk that this current generation of students is much more capable than their predecessors.

“Today, young generations are growing up using smartphones, game consoles and powerful computers from their childhood onwards,” says Pamuk, a retired professor who used to teach at Istanbul University’s Department of Prosthodontics in Turkey before opening up his own private practice in the same city.

“Teaching these students everything in a virtual environment is much easier than adapting ourselves to these changes. They understand how to use technology with ease, and do it instinctively,” he admits.

Pamuk’s assertions are echoed by Hack, who emphasises that “there really is no learning curve” for the dentists of tomorrow. “These students pick it up within minutes, to a point where they understand it better than I do!” he remarks. “They grew up with computers and are naturally drawn to this technology, are passionate about it and are excited to bring it into their future dental practices.”

Are we moving too fast?

It can be somewhat easy to argue that, given CAD/CAM’s increasing influence in the dental world, it should be
readily and widely employed in dental schools. "More and more dentistry is surrounded by new digital ‘toys’ that can make our practices more efficient than ever before," claims Pamuk, who is a strong believer in the power of CAD/CAM.

"Digital dentistry is now a reality, and dental schools and practices should all be part of this. Dental schools should change and adapt their curricula accordingly," he adds.

However, the truth of the matter, according to Dehghan, is somewhat more complicated given the oral health inequalities that continue to exist between and within different communities.

“A lot of the time, we don’t know exactly where our students are going to end up working,” Dehghan says. “They may end up working in public health, in remote areas, in the military—any number of places that often have less access to CAD/CAM. This is why we’re exposing them to these advanced technologies while also ensuring that they learn all of the traditional methods of impression taking, crown preparation, temporizing the patient, sending the information to the laboratory, and so on. CAD/CAM is wonderful, and while it should be integrated into dental education, it shouldn’t be the sole method," she adds.

Dehghan affirms that the initial cost of investing in CAD/CAM devices and technologies is something that puts off not just private dental practices but certain schools as well.

It’s a sentiment that Hack readily agrees with. “In my opinion, all dental schools are, to some degree, struggling with this decision,” he says. “Clearly, they know that they have to do this, that it is incumbent on them that they teach their students this technology, since if they don’t, they are not properly preparing them for their future practice. Yes, the financial cost can be a barrier, but this is clearly outweighed by the benefits that come with integrating CAD/CAM devices into current methods of teaching," Hack continues.

There is a way, however, that the financial burden of CAD/CAM investment can be lessened for dental schools: partnering with key players in the industry.
Industry involvement in dental CAD/CAM education

The role that industry can play in promoting CAD/CAM use in dental schools has already been recognised. Henry Schein, for example, has partnered with the American College of Prosthodontists Education Foundation since 2018 to create its Digital Dentistry Curriculum Initiative, which aims to develop new curricula for American dental schools that incorporate CAD/CAM technologies into their curricula.

“We believe CAD/CAM technology enhances dentistry and we are pleased to support this initiative, which will offer dental students the education and training needed to effectively apply this exciting technology in their future work,” said Stanley M. Bergman, chairman of the board and CEO of Henry Schein, in a press release announcing the company’s initiative. “By rallying the industry to ensure that dental students are fully educated on the practice benefits and patient benefits of digital dentistry, we are helping the dentists of tomorrow succeed.”

Hack sees the relationship between dental schools and CAD/CAM providers as one that, if executed correctly, can prove to be essentially symbiotic in nature. “As teachers, we can go back to the manufacturers and tell them what we would like to see in their evaluation software and they will work on it,” he explains.

“There is a collaboration between dental school education and the manufacturers that becomes a win-win situation. The manufacturers know that, if the students are being taught digital dentistry, then chances are, when they get into private practice, they’ll move in that direction,” Hack adds.

For Pamuk, this association is something that can ultimately lead to reduced costs and greater access to CAD/CAM technology for dental schools.

“The industry has to collaborate with dental schools and research centres, even with private practitioners, in order to develop digital dentistry and reduce the cost of equipment,” he says.

“Once the cost has been lowered, digital dentistry will be more democratic. But for this, close collaboration is needed, as teaching and learning skills will change completely with the adoption of digital tools in classrooms,” Pamuk adds.

On the whole, it appears as though the integration of CAD/CAM into dental school curricula throughout the world is on the increase. Heidelberg University Hospital in Germany, Queen Mary University of London in England and RMIT University in Australia are just a few of the educational institutes that currently offer courses centred on dental CAD/CAM technologies. Though there are certain barriers to its widespread adoption, this number looks set to continue to grow.