Simplified digital impression-taking

As the only system in the world that uses the principle of triangulation for intra-oral measurements, the CEREC system is setting higher standards in CAD/DAM technology with CEREC AC and the CEREC Bluecam camera. Never before have intra-oral scans been made as fast, sharp, or accurately in 3-D. Whole-jaw images broaden the indication spectrum and, with virtual models, allow the dental office and the dental laboratory to work together impression-free.

The acquisition unit of the CEREC 3D system—called CEREC AC (acquisition center)—has been equipped with a new camera (Bluecam). CEREC AC replaces the previous CEREC 3 acquisition unit; however, the new software still supports the CEREC 3 camera. CEREC AC is compatible with both milling units—CEREC 3 milling unit and CEREC MC XL (extra large).

The advantages of an improved intra-oral image-capturing system do not stop at producing larger restorations chairside. The simplified inclusion of the adjacent teeth and the opposing jaw makes it possible to improve the occlusal and functional design, and the more exact measurement of the preparation enables an increase in the information content of the image. Furthermore, intra-orally recorded 3-D data sets of gnathic situations offer new diagnostic possibilities.

The heart of CEREC AC is the Bluecam camera. Instead of infrared light, Bluecam emits short-wave blue light produced by diodes. In addition, the lens configuration is new: aspherical lenses bundle the light beam and orient it parallel to the image sensor (CCD). The light sensitivity has been increased, the image capture time shortened by 50 per cent, and the image sequence accelerated. The projection matrix still employs the tried-and-tested light-stripe grid.

As a result, the new Bluecam offers higher image accuracy in the clinical situation: the meas-
Measurement depth has been increased by 20 per cent and the focus depth deepened to 14 mm. The sharpness of individual images has been heightened, and marginal blurring eliminated. Blur control (automatic capture), the sensitivity of which can be pre-selected, checks the intended image, and the camera automatically takes the image only when it is certain there is no blurring. In quadrants and across the dental arch, any number of pictures can be taken as an overlapping sequence.

The 3-D image catalogue manages the individual images on the screen. The software assesses their usefulness, marks and rejects useless scans, and joins the images to form a complete row of teeth (matching) and a virtual cast modelled on the natural example. Images acquired at the beginning of the sequence, the quality of which may have been lessened owing to the presence of rubber dam or cotton rolls, are automatically exchanged for a suitable image pair as soon as this is found. In this way, inadequate images are quickly replaced.

_In vitro_ studies in the laboratory at the University of Zurich in Switzerland have shown that the image accuracy deviates from the reference measurement of a master laboratory scanner by only 19 µm—this is equivalent to one-third of the diameter of a human hair. This means Bluecam’s accuracy is similar to that of stationary laser scanners. Such precision increases the marginal fitting accuracy of the restoration; thus, less excess occurs during adhesive luting, which in turn takes less time to remove.

Because of the image depth and focus depth, it is not necessary to keep an exactly determined distance from the preparation; the camera’s prism window can be placed directly on the tooth, which makes image acquisition easier, particularly in the distal region. The Autocapture function, responsible for actually taking the image, engages automatically upon ensuring that the image is in focus. Hence, there is no need to operate a footswitch, which requires eye–foot coordination. This means that an entire quadrant can be scanned in 30 seconds. The blur control makes the image sequence and menu operation accurate and simple; thus, this phase can be delegated to the dental assistant. If the acquisition unit has a wireless or WLAN connection to the milling unit, the system can operate without power with no data loss for up to six minutes, thanks to its own optional, uninterrupted power supply—ideal for changing location during the milling/grinding phase.

**Up to four-unit bridges chairside**

Bluecam takes about 30 seconds to scan a complete quadrant and is suitable for scanning stone casts. In addition, bite records with static and dynamic occlusion are digitised and prepared for functional articulation of the restoration. After selecting _bridge tooth databank_, the preparation for a four-unit bridge can be scanned with Bluecam. This enables the construction and chairside manufacture of long-term, provisional composite-resin restorations employing the CEREC milling unit, which broadens CEREC’s indication spectrum considerably.

As when constructing crowns with CEREC 3D, fissure axes and cusps of the adjacent teeth are analysed—if desired, the antagonists’ morphology is also analysed—and incorporated into the occlusal surface calculation. The software adjusts the occlusal contact points and sliding planes of the crown construction to the occlusal surface.
of the antagonist. The wall thickness of the projected ceramic framework is checked beforehand, as are the insertion paths of the abutment crowns.

After designing the restoration, the data set can be transmitted to the milling unit or the practice's laboratory, or sent via LAN or wireless LAN to the dental laboratory. In the rapid milling mode of the CEREC MC XL milling unit, a four-unit bridge can be produced in about 20 minutes. Composite resin blocks by VITA (CAD-Temp) and Merz (artBloc Temp) can be used to fabricate the provisional restoration. The milling preview shows the size of the block required and the positioning of the restoration in the material—ideal when using ceramic blocks with integrated, density-determined enamel/dentine colour progression (VITA TriLuxe, Ivoclar Multishade).

_The virtual cast, online_

Using the CEREC Connect system, the digital data of the optical impression, even of the whole jaw, can be sent from CEREC AC to the dental laboratory. This enables the cast-free manufacture of the restoration. In the future, it will be possible to manufacture a physical cast using these data from a portal, for dental laboratory use. In this manner, all single-tooth restorations could be manufactured, such as inlays, onlays, partial crowns, veneers, crowns and temporaries.

For crown-and-bridge frameworks of up to four units, any dental laboratory lacking a CEREC milling unit will in the future be able to access the Internet portal infiniDent to have a cast manufactured, which will serve as the starting point from which the laboratory itself can manufacture the framework. Thus, CEREC AC and CEREC Connect together offer the smallest possible initiation into the CEREC system, which can be expanded upon to any extent desired. Every inlab laboratory can make use of this option to accept work from impression-free practices and manufacture all-ceramic crowns and bridges using CAD/CAM technology.

With the milling unit CEREC MC XL, the new CEREC 3D software and CEREC Connect, CEREC AC sets a new standard in restorative dental treatment. The system’s ease of operation allows a constant and time-saving workflow in the dental office. The progressive technology also offers new opportunities for highly efficient cooperation with the dental laboratory. In addition, the modular nature of the CEREC system, its consistent development, and its total compatibility with all system components, including the labside system inLab, ensure complete treatment flexibility and sustainable investment security.

_Dr Helmut Götte_

studied dentistry at the University of Munich where he graduated in 1993. Today, Dr Götte runs a fully digitalised, paperless dental office in Bickenbach, Germany. He has been using CEREC since 1996 and is a member of German Society of Computerized Dentistry.

Dr Götte can be reached at helmut.goette@goette-online.de