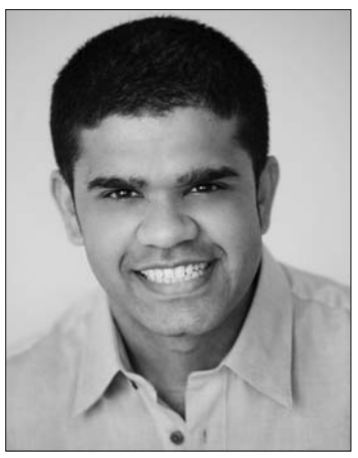
CAD/CAM and growth factors—Key areas of dental innovation

By Dr Nilesh R. Parmar, UK



Dr Nilesh R. Parmar

Dentistry has come along way since our colleagues were forced to use foot powered drills and mix amalgam from its bare components. Modern day dental equipment and materials are at the cutting edge of medical and dental innovation, and it's shows such as the International Dental Show (IDS) where the developments of the future are announced. Modern dentists no longer have merely a straight probe and a dental drill at their disposal. We now have scans, 3-D images, growth factors and an almost unlimited choice of materials available to use.

In writing this piece, I made a tough decision to focus on what I believe to be key areas of dental innovation. It is in these areas of imaging, CAD/CAM technology and growth factors that I believe are going to be important in the dental surgery of the future.

CAD/CAM

Computer-aided design/computer-aided manufacturing has had a presence in dentistry for nearly 20 years. However, only it is only in the last ten years that developments have really made a difference in the reliability, ease of use and functionality of these devices. We now have CAD/CAM machines (e.g., CEREC, iTero, Lava) that can scan an entire arch, design and fabricate all-ceramic restorations in the practice. The popularity of chairside CAD/CAM units has never been greater. The materials that we are able to use in conjunction with CAD/CAM scanners have gone from monolithic, one shade blocks to multi-layered, all-ceramic, lithium-disilicate constructions that can be sintered and finalised in as little as 15 minutes.

The appearance of these restorations, although still needing a well-trained (and artistic) dentist, could be said to be on par with certain lab-based fabrications whilst maintaining the advantages of being a chairside single visit restoration. CAD/CAM technology is now almost universally used in the fabrication of dental implant abutments and bars, reducing construction times, designs and fit. Dentists are now beginning to use chairside CAD/CAM devices to restore dental implants without the need for any impressions.

CBCT 3-D scanners and CAD/CAM integration

Cone beam computed tomography 9CBCT) scans are now commonplace in dentistry, particularly in implant dentistry where Grondahl (2007) found that 40 per cent of all CBCT scans were taken for implant treatment. Where 3-D scans were reaching a shortfall was in actually relaying the information obtained into the mouth during the surgical procedure. One recent innovation has been to overlay scans of the patient's own teeth and soft tissues onto the CBCT scan data. This gives an accurate representation of the hard and soft tissues and their relationship to each other. For example, an implant can be planned in the implant software with the angulation of the implant taking into account the ideal position of the final crown, which can also be shown in the CBCT scan.

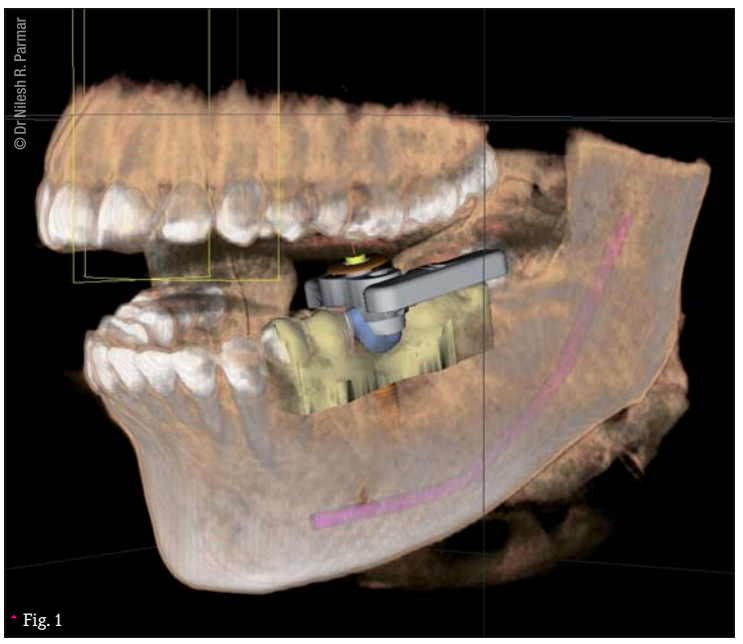


Fig. 1

In order to do this previously, the dentist would have to make a study model and then wax up the ideal final restoration contour, ensuring some barium sulfate within in the wax in order for it to show up in the scan. This was both costly and time consuming. Recent developments have allowed one to take an intra-oral scan using a suitable device, such as a CEREC or iTero machine, and overlay this with the CBCT scan. No models, no wax ups; the procedure is almost instant and can be done with the patient in the chair. As a patient education tool, this visual format is invaluable, allowing patients to fully understand the proposed work and its execution.

Taking this one step further, guided implant surgery now allows us to not only plan implant placement using ideal restoratively driven protocols, but actually allows us to make a guided surgical stent, made in-house or by a lab, and place the implant through the stent. Studies have found that this is an accurate treatment modality that can be reliably executed. Flapless surgery with immediate temporisation has the ability to revolutionise the patient journey and help us to meet their expectations.

Facial scanners

A small but rapidly developing area of digital dentistry is facial scanners. These are in their infancy at the moment, with a lot of companies still trying to iron out the bugs in the machines. Their potential applications in the field of plastic surgery, facial aesthetics, orthodontics, implant surgery and orthognathic surgery are endless.

I have been fortunate to see a prototype facial scanner from Sirona and even managed to have my face scanned *(Figs. 1 & 2)*. The detail achievable with these units is impressive. Once this information is combined with 3-D scans, teeth scans and jaw articulation, a fully working and movable representation of the patient's head can be compiled on the computer screen. Allowing for treatment planning and assessment to be carried out without any need to see the patient. One application of this may be in developing countries, where various experts from around the world can examine complicated facial reconstruction cases without them actually seeing the patient. As already mentioned, the opportunities for patient education are huge, and with procedures such as plastic surgery and orthognathic surgery being so difficult to properly consent for, facial scanners will greatly aid clinicians.

Growth factors

Available for a long time in medicine and dentistry, growth factors have been the reserve of PhD students and professors until recently. The resurgence of the usage of platelet rich plasma (PRP) has come about with added research showing that using PRP can greatly improve osteoblast proliferation (Parmar 2009) and accelerate soft-tissue healing. Companies are now offering clinical courses for dentists to make, produce and use PRP in their own surgeries within 15–30 minutes. The main advantage of PRP is that it's free; is obtained from the patients' own blood, thus removing the risk of rejection; and can be made in vast quantities. As more research is published, coupled with simpler production kits, PRP use will increase in all aspects of invasive dental surgery.

The above is just a short description of what is being developed for the future. Dentistry has never been so intertwined with technology.

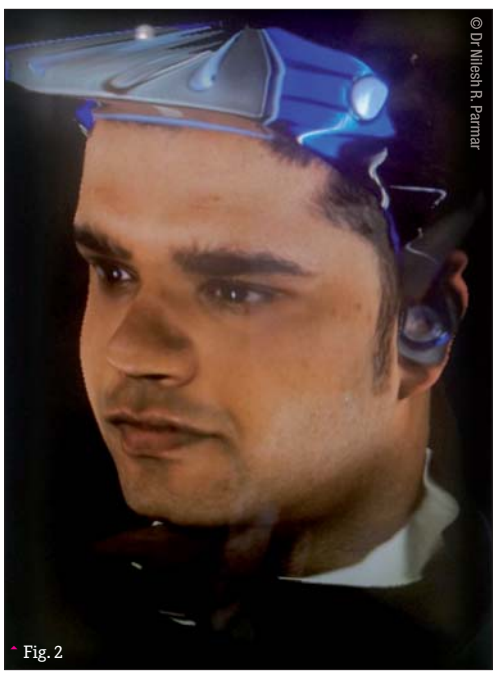


Fig. 2

The next ten years will prove to be exciting and I eagerly await to hear, see and use the new technologies that are being developed today.

Dr Nilesh R. Parmar runs a successful five-surgery practice close to London and is a visiting implant dentist to a central London practice. His main area of interest is in dental implants and CEREC CAD/CAM technology.

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BruxZir CASE 1

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