Advancing technologies in ceramic implantology—AI sets new milestones in dental treatment

An interview with Dr Shepard DeLong, owner of the holistic dental practice Lotus Dental Wellness, USA

Artificial intelligence (AI) in dentistry has started to bloom in recent years. From a dental perspective, applications of AI can be classified into diagnosis, decision-making, treatment planning and prediction of treatment outcomes. Computer programs for dental use are becoming increasingly intelligent, accurate and reliable. OEMUS MEDIA had the great opportunity to interview Dr Shepard DeLong, who is known for his use of and knowledge on advanced dental technologies and their application to holistic dental care, about his approach, findings and experience with AI in dentistry and implantology in particular.

The integration of AI in dentistry can have various effects on the dentist–patient relationship. From your perspective, what are the major benefits of using AI in the dental practice in this regard?
I had the opportunity to use an AI diagnostic tool with one of my patients yesterday. I asked the patient how it made

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her feel to see me using AI as an aid in my diagnosis of her health, and she said that she thought it was a good thing as long as I employing my own experience and knowledge to interpret the AI findings. I reassured her that this was the case and that when used with care and expertise AI is becoming an invaluable tool. Actually, the biggest benefit I see is that I am less likely to miss a meaningful finding, and it greatly enhances trust between dentist and patient.

Have you been able to further individualise treatment plans since you implemented AI in your office?
Our dentists and patients at Lotus Dental Wellness have all experienced the benefits of cutting-edge technology for almost a decade. Each patient already receives very individualised care with every case and treatment. AI only enhances our sensitivity and ability to stay true to a preventive, minimally invasive, accurate diagnostic and treatment workflow. Now, if it is not used, patients will ask for it. Some of the data is still anomalous, so it can be overwhelming or hard to explain. Overall, it adds value for me and my patients.

Does it save time? How efficient is the use of AI in your office?
Yes, it saves time, because it draws out and quantifies findings that may otherwise be unremarkable. In the case of periodontitis and bone loss, I found myself making different treatment recommendations based on seeing measurements of the cemento-enamel junction to the crest visible on routine radiographs. The severity of caries is also now quantified, so decision-making is facilitated, as well as risk assessment.

Can AI tools help address dental anxiety among patients? How do patients perceive the trustworthiness of AI-driven diagnostic and treatment recommendations?
I think the key here is that care, compassion and the goal of improving well-being drive the entire dentist–patient relationship when it is functioning properly. With the aid of AI, trust no longer relies solely on a dentist's personality

or powers of persuasion, both of which are pretty irrelevant to quality of care. Much of what drives patient anxiety is the loss of control or of confidence that what is being done is the right thing. AI helps with that.

Let's dig a bit deeper into the clinical aspects and benefits of AI to your work and your routines in your clinic. We know that you are using a robotic surgery aid. What is it exactly that you have implemented? What are specific challenges in oral surgery utilising a robot?

This question strikes close to home. I pour my soul into advancing technology for the dental industry. In almost every way, the quality of care, the beauty of form and the nuts and bolts of strength and function have been enhanced with digital workflows. The ease of operating has increased for our dentists, and our practice has a cult-like following of believers. Good ergonomics and long-term well-being of dentists and other members of the dental team are part of our core values. Robotic surgery for implant placement is the latest addition in our office. Our commitment is not only to electronic, digital or AI-driven tech but to biotech and biomaterial advancement too. We are the only team in the world dedicated to the placement and restoration of zirconia dental implants utilising dynamic navigation and robotic assistance in all but the unavoidable freehand cases.

The challenges are still great. It's 8 p.m., and I literally just finished a dual-arch ceramic implant case for which, after much planning, the robotic workflow had to be abandoned. This can happen. Time, cost and new obstacles are all part of the puzzle, but we have gotten glimpses of the future. Terms like "ultra-precision" started to pop up as we planned in robotic software, then we were able to make micro-modifications during surgeries, and the results have been fantastic. For the early adopters that have made their way through CEREC or digital dentistry, CBCT, and guided and ceramic implantology, we can already see the other side.

Does AI contribute to the diagnostic phase of treatment planning in oral surgery? How do AI algorithms assist in analysing patient data such as obtained from CT scans or 3D imaging for optimal implant placement?

I would lean heavily on companies like 3DDX, ImmersiveTouch, CAD-Ray or Anatomage to do segmentation and deeper analysis of CBCT data. Implant positioning for the various ceramic systems I use still requires significant thought and prosthetic tweaking so that our placement and restoration are near ideal. There are some tools in use within YomiPlan software, things like automatic segmentation of the sinus cavity to aid in sinus lifts, but the software is not yet predictably mapping for us. Nerve segmentation is still through third-party software or radiology services.

Robotic surgery conducted by Dr Shepard DeLong and Dr Travis G. Hunt.

And how does the incorporation of dental robots enhance the precision and efficiency of oral surgery procedures?

This is something that I got great perspective on last year at the first Mayo Clinic Robotics and Advanced Surgical Technologies symposium. Other surgical specialties were discussing the overwhelming adoption of robotics in enhancing patient outcomes. Freehand skills, static guides and dynamic navigation all can lead to excellent outcomes, but robotics allows a less skilled surgeon to perform at or near the level of the best, especially when mentored, and it demands that dentists keep learning and practising so that the results continue to improve. I've been using the term "ultra-precision" to describe some of what I have seen during surgery and, even more impressively, during restoration of zirconia dental implants placed utilising robotics.

We have learned that the implementation of dental robots works wonderfully with titanium implants. You are using zirconia implants. What are the differences and challenges for both the surgeon and the robot-based system, if any?

It has been a remarkable year and a half! We have now placed four ceramic implant systems—SDS, CeraRoot, Zeramex/Nobel and Z-SYSTEMS—successfully and fully guided. It was laborious to get all the companies to work

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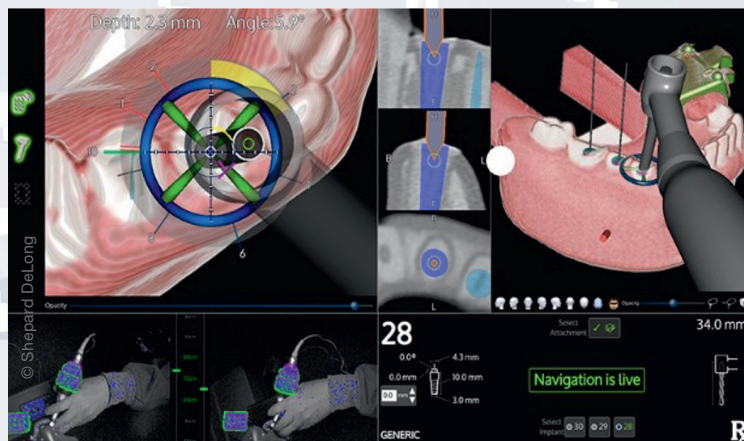
together to put the sizes and shapes into the software as fast as possible, and yet we placed a lot of implants while calculating all the data the software didn't have right yet. Other challenges include carrier systems and implant mounts that are not retentive enough or too retentive for the rigidity and freedom of a robotic arm and incorporated dental handpiece. Also, driver lengths, hand-based carriers and low maximum torque values add to the challenges.

How does AI play a role in selecting the most suitable zirconia implant size, shape and placement for each patient?

At this point, AI plays a negligible role in implant selection. I know this will come. As talk to text and AI can code, we will move towards an automated, ultra-precise surgical and restorative plan. For now, it is a lot of thought, experience and care that goes into making each case a success.

In what ways can AI assist in real-time decision-making during surgery, considering factors like bone density and tissue response?

This is where the haptic guidance of the Yomi robot and the freehand feel of the X-Guide allow the surgeon to feel the bone. Visualisation of the surgical site with physical guidance is where Yomi shines. During surgery with X-Guide, the surgeon's eyes must be on the screen. With Yomi, you get both freehand tactile feel and haptic feedback, and you can use real-time visual observations to modify surgery towards achieving great outcomes.

How are ethical concerns addressed, such as patient consent, data security and the responsible use of AI in the context of oral surgery? Have you faced any issues on that?

Thank you for asking. Almost all our patients have been very receptive of Yomi. Its use in our practice was preceded by X-Guide and my previous commitment to place ceramic implants exclusively. There is regulatory clearance on all these products and devices, and yet we encounter the unknown and untested when using all of them

together. This is where new connections, new workflows and, ultimately, new solutions to human health problems will come from. We have a thorough understanding of risk and believe privacy, autonomy and informed consent are all paramount in modern medicine. There will be new standards of care. It is up to us to define them.

We seem to have entered an unprecedented time of new and exciting discoveries in dentistry. Please would you share this journey with us and give us a few concluding remarks?

I know that the readers of *implants* will take what I have said here with a proverbial grain of salt or a bit of healthy caution. I think that is wise. Let experience guide your wisdom and opinion. After you see something intriguing, promising even, follow your own intuition and go where it leads. If we utilise new ideas and technology while allowing our human knowledge and hearts to guide what to do, the results are going to build a new reality. This is just the beginning. AI, robotics, ceramic implants—the future we are creating is already here. When we see solutions, I think we must share. I look forward to continuing our conversation and journey!

about the interviewee

Dr Shepard DeLong is a third-generation dentist at the forefront of digital evolution and the development of novel technological workflows in dentistry. He holds a BS from Portland State University and a DMD from Oregon Health and Science University in Portland and completed a general practice residency at the Queen's Medical Center in Honolulu in Hawaii, all in the US. He has a part-time position at Pure Health Dentistry in Maui in Hawaii and owns Lotus Dental Wellness in Lake Oswego in Oregon. He is a residency site director for the MSc in implantology programme at Jacksonville University in Florida in the US and lectures on ceramic implantology, robotics, lasers and digital dentistry. His latest project has been the sharing of the profound advantages of combinational technologies for the health of both dentist and patient. He is a member of the Academy of Microscope Enhanced Dentistry, International Academy of Ceramic Implantology, European Academy of Ceramic Implantology, and International Academy of Oral Medicine and Toxicology and has served as a mentor for CDOCS. He can be reached at drdelong@lotusdentalwellness.com.

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