Artificial intelligence (AI) has broken free from the pages of science fiction to become fact. Machines and software that can think and learn are now a reality and a wave of dental startups are developing new AI-assisted technologies for dentists. So what are some of the youngest companies in the industry hoping to achieve? And how can they bring their AI solutions from the drawing board to the dental practice?

Most readers will have first been introduced to AI as the fodder of fiction in comic books, novels or films screened on late-night television. AI typically impressed but usually came with the ominous caveat of potentially outsmarting its creators. The murderous Hal 9000 computer in Stanley Kubrick’s 1968 film *2001: A Space Odyssey* is just one example in a litany of bad introductions to AI. Nowadays, science has caught up with science fiction. Around 16,000 peer-reviewed scientific papers are published in the AI field each year, and smart software has proven its worth in applications spanning a range of fields from the automotive industry to health care. According to dental startups, AI has the potential to make a big impact in dentistry in areas such as diagnostics, smile design and treatment monitoring. These companies are focusing on research and development and obtaining the funding that will help them to make AI a part of daily business in dental practices.

Getting smart with medical imaging

Medical imaging is a valuable source of information in diagnostics and quick advances in the segment mean its availability may grow to outstrip the capacities of medical specialists. Tasking machine learning algorithms with lightening the workloads of doctors and dentists need not be seen as a compromise.

A systematic review and meta-analysis, published by the *Lancet Digital Health* on Sept. 25, 2019 compared the performance of deep learning—a type of AI—with that of health care professionals in the detection of diseases using medical imaging. Based on a review of 14 studies conducted between 2012 and 2019, the review found that the diagnostic performance of deep learning models was equivalent to that of health care professionals. The researchers noted that AI models have become more accurate in diagnosing diseases in the last few years, hinting at the possibility of a continued improvement that may see AI models outperform medical professionals in diagnostics in the near future.

AI in dentistry is now a reality, and both the literature and the practice show a broad application. From digital smile...
design through to cutting drug prices, visualizing a patient’s pain in real time during treatment and detecting oral cancer, the question is no longer whether but how dentists and dental technicians can harness this technology. The range of reasons that they should be interested in AI include improving patient care, streamlining workflows and increasing revenues. The Canadian startup Denti.AI, for example, is using cloud-based AI to interpret dental images for diagnostics using machine learning algorithms. Denti.AI’s promise to customers, according to company information, is to increase revenue per patient while addressing problems related to quality assurance and liability.

Dental startups are leading the way

The recent Charité BIH Entrepreneurship Summit 2019 in Berlin, Germany, focused on global trends in health care, including AI. Jurors selected a pitch by Dr. Falk Schwendicke, Deputy Director of the Department of Restorative and Preventive Dentistry at Charité—Universitätsmedizin Berlin and Chief Medical Officer of the dental startup dentalXr.ai, as the winner in the digital category. Schwendicke and his colleagues have focused on digital radiography to develop a tool that helps dentists to diagnose, document and make decisions based on digital radiographs. The tool—a decision support platform—seeks to improve the reliability of using this staple of diagnostics while also speeding up what can be a time-consuming process for dentists.

Schwendicke told DTI that the treatment application for using AI to screen digital radiographs varies widely, improves accuracy and saves time.

“We help dentists detect dental pathologies, such as caries, apical lesions, periodontal bone loss; and plan for restorations like crowns, implants and fillings quicker and more accurately—up to 40 per cent higher accuracy—thereby allowing them to make better treatment decisions for their patients. As well, multiple tests with dentists have shown that our product supports dentists in reducing the time spent on documentation of dental radiographs by 50 per cent.” Schwendicke added that the platform has also had a positive effect on patient relations. “All dentists have confirmed that the use of our product enables them to have a more transparent and trustworthy communication with their patients,” he said.

DentalXr.ai is a new startup company based in Berlin that will be begin business in the fourth quarter of this year. Numerous dentists in Germany have tested the company’s product and dentalXr.ai is currently running a beta test with a broader dentist population. After receiving the CE marking product certification, dentalXr.ai plans to launch its product in Europe in the first half of 2020.

According to Schwendicke, in order to gain acceptance among dentists, newly introduced AI technologies, such as the decision support platform, need to deliver what they promise. If they can do this, then the potential in the practice is considerable.

“At the beginning, it will be important for us to deliver our value proposition—better diagnostic decisions in less time—to dentists with our initial product. In the future, we see the potential to move from AI-assisted diagnostics for numerous dental pathologies to AI-based prognostics supporting dentists in making the best and most informed treatment decisions at any given time. Given our access to substantial longitudinal datasets—radiographic data, patient data, claims data—and our outstanding network of renowned dentists from the Charité and many other clinical partners worldwide, we are in the best position to create the maximum value for dentists.”

Funding will bring AI into more dental practices

VideaHealth says AI is the future of dental care and can help dentists detect dental diseases earlier and more reliably. The Cambridge, Massachusetts-based dental startup spun out of the Massachusetts Institute of
Technology (MIT) in 2018 after two years of research into how AI can improve dental care. It says its product VideaDetect can identify up to 25 per cent more dental diseases than the average dental practitioner and that it collaborates with dentists around the world to continuously improve its algorithms.

VideaHealth has partnered with dental organizations to bring its AI-assisted diagnostics to dental practices across the U.S., and a recent cash injection will help the startup company to make an even bigger impact. A September U.S. Securities and Exchange Commission filing showed that the 1-year-old company raised $5.4 million in equity through reported investment by Zetta Venture Partners, Pillar and the MIT-affiliated Denta V.

After the funding round, VideaHealth CEO Florian Hillen told TechCrunch that dental practitioners are proving more receptive to automation technologies than other health care professionals are. He explained that dentists perform multiple roles within their practices and therefore see technologies like image recognition software not as a threat but as a something that can increase efficiency. “AI in radiology competes with the radiologist,” Hillen told TechCrunch. “In dentistry we support the dentist to detect diseases more reliably, more accurately, and earlier.”

VideaHealth will reportedly use the funds to increase its team and conduct further research and development.

From startup to major player

The Paris-based orthodontics technology specialist Dental Monitoring is no longer a startup because it has a range of products that have successfully found their markets. Founded in 2015 and now employing over 200 staff members in Europe, the U.S. and Asia, the company is an example of how AI-oriented startups can quickly have an impact of scale on dental care.

Dental Monitoring has three AI-powered solutions for dentistry. SmileMate is a mobile app-driven system that analyses the oral cavity to identify a range of oral, dental and orthodontic conditions. The company’s DM Vision solution uses AI to generate simulations of future smiles as the outcome of potential treatment. The third solution is Monitoring, which helps patients to photograph their own teeth at set intervals using a smartphone. The app crops the photographs and organizes them by date and angulation and helps to streamline the treatment experience for patients and minimize practice visits.

The company’s claims of helping dentists to provide treatment that is more efficient are backed up by science. Researchers from Virginia Commonwealth University in Richmond, U.S., investigated the company’s smartphone-based orthodontic treatment app in a study published online by the Angle Orthodontist journal in March. The study compared tooth movement calculated by the software using intraoral video scans taken by patients with actual tooth movement data gathered during practice visits using plaster models. The researchers found only a negligible average difference between the movements calculated by the app—those for intercine and intermolar varied on average by 0.17 mm and −0.02 mm, respectively. The researchers concluded not only that the in-office and software measurements were equivalent within 0.5 mm but also that the at-home intra-oral scans done by patients were just as good as those done in the practice by clinicians.

The Straumann Group announced in April 2018 that it had invested in the French company. At the time, Marco Gadola, CEO of the Straumann Group, said the company’s technology and its mobile applications would change dentistry. “Our investment in DM provides us with a proven orthodontics tracking system and access to artificial intelligence technology. It also secures an innovative partner with the expertise to develop further leading-edge solutions in our field.”

The agreement gave Straumann distribution rights to the company’s technology and an unspecified stake in Dental Monitoring.

The future of AI in dentistry remains unwritten

AI has experienced several “winter” periods. The most notable of these was between 1974 and 1980 and between 1987 and 1993, when the thread of progress was lost and funding and research initiatives for AI technologies went cold. The level of research and development currently being invested indicates a strong resurgence period for AI, particularly in health care. Obtaining funding is crucial for AI startups in dentistry, but the industry’s thirst for new technologies means that cash is available. Established dental companies, meanwhile, will be keeping a close eye on the potential of new AI solutions.

Is AI a panacea for streamlining dental care? This remains to be seen, because the technology’s ultimate impact rests also on future developments. As the American professor of cognitive science Dr. Douglas Hofstadter wrote in 1979, the “AI effect” tells us that the definition of AI is constantly evolving. He continued: “[Once] some mental function is programmed, people soon cease to consider it as an essential ingredient of ‘real thinking.’” Hofstadter quoted the prominent computer scientist Larry Tesler, who said: “Intelligence is whatever machines haven’t done yet.” If Tesler was right, in the future, AI may be used in dentistry in ways we have not yet considered.