19th BDIZ EDI Expert Symposium, Cologne, Part 1

Start of the BDIZ EDI training year: Digital dentistry

At the 19th BDIZ EDI Expert Symposium, the focus was on digital dentistry—the current possibilities and limits of digital treatment therapy. Controversial expert discussions met with a highly motivated professional audience.

The symposium was hosted by BDIZ EDI President Christian Berger, Prof. Jörg Neugebauer and Prof. Hans-Joachim Nickenig from the University of Cologne. The different approaches—from AI in medicine and dentistry to digital procedures in periodontology and implant surgery, navigated implantology, and the state of the art of dental 3D printing in the practice and laboratory—highlighted the present and future of the digital workflow. The scientific director of the symposium was Prof. Joachim Zöller.

Part 1 of this summary covers the first five presentations; The remaining presentations will be covered in the 2/2024 issue of the *EDI Journal*.

Jörg Neugebauer, Prof. Dr med. dent.: Digital planning and diagnostics: where do we stand today?

Prof. Jörg Neugebauer (Landsberg am Lech, Germany), Secretary General of BDIZ EDI, provided an insight into current and future developments in treatment planning and diagnostics. When do I use the CBCT? According to Neugebauer, CBCT is a highly invasive diagnostic procedure because of the ionising radiation it produces. However, there is no need to do without CBCT, as the radiation exposure can be significantly reduced depending on the indication. Neugebauer, who is Professor of Digital Dentistry at Steinbeis University, made it clear that CBCT, in combination with surface scans, can significantly improve the results of the diagnostic process. Much more can be expected in the future—especially for prosthodontists, where CBCT could open up new possibilities in the area of implant preparation.

AI can be expected to improve the effectiveness of treatment quality. Neugebauer criticised the AWMF guidelines on

digital planning and diagnostics as not reflecting the current state of the art. Alternative techniques such as magnetic resonance imaging (MRI) do not use radiation at all, but only the more benign influence of a magnetic field. The tube into which patients are placed no longer has to be as claustrophobically narrow. Soft-tissue structures—especially the alveolar canal—can sometimes be visualised better than with a CBCT. The use of MRI in treatment planning is also a possibility. Based on the developments of the past few years, Neugebauer has lofty expectations for the future.

Klaus Ständer, Dr med. Dr med. dent.: Fundamentals of AI in medicine and dentistry

The first presentation on the basics of AI in medicine and dentistry was given by Dr Klaus Ständer (Traunreut, Germany). Ständer introduced the sub-disciplines—pattern recognition (e.g. speech and handwriting recognition), knowledge modelling, expert systems (e.g. question-and-answer sessions, chatbots), machine learning, artificial neural networks and deep learning, computer vision, robotics and universal game programs.

He affirmed that he believes AI has the potential to improve patient care and meet the challenges of an ever-increasing flood of information and data in dentistry and medicine at a time of limited human resources.

At the same time, he called for a critical and responsible reflection on the limitations and risks of AI applications. In addition to scientific transparency, he also sees the strengthening of medical expertise as an important basis for this reflection. "AI makes mistakes, and we need to control it. But AI also learns from its mistakes!"

Volker Knorr, Dr med. dent.: AI in dentistry—a curse or a blessing?

Dr Volker Knorr (Eislingen, Germany) began by recalling that eight years previously he had been working on implant robots with the aim of replacing human surgeons. "Today we know that we still need human power!" But there are other forms of AI, he said, such as apps that allow patients to upload selfies on their mobile phones to find out about the state of their dental health. The automotive industry has shown the way—not only in car design but also by putting all those sensors in their cars. In dentistry, for example, some electric toothbrushes have sensors that monitor the pressure applied to the teeth. He described CNNs (convolutional neural networks) in deep-learning systems as a complex technology, inspired by biology.

Anything that is not physiological—including pathologies—is recognised by specific filters. In Knorr's estimation, the detection of various orthodontic fixture with radiological analysis programs means faster processing and lower as the "data rush" in dentistry has begun. The creation of surgical templates with intercuspation models that match the maxilla and mandible eliminates the need for traditional bite registration. His credo when it comes to artificial intelligence: "Don't rely blindly on AI. Data matching is the most important issue!"

Falk Schwendicke, Prof. Dr med. dent., participated remotely with his presentation on "Artificial intelligence in dentistry: opportunity or folly?"

Prof. Falk Schwendicke (Berlin, Germany) began by recalling that AI has been around since 1943 and has continued to evolve, with the *New York Times* describing what AI was already capable of in 1958: "[The Perceptron] is the embryo of a computer that [...] will be able to walk, talk, see, write, reproduce itself and be conscious of its existence." But we also experienced various "AI winters", period of reduced funding and interest in AI research, because we had neither the hardware nor the software and could not develop a coded language with rule-based systems. It is only in the last 15 years that AI has achieved success in self-learning. This has a lot to do with other algorithms, with neural networks and with today's vast amounts of digital data: video, speech, photorealistic representations of people, which never existed before. So-called prompting (keywording)—which drives ChatGPT interactions to elicit responses or images—has begun to eliminate the need for video dubbing and language interpretation. As an example, he cited the EAO congresses, which use AI to provide synchronous interpretation in different languages. Meanwhile, AI systems have also appeared in dentistry: take a picture, send it to the cloud to detect periodontal bone loss, carious lesions, distances between the lower molars and the alveolar nerve, and much more. The results of the detection can then be evaluated accordingly. The accuracy is currently around 90 per cent. "That's why it's so important to check the results", advised Schwendicke. The bottom line is that AI is nothing more than mathematics, a technology for processing massive amounts of data, and can be seen as a "learning" system. Today's AI systems achieve results similar to those of well-versed practitioners but can provide massive support for communication and documentation. They already have an advantage in certain indications and can be used for diagnostic purposes: "AI systems are constantly improving, while we dentists are not necessarily improving." However, according to Schwendicke, P4 dentistry by AI—predictive, preventive, personalised, participatory—is still a long way off.

Gerhard Werling, Dr med. dent.: Dental printing in the laboratory and practice

Do you need a dental 3D printer in your practice? Dr Gerhard Werling (Bellheim, Germany) answered his own initial question with a resounding "yes". In his presentation, Werling provided an overview of current 3D printing landscape and highlighted practical aspects, including the integration of 3D printing technologies into prosthetic manufacturing processes, the production of surgical guides for implant planning and the manufacture of patient-specific models, splints and even definitive 3D-printed restorations. A 3D printer takes care of the printing, washing and post-curing steps. The workflow is simple—you scan the impression and either create the design yourself or outsource it via cloud services. Then comes the printing phase and finally the post-curing phase. Werling's logical conclusion: "Anyone who has an oral scanner will also get a 3D printer."

He was unable to give a clear answer to the question of whether additive 3D printing will be largely replaced by subtractive grinding and milling in three years' time. But he did say that 3D printing has specific advantages: while milling has advantages in the crown/bridge technique, in terms of aesthetics, strength and, above all, the many extant clinical studies, Werling contrasts this with the advantages of 3D printing, which include low material and processing costs, almost no geometric limitations, time savings and many indications, including at chairside. He declined to answer the question of whether there milling machines will have disappeared three years from now. Werling also believes that the combination of innovative materials, specific dental workflows and AI-based software, as well as increasing cost pressures, will make 3D printing indispensable for dental practices and laboratories.

To be continued

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