CBCT is an advanced diagnostic used in modern dentistry. However, many clinicians still have not mastered CT systems, as this requires good awareness of viewer software, image preparation skills and knowledge of radiographic anatomy. It takes a dentist over 20 minutes to properly analyse a CBCT image. In a real-world setting, a dentist has only a few minutes for image interpretation during a patient visit. As a result, the region of interest is narrowed down to several teeth, while the majority of other medical conditions remain off record. Additionally, when a patient shows a dentist images obtained with different CT systems, the dentist needs some time to adapt to the new software, even if it is much like the others. In other words, image interpretation is subjective and depends exclusively on the clinician’s experience and skills. This may lead to diagnostic discrepancies and cause difficulties affecting the accuracy of dental diagnosis and control of diagnosis and treatment plans. Diagnocat is a powerful tool in which computer vision assists human in the detection and characterisation of the anatomy and most often pathologies affecting the jaws.

At the core of Diagnocat is a system of 3D neural nets. The nets are designed and taught to function collaboratively. For example, one net finds an approximate position of a tooth, another one precisely defines the tooth boundaries and the next one predicts its conditions and pathologies. Datasets have been assembled for each of the nets, specific to their type and function. In addition to this system of neural nets, Diagnocat uses multiple algorithms and heuristics, which turn raw outputs from the neural nets into reports and imagery that are easy for dentists to understand. Diagnocat’s artificial intelligence analyses 3D dental studies in DICOM format. The innovative solutions of Diagnocat allow a dentist to evaluate CBCT images obtained with any CT units without using the conventional software (viewer). The software has a convenient, intuitive interface.

How does Diagnocat work?
A neural network, while processing DICOM files of CT images, finds and segments the main anatomical regions (jaws, teeth, periapical space). Diagnocat identifies various conditions and disorders by assessing 50 signs (normal appearance, filling, crown, treated root canal, implant, sign of periapical lesion, etc.). Diagnocat helps the dentist to quickly make a diagnosis in the region of interest, evaluate the overall state of the teeth and jaws, and select images to aid preparation for dental implant placement or root canal therapy.

Diagnocat cloud service
To use the service, a dentist needs a computer connected to the web. A desktop, laptop or tablet are all suitable. CT images and reports are stored in the dentist’s personal account (Fig. 1). The dentist thus receives a data storage system platform in which data may be arranged by patient name, medical condition, and creation and modification dates. CT images may be transferred from dentist to dentist in a protected protocol involving no file transfer procedure. Immediately after uploading files, the dentist obtains access to Diagnocat Viewer, which automatically produces:
1. panoramic view of various thicknesses (Fig. 2);
2. a set of slices in three planes for each tooth (Fig. 3); and
3. a patient report to inform the patient and to motivate him or her to continue and complete treatment (Fig. 4).

**Fig. 1:** View of dentist’s personal account. **Fig. 2:** Separate panoramic image of 7.5 mm in thickness. **Fig. 3:** Tooth visualisation.
Apart from a panoramic image, a patient report contains the dental chart with annotation in colour: teeth with findings requiring the dentist’s attention are marked in red. Other interactive report formats may be generated and obtained from Diagnocat at the dentist’s request.

**Diagnocat Report**
In addition to tooth slices, the system generates a textual description of each tooth after analysing over 50 parameters: anatomical structure, status post-treatment, and signs of crown, root, canal and periapical space abnormalities. The dentist has an opportunity to define an area of dental interest so that only selected teeth are included in the printout. The dentist can also make changes to the descriptions.

**Diagnocat Implant**
The most frequent indication for CT is implant planning. Diagnocat automatically generates images that an implant surgeon would need. The only thing the dentist needs to do is select a region of interest. Diagnocat will illuminate the mandibular canal and the bottom of the maxillary sinus, and will make measurements between key points.

**Diagnocat Endo**
Complicated anatomical structures of roots and canals require careful studying of the image by the treating dentist; however, it is not so easy to understand 3D views. A dentist often has to work under time pressure while the patient is waiting. Diagnocat comes to the rescue. The dentist just needs to select a tooth and all images (roots, canals, apical damage areas) will be ready within one minute.

**Diagnocat and medical records**
Diagnocat enables recording of diagnostic protocols in just a few clicks. Medical record entries will always be correct, as the Diagnocat terminology has been carefully examined by an experienced dentomaxillofacial radiologist. Images can be added in only a few seconds. Accurate and fast processing of CT images by the artificial intelligence of a neural network offers exciting diagnostic opportunities.

The company is exhibiting at this year’s International Dental Show in Cologne in Germany (Hall 2.1, Booth C089).

www.diagnocat.com
New intraoral scanner

Primescan perfects digital impressions

Easier than ever, faster than before, more accurate than previously possible—all describe Primescan, the new intraoral scanner from Dentsply Sirona. With its completely new, patent pending digital impressioning technology, Primescan enables high-precision digital impressions to be taken of the entire jaw. These scans present numerous possibilities for users. Primescan was designed for various digital workflows—with the laboratory directly in the practice, with CEREC, or in cooperation with external partners. Validated interfaces noticeably simplify the process, offering dentists the flexibility they desire.

What was considered an absolute sensation more than 30 years ago is almost taken for granted today. In terms of quality, digital intraoral impressions are in no way inferior to conventional methods, and therefore, are becoming a reliable alternative for taking impressions of both individual teeth and the entire jaw for more and more dentists. Dentsply Sirona introduced the digital impression to dentistry with CEREC. Now, with Primescan, the company is introducing an intraoral scanner with outstanding technology, which enables scans that are more precise than anything we have known before. This has been substantiated by a new study at the University of Zurich. Dentists rightly expect products and solutions from Dentsply Sirona, that make their work at the dental practice easier, safer and better,” says Dr Alexander Völcker, Group Vice President, CAD/CAM and Orthodontics at Dentsply Sirona. “Primescan is the solution to an important issue in practices—the option of faster, precise impressioning—which is easy to manage in the usual practice environment, which is reliable, which delivers clinically flawless results, and which is simply fun to use.”

Scans up to 20 millimetres in depth

Primescan’s optical impression system has been decisively developed. The scan of the surfaces of the teeth is performed with high-resolution sensors and shortwave light, capturing up to one million 3D data points per second. With optical high-frequency contrast analysis, they can now be calculated more accurately than ever before. Dentsply Sirona has submitted a patent application for this process. With Primescan, it is also possible to scan deeper areas (up to 20 mm). This enables digital impressions even for subgingival or particularly deep preparations. Virtually all the tooth surfaces are captured, even when scanning from very shallow angles. Primescan captures the dental surfaces immediately, in the required resolution and with a high sharpness even at great depths, thereby ensuring a much more detailed 3D model.

To monitor the scanning process simply and easily and to be able to assess the model immediately, the accompanying Primescan AC acquisition center has a modern touchscreen that pivots and swivels as needed to ensure it is always set to the most favourable ergonomic position. Dentists acknowledge the intuitive operation...
and high level of comfort during first-time use, which is also greatly appreciated by patients. Primescan also scores in terms of hygienic safety. Thanks to the smooth surfaces of Primescan and the acquisition center, the hygienically critical areas, which are often difficult to clean, can be reprocessed safely, quickly and easily.

Comprehensive range of applications
The precise scanning technology enables Primescan to be implemented universally. Not only does it produce high-precision images of natural teeth and preparations, it also provides extremely accurate images of other materials commonly used in dentistry. For example, implant specialists appreciate the simple impressions of edentulous arches or sites with implants, and orthodontists highly rate the detailed scan results for soft tissues (gums, frenulum). With this new scanning technology, impressions can be completed very quickly. A full jaw impression, including model calculation, is complete in just two to three minutes.

Maximum flexibility for further processing of the scanned images
With Primescan, users can leverage the full potential of digital processes for better treatment. The modular concept offers a suitable solution for every need within the practice. The digital 3D model can be transmitted to a laboratory via the new Connect software (formerly Sirona Connect), and can also be further processed with different software, e.g. for orthodontic or implant treatment planning. The newly developed Connect Case Center Inbox enables laboratories around the world to connect to the Connect Case Center. In the process, validated scan data from both Primescan and Omnicam can be received easily for further processing in the desired programmes and workflows. Alternatively, the restoration can be planned and manufactured in the practice using the new CEREC software 5, with its pleasing fresh, new design, intuitive touch functionality and noticeably improved screen resolution.

Dr Alexander Völcker expresses his confidence: “Digital impressions with Primescan are the starting point for other exciting digital processes without limiting the future decisions of dental practices. With our seamless solutions and validated workflows with external partners, we are setting new standards, which, thanks to digital technologies, enable even better dentistry.”

Due to various certification and registration periods, not all products are immediately available in all countries.

Dentsply Sirona at IDS 2019
“Inspired by your needs” is the motto under which Dentsply Sirona will demonstrate at the IDS 2019 how it is redefining dentistry. From 12 to 16 March 2019 in Halls 10.2 and 11.2, dentists and dental technicians can look forward to revolutionary technologies and equipment for practices and labs, and simpler, more clinically safe solutions along with an attractive trade show bonus.

Visit our website www.dentsplysirona.com/ids.

Editorial note: A list of references is available from the publisher.
Cooperation between Dentsply Sirona and exocad

Digital workflow in the practice and laboratory

Dentsply Sirona, the world’s largest manufacturer of dental products and technologies, and exocad, one of the leading dental CAD/CAM software manufacturers for the dental lab, have announced their extensive cooperation in the field of digital dental workflows. International customers of both companies will now benefit from the direct transmission of digital impressions from Dentsply Sirona’s intraoral scanners to exocad labs. Furthermore, both companies will align elementary interfaces between the inLab hardware and exocad software and, among other aspects, implement Dentsply Sirona tooth lines and material-specific parameters in the DentalCAD software from exocad.

Flexible open systems play an important role in digital dentistry. At the same time, ensuring the maximum compatibility of the systems used in practices and labs is becoming increasingly important to design reliable and efficient digital workflows. Considering these objectives, the cooperation between Dentsply Sirona and exocad offers completely new options in the digital production chain.

Validated workflow for digital impressions

Thanks to this cooperation, dental practices with Dentsply Sirona intraoral scanners will now, for the first time, be able to work with exocad laboratories in a validated workflow and transmit digital impressions conveniently and directly for a broad range of indications. Using the new software application, Connect Case Center Inbox from Dentsply Sirona, exocad labs have direct access to the complete intraoral scan and order data in the Connect Case Center Portal.

“With the connection of exocad labs to Dentsply Sirona’s intraoral scanners, the digital production options based on intraoral impression data for practices and dental labs around the world are expanded,” explained Dr Alexander Völcker, Group Vice President CAD/CAM & Orthodontics, Dentsply Sirona. “Furthermore, the high level of scanning accuracy offered by our new intraoral scanner Primescan is set to inspire digital dentistry among numerous dental practices and labs.”

An application-oriented approach to developing digital dental technology

This cooperation also comprises the alignment of data interfaces between the exocad DentalCAD software and the inLab CAD/CAM components from Dentsply Sirona, such as the highly accurate scanner inEos X5, and the laboratory production units, inLab MC X5 and inLab MC XL. Above and beyond this, the material-related design parameters of selected Dentsply Sirona CAD/CAM materials and dental databases will be integrated in the exocad software.

“The integration of material parameters and tooth lines in the DentalCAD software offers exocad users additional advantages, as well as enhanced process safety in terms of indication-tailored designs and reliable workflows in the lab”, explained Tillmann Steinbrecher, the CEO of exocad.

The cooperation between these two dental companies not only promotes digital dental technology and dentistry as a whole, but also the position of the individual user groups—for even safer and more efficient dentistry.

Fig. 1: Thanks to this cooperation, dental practices with Dentsply Sirona intraoral scanners such as Primescan will now, for the first time, be able to work with exocad laboratories in a validated workflow and transmit digital impressions conveniently and directly for a whole range of indications. Fig. 2: This cooperation also comprises the alignment of data interfaces between the exocad DentalCAD software and the inLab CAD/CAM components from Dentsply Sirona, such as the highly accurate scanner inEos X5 and the laboratory production units inLab MC X5 and inLab MC XL.