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digital

international magazine of digital dentistry

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Dr Scott D. Ganz

Editor-in-Chief

Choices

Another year has passed, and 2022 will soon be history. As we look forward to 2023, we should appreciate how technology and innovation have impacted our world of dentistry. So much has changed, and yet so much remains the same. While it is clear that digital dentistry has evolved from a concept to a reality for many dental practitioners worldwide, many have elected not to move from an analogue workflow to a digital workflow. Whether it be for general dentistry, crown and bridge restorations, endodontic treatment, oral surgery, dentures or dental implants, a digital solution is available. Although digital imaging has taken the place of film for necessary focused imaging for everyday dentistry, there are still those who have not parted with their developers for financial reasons or owing to old-school philosophical reasoning or fear of change.

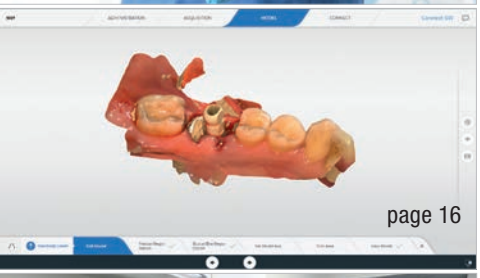
When it comes to patients who require complete dentures, the conventional training for understanding lip support, centric occlusion and vertical dimension of occlusion is still provided in dental schools around the world despite the fact that new digital protocols are available. However, it is still important to note that we must follow sound prosthodontic protocols to ensure success. Denture fabrication has been greatly impacted by new and improved materials that offer excellent strength and acceptable aesthetics produced by milling or 3D-printing modalities. The art of the denture impression with heat-activated border moulding, custom trays and wax rims has been replaced with intra-oral scanning and advanced software applications to aid in the virtual design of the definitive prosthesis.

The use of CBCT can provide 3D diagnostic imaging, which can be combined with other digital data to fully appreciate the patient's unique anatomical presentation. It is the complete assessment of the patient that will become the foundation for the treatment recommendations which become the plan to be completed by one or more practitioners. Yet, many dentists still live in a 2D world and have yet to appreciate the world of 3D imaging for dental implants, endodontic treatment, oral surgery, temporomandibular disorder, aesthetic smile design and much more. Unfortunately, there is both a financial cost as well as a cost in time for the clinical team to utilise technology correctly. As an example, we can use CBCT and interactive treatment planning software to assess implant receptor sites, merge the data with that obtained from the intra-oral scan and plan for implant placement and still place the implants utilising a freehand protocol, or we can use all of that information to elevate treatment and fabricate a surgical guide to accurately place the implant based on the 3D planning, taking the guesswork out of the process.

What does all this mean? We must decide which road to take when addressing the needs of our patients. As analogue methods are being replaced with digital workflows, we can either choose to be on board with a full commitment or we can adapt slowly after becoming educated and trained in the various protocols. Our end-of-the-year publication of digital may provide information to help clinicians learn more about what leaders in the field are doing so that an educated decision can be made.

Happy holidays!

Dr Scott D. Ganz
Editor-in-Chief



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What is driving the European dental implant markets?

By Simon Trinh, Canada

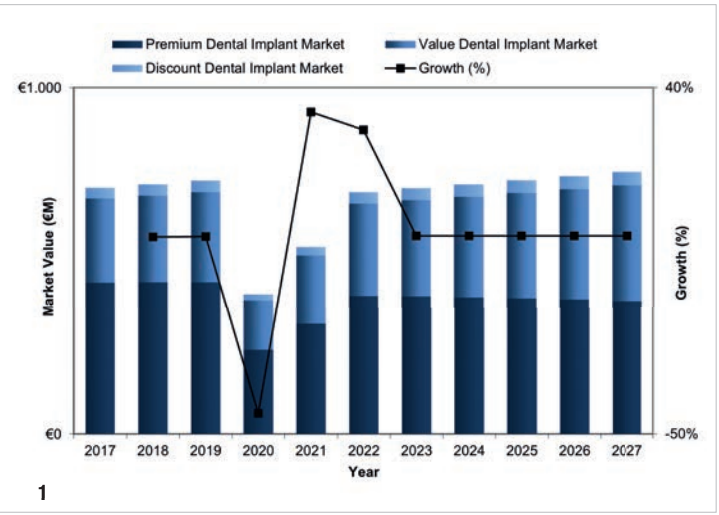
Unsurprisingly, the COVID-19 pandemic crippled the entire dentistry industry in 2020 and 2021, when elective medical surgeries such as dental implant and bone grafting procedures were postponed. Some countries, namely Switzerland, Belgium and the Netherlands, recovered more quickly than others, and others were heavily affected by extended shutdowns, particularly those that rely on patients from abroad, such as Italy. However, this impact on the market is relatively straightforward and predictable, devastating as it may be, and recovery will be a linear process. What is far more intricate to uncover are the factors that are driving the industry on a broader scale, looking years ahead instead of months.

It would be foolish to begin a discussion of market drivers for dental implants without addressing the most obvious factor: an ever-growing ageing population that naturally has a higher incidence of missing teeth and the need for aesthetic dentistry procedures. Once again, however, this is an obvious avenue of growth. A far more compelling patient-driven trend to discuss is cost and its implications.

It is not surprising that implant procedures are expensive by nature; however, it comes as more of a shock that there is almost no insurance coverage or reimbursement for such procedures. It is true that in some countries, such as Sweden, Germany and the Netherlands, governments do provide some form of reimbursement for dental implant procedures. However, coverage is usually limited and partial reimbursement is only so useful when the cost of a typical procedure is already so high. Furthermore, most private health and dental insurance policies do not cover dental implants. This is a severe hinderance for procedure growth, particularly in the younger demographic who cannot easily afford a procedure costing thousands of euros compared with people in their 50s or 60s.

Value segment companies flooding the European implant market

The use of cheaper implants is driving market growth, not in terms of sheer market value but in terms of procedure numbers. Nowhere is this more evident than in the Italian market, where there is a perfect storm of cost sensitivity and massive demand for aesthetic dentistry. Previously, patients had no alternative to expensive, premium implants, but dentists are now able to offer significantly discounted products at a fraction of the cost. Implants were once dominated by European products, but companies from South Korea, Israel and Argentina, to name a few, have emerged in great numbers in the market. Opening the market up to patients who could previously not afford such treatments has contributed to a substantial increase in potential procedure volume.



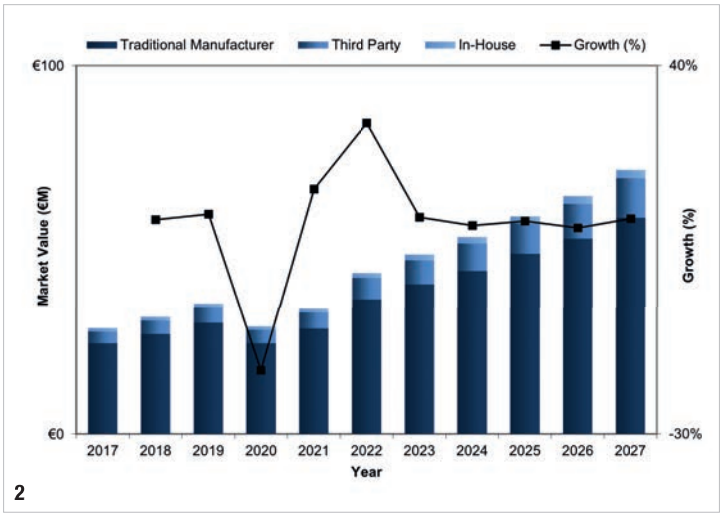


Fig. 1: Dental implant market growth in Europe. **Fig. 2:** Overview of the surgical guide market by manufacturer type. *(Source: © iData Research)*

Increasing number of general practitioners placing implants

Many would assume that the materials are only a fraction of the cost of the procedure and that the majority of the expense comes from treatment by a specialised dental implant professional, particularly in light of the limited availability of such practitioners. That was the case until recent years. Much more evident in the US but still a growing trend in Europe is the increased number of general practitioners who are able to perform dental implant procedures. Many postgraduate education programmes and training courses have gained popularity among general practitioners seeking to broaden their skills and increase the services they can offer.

This has had two major benefits:

a sizeable increase in the number of professionals who are able to offer dental implant services and the potential for longer-term decreased costs to patients as a result of this growing supply.

It is all about digital technology

Lastly, and certainly not a trend on the forefront of everyone's mind, is the slow but steady development and integration of digital dentistry. Over the course of the last two decades, digital dentistry has revolutionised the industry. While dental professionals are not known for their technological literacy or desire to be on the front lines of digital innovation within their practices, sentiment has dramatically changed in recent years, and this trend is an inevitability over time. This is particularly true for new dentists entering the market who are increasingly aware of the digital technologies available to them, such as treatment planning software, CAD/CAM, and software supporting the design of surgical guides and their use during procedures.

Additionally, an increasing number of dental schools are incorporating the latest technological advancements into their curricula, exposing prospective dentists to a wider array of available tools and reducing the time and effort needed to learn to use these. Also, of course, while an investment in computer technology such as treatment planning software greatly benefits dental professionals in terms of both efficiency and scope of services they can offer, it ultimately improves the quality of service delivered to the patients. The use of computer aids allows for maximum customisation for each individual patient case and higher levels of accuracy during procedures.

about

Simon Trinh is a research analyst at iData Research. He develops and composes syndicated research projects regarding the medical device industry.

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Artificial intelligence and augmented reality in implant planning

Dr Francesco Mangano, Italy

Dr Francesco Mangano.

Technology is now pervasive in dentistry, and implantology is no exception. Intra-oral and face scanners, CBCT and digital condylographs allow us to acquire 3D images and videos of our patients, useful not only for diagnosis but also for treatment planning. The patient becomes virtual.

Until recently, however, this information was difficult to segment and assemble, and this limited the patient virtualisation process. Obtaining the virtual patient was difficult and costly, needing time and effort, since segmentation and alignment were essentially manual, and operator-dependent.

Today, thanks to artificial intelligence (AI), it is possible to use cloud-based software capable of returning to the clinician, in a few minutes and at very low cost, the entire set of 3D files of the patient (derived from intra-oral, face and CBCT scanning). These files, in STL format, are perfectly aligned and segmented, eliminating any possible error by the operator. Each tooth, for example, is the result of the perfect fusion, segmentation and alignment of CBCT (root) and intra-oral (crown) scans. The segmentation and alignment are automated, being the result of a learning process (machine learning) which represents the basis of AI.

It is a real revolution that has opened the door to changes in all fields of dentistry: from the possibility, for example, of planning a 3D orthodontic set-up that is truly safe for the bone to the planning of prosthetic complex cases. In implantology, AI-assisted software such as Virtual Patient Creator (Relu) allows us to enhance our diagnostic and planning skills.

In particular, the use of 3D files in STL format processed by Virtual Patient Creator (Figs. 1 & 2), combined with modern virtual reality and augmented reality (AR) systems, creates new possibilities. In fact, it is possible to upload all files derived from AI-assisted software directly into apps specifically designed for AR, such as HoloDentist (FifthIngenium). Thanks to these apps, wearing an AR device such as HoloLens 2 (Microsoft), the dentist can view the holographic 3D models of the patient and use them to make a correct diagnosis and for communication with the dental laboratory, colleagues or patients in order to illustrate to them the selected treatment plan.

The use of AI and AR technologies transforms the manner of not only diagnosis and communication but also of implant planning. On the basis of the set of files segmented and aligned via AI, the surgeon wearing AR glasses such as HoloLens 2 or Magic Leap 2 (Magic Leap) can plan the positioning of one or more implants in the correct 3D position, inclination and depth, using holograms.* Basically, it is no longer necessary to use software dedicated to guided implant surgery: the surgeon drags and drops the desired fixture from a 3D library provided by the HoloDentist app and positions it within the holographic model of the bone. The surgeon can also enlarge the holographic models to such an extent that they have the same dimensions as the operator, and the same applies for the hologram of the implant. Finally, by navigating inside these models, the surgeon can tilt, rotate and otherwise move the implant within the bone hologram. This process is also guided by other masks and holograms, which can be on or off during 3D planning, for example that of the teeth and soft tissue or that of the prosthetic wax-up. This is authentic 3D planning, without the need for any guided

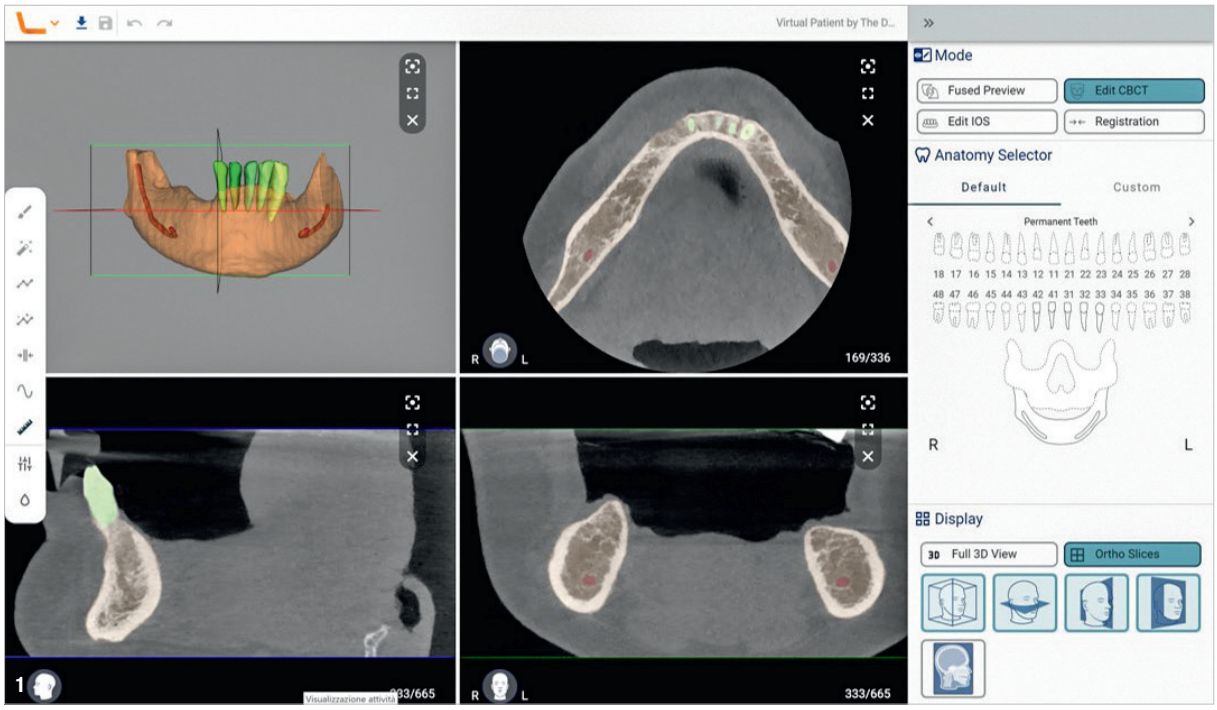

Fig. 1: Automatic segmentation from CBCT in Relu's artificial intelligence-assisted, cloud-based software.

implant surgery software or conventional 2D radiographic sections. This allows planning in a fast, intuitive and fun way, drastically reducing costs. The spatial position of the implant thus designed is saved and exported, together with the other files, for the design of the surgical guide, in open-source software. The next future development will be the import of this planning into a dynamic implant navigation system.

** Scan QR code to watch a video on 3D implant planning with holograms using HoloDentist and HoloLens 2.*

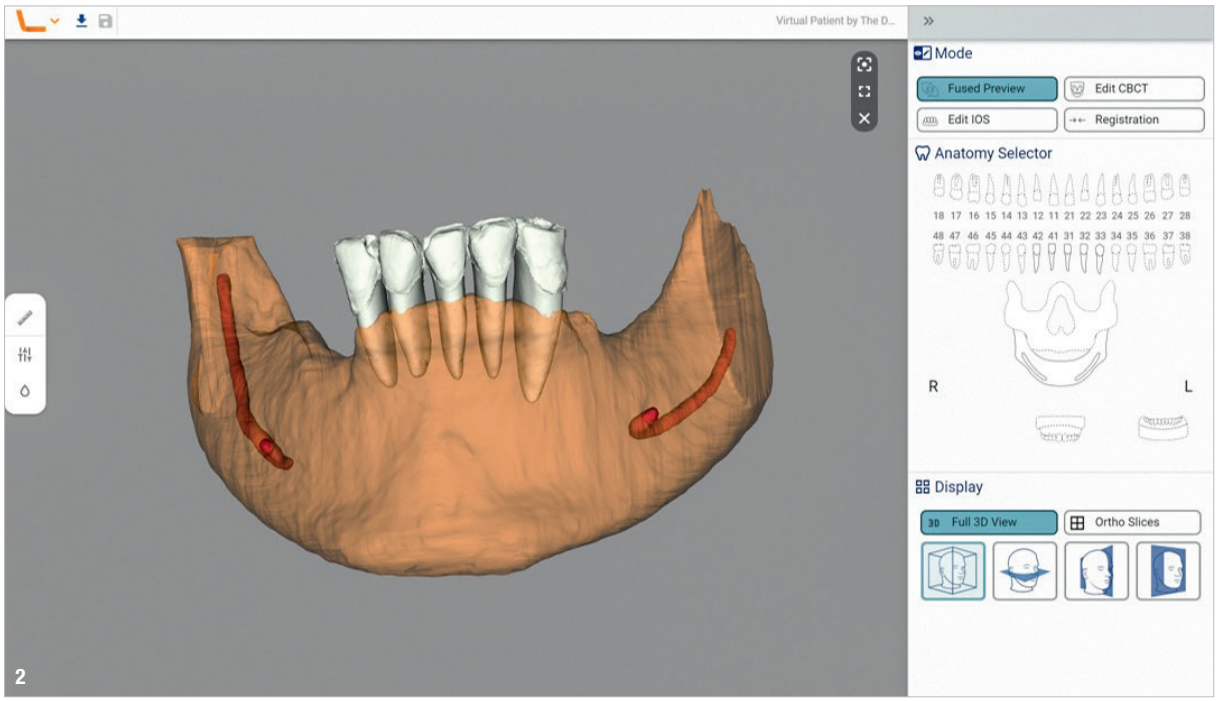

Fig. 2: Fusion and automatic alignment and superimposition of 3D files from the intra-oral scan over the CBCT data.