Dr João Fonseca: Computer chips and architecture have evolved enormously over the last few decades. Nevertheless, some predicted leaps in technology have yet to happen, as Moore’s Law predictions are right on track. Google announced recently that it is launching a new processing unit that will enhance our processing capabilities by a factor of three Moore’s generations (seven years). Smarter machines with better algorithms that take advantage of billions of transistors and complex chip architecture will be used in the future to better aid the dental team in all phases of the treatment plan. And that will, of course, mean the generation of better proposed treatment based on morphology databases and algorithms, with higher possibilities of success regarding aesthetic integration. In addition, the possibility of immediately printing and snapping on aesthetic mock-ups might be a powerful diagnostic tool in the near future.

Although digital technology can facilitate and increase the efficiency of dental treatment, some human qualities are probably difficult to replace. Yes. Although some enthusiasts in the field of artificial intelligence predicted a technological singularity [Editorial note: According to the technological singularity hypothesis, accelerating progress in technologies will result in a runaway effect in which artificial intelligence will surpass human cognitive ability] during this century, to date, machines are not able to learn or to feel the way we humans do. When you gaze at the stars or watch the sunset on a perfect summer’s day, it is this kind of sensation that cannot yet be described in a mathematical formula or decomposed in a way that could be emulated by a computer. There are other aspects in dental prosthodontics and aesthetics for which we could debate whether machines would be able to replace us, but I think human emotion will continue to draw a line for many years to come.

Apart from the new possibilities that digital dentistry offers, what does the increasing automation mean for both the patient and the clinician? Increasing automation means that fewer and faster human-intervening steps will likely relieve the bur-
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den of complicated execution in oral rehabilitation. Clinicians will have more sophisticated tools in every phase of treatment planning and execution. This will allow them to give greater attention to patients’ expectations and details that are sometimes compromised, as clinicians focus on the execution barriers often imposed by the workflow. Patients will benefit because automatisation has the potential to reduce treatment time, improve the treatment experience, potentially reduce overall cost and increase success rates.

What would be a good combination of the best of both conventional methods and CAD/CAM regarding dental restorations?

In my opinion, with the currently available technology, functional and aesthetic diagnostics in dental medicine should be a human-based, human-executed task. To give an example, although I find digital tools of interest in aiding patient–clinician–technician communication, morphology assessment, discussion and approval should be a process involving real intra-oral prototypes (regardless of the way these are obtained during the diagnostic workflow). Regarding definitive restorations, I think that the future is unpredictable, as bioengineering is advancing at a fast rate. So, it is unlikely that ceramic materials will be cutting-edge in 30 years’ time. For now, we can make monolithic restorations with 3-D staining and glazing, combined with mechanical polishing. This integrates amazingly in many clinical scenarios and is likely to become a trend as materials improve every year. It may be that, in the next ten years, laboratories can print dentine mamelons and inner characterisation effects, which would make handcrafted veneers and crowns a thing of the past.

A recent study in Japan has investigated the possibilities of a robotic device for automatic tooth preparation. Do you think that this is a realistic scenario for the near future?

As Tom Davenport stated early this year, "...smart leaders will realise that augmentation—combining smart humans with smart machines—is a better strategy than automation." Evolution will happen in both directions, as smarter machines will require smarter minds. I believe that the digital future holds promising prospects. Never before have we witnessed so many young talented dentists eager to share their experience and contribution to dental aesthetics. Materials will improve even further in the near future, with better functional performance and chameleon effects. 3-D printing will enable multilayering to be an automated process, reducing human resources spent on minor tasks and allowing professionals to focus on planning and decision-making during fabrication of dental prostheses. Dental aesthetics will become more attractive for the patient, and more clinicians will be able to deliver restorations with a high-quality standard to their patients.