Intraoral impression-taking: Digital datasets soon to catch on everywhere

The annual meeting of the German Society of Dentistry and Oral Medicine (DGZMK), held in conjunction with the Society for Dental Ceramics (AG Keramik), the DGZMK’s professional society, is a major event that critically examines experiences with all-ceramics and CAD/CAM methods in clinics and practices. At this year’s meeting, the 10th Annual Ceramic Symposium, Prof Bernd Wöstmann, Head of Prosthodontics at the University of Gießen in Germany, focused in his paper on the progress in producing the final restoration directly, whether it is an inlay or restoration, creating an image of the dental arch (Figs. 3 & 4).

The waveform sampling of C.O.S. Lava captures the tooth shape by moving the video camera over the teeth. The distance to the camera can be calculated from the changing position of individual pixels during filming, giving rise to a 3-D image of the dental arch (Figs. 3 & 4).

The functioning of the iTero scanner is based on the principle of laser triangulation. The image captures the tooth and vertically scans 500 levels, each 50 µm deep (Figs. 5 & 6).

According to Prof Wöstmann, the scanning accuracy of CEREC AC and C.O.S. Lava corresponds to a conventional hydrocolloid or polyvinyl-siloxane impression. The differences were not significant. Measurements of crown copings fabricated with C.O.S. Lava yielded an average of 35 µm (± 16 µm) for all marginal gaps. Copings produced using the conventional impression-taking technique had a mean marginal gap of 60 µm (± 23 µm). Syrek et al. found comparable results in a clinical study. The mean marginal gap of conventionally manufactured crowns was 71 µm, as compared with 49 µm for the C.O.S. Lava crowns. For CEREC 5D, the literature cites a tolerance of 40 µm (± 21 µm).

Another advantage of digital impressions is that the scanned preparation can be checked directly on the screen, where imperfections can also be immediately corrected (Figs. 7 & 8). For patients with an easily triggered gag reflex, these scanning methods greatly improve treatment comfort. Further benefits result from fewer working steps involved, especially in the practice. Choosing an impression technique, mixing the elastic impression compound, waiting during setting and disinfection, as well as producing a model are no longer necessary.

Fewer treatment and working steps also mean fewer sources of error and better standardisation, which in turn can improve the predictability of treatment outcome. Prof Wöstmann cautioned that with crown margins that are clearly subgingival, the optical systems reach their limits; thus, conventional impression-taking techniques are still used in such cases.

Digital impressions are more accurate

At the 12th annual meeting of the International Society of Computerized Dentistry, Prof Gerwin Arnetzl, University of Graz, compared the accuracy of digital-generated impressions with that of conventional elastic impressions. When conventional impressions demonstrate an elastic recovery of 98.5% after de-formation, a fitting accuracy of 55 to 75 µm for an inlay cavity can be expected. For cast pieces, additional tolerances of up to 46.5 µm accumulate, so that indirectly manufactured crowns can attain deviations of up to 114 µm.

Dentists using analogue impression-taking techniques are familiar with these results. Different elastomeric impression techniques can cause considerable deviations. For instance, in analogue impression-taking using different impression materials and trays, dimensional changes compared with the reference (a cast metal control) varied between 0.32 and 1.17 µm. A deviation of 49 µm was found for standard and 122 µm for control impression-taking. As a rule, however, the studies on analogue impression-taking techniques were performed using 2-D measurements; the new studies on the imaging accuracy of optical methods were conducted with 3-D volume analyses.

Digitally or optically produced impressions must be similar in this regard. Potential sources of error in the digital impression-taking technique are scanner adjustment, magnetic interference fields during image processing, image noise and the software. According to Prof Arnetzl, these results prove that when proper use is made of a camera or scanner, digitally generated data exhibits fewer errors and greater
Dental Tribune Middle East & Africa Edition

Media CME

Fig. 11 Short-wavelength blue light with structured light projection. (Photo courtesy of Ender.)

Fig. 2 Single images are matched to create a digital full arch model, basis for construction and milling of the framework. (Photo courtesy of MHI.)

Fig. 3 Optoelectronic introral scan using the C.O.S. Lava system. Crown preparation and post preparation margins are portrayed exactly. In addition to framework manufacture, the dataset enables production of an SLA resin model including the antagonist teeth. (Figs. 3 & 4 courtesy of Wissmann.)

Fig. 1 Tetro is equipped with a touch screen. It is the third introral scanner on the European market.

Fig. 6 Each scan of the quadrant or maxilla/mandible is computed from structured light projection. (Photo courtesy of Lauer.)

Fig. 14 Veneering and articulation. (Figs. 11–14 courtesy of Baltzer.)

Fig. 9 SLA resin model using the C.O.S. Lava system. (Photo courtesy of Invisalign.)

Fig. 10 Digitally milled resin model using the iTero system.

Fig. 12 SLA model (acrylic) for trying in the framework.

Fig. 13 Trying in the ZrO2 framework. (Figures courtesy of Wittmann.)

Fig. 14 Veneering and articulation. (Figs. 11–14 courtesy of Baltzer.)

accuracy and the conventional impression-taking technique with elastomeric impression materials.

A virtual model of the maxilla/mandible is computed from the scans of the quadrants or complete dental arch with the antagonist dentition. Via the Internet, the dentist sends the datasets from C.O.S. Lava or iTero to the manufacturer, where they are checked before being used to produce a resin model (Figs. 9 & 10). After CAD construction of the restoration, the dental technician can either mill the frame-work in his/her own laboratory or have it done at the milling centre. The resin model is needed to layer on the veneers and perform articulation. CEREC MC also computes a virtual model (Fig. 11).

Framework-free crowns and short-span FDPs can be milled immediately, directly from the dataset, in the practice’s laboratory or in another dental laboratory with an online connection to the practice.

For veneered crowns and multi-unit bridges, a stereolithographically produced resin model (SLA) is necessary, which is provided by InfiniDent (Sirona) and makes veneering the framework and articulation possible (Figs. 12–14).

Optoelectronic impression-taking systems are extremely promising. Owing to the offered advantages in standardisation, quality assurance, patient comfort, digital intraoral impression-taking systems have great potential for the future. In the coming years, they will be seen in ever-increasing numbers in daily dental practice.

The datasets they create, thanks to the exchange of information online, simplify communication between the dentist and the dental technician, regardless of distance. Supplemental facial photos, information on tooth colour, individualisation, material, occlusal con- cept, etc. can also be attached. All of this happens with conventional impression-taking and the associated gag reflex, wax check-bite and stone model...

MEDIA CME Self-Instruction Program

Dental Tribune Middle East & Africa in collaboration with CAPP introduce to the market the new project mCME. Self Instruction Program. mCME gives you the opportunity to have a quick and easy way to meet your continuing education needs. mCME offers you the flexibility to work at your own pace through the material from any location at any time. The content is international, drawn from the upper echelon of dental medicine, but also presents a regional outlook in terms of perspective and subject matter.

How can professionals enrol? They can either sign up for a one-year (10 exercises) by subscription for the magazine for one year ($65) or pay ($20) per article. After the payment, participants will receive their membership number and will be able to attend to the program. How to earn CME credits? Once the reader attends the distance-learning program, he/she can earn credits in three easy steps:

1. Read the articles.
2. Take the exercises.
3. Fill in the Questionnaire and Submit the answers by Fax (+971 4 3686885) or Email .info@cappmea.com

After submission of the answers, the membership number must be included for processing. They will receive the Certificate with unique ID Number within 88 to 72hours. Articles and Questionnaires will be available in the website after the publication. www.cappmea.com

1. Celebrate the uniqueness of FDI at its 100th Annual World Dental Congress.
2. Learn about the latest developments from international and regional experts.
3. Discover new technology, equipment, products and materials.
4. Interact with renowned world specialists.
5. Empower yourself through FDI sessions on policy and public and oral health.
6. Enjoy exclusive face-to-face encounters with your peers worldwide.
7. Develop your knowledge and skills through a new and innovative programme.
8. Sample some of the best cuisine in Asia; one restaurant for every 600 inhabitants!
9. Marvel at the breathtaking views of Hong Kong and Macau.
10. Uncover the riches and mysteries of mainland China.

2012 Hong Kong FDI Annual World Dental Congress
29 August - 1 September 2012

www.fdicongress.org

Leading the world into a new century of oral health

funding: Hobson Media