Implantology: An Evolving Dental Discipline

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In the past few years, implant dentistry has experienced unrivaled technological advances both surgically and prosthetically. Concomitant with this technological revolution in implant dentistry, the literature is being populated with longitudinal studies. Without precedent, implant dentistry has reached a crucial period where the long-term evidence on clinical efficiency has merged with recently documented technological advances. In this context, a balanced approach that embraces new technologies in clinical situations where the current scientific evidence has demonstrated optimal long-term outcomes would represent a model for implementing future clinical protocols in implant dentistry. This special report on implants addresses the impact of various new technologies on traditional implant protocols and its potential for improving outcomes.

Implant designs: The "platform switching" (PS) concept claims stable marginal bone levels in esthetically demanding areas, including thin gingival biotypes. This can be attributed to the smaller diameter abutments connected to a larger diameter implant platform. One of the predominate theories is that this change in platform diameter would allow more room for the collagen fibers' adaptation around the implant neck without a microgap existing in the matching connection implant type. Moreover, an inverse relationship between the size of the horizontal offset and marginal bone loss measured radiographically is being shown in clinical studies.[1,2]

Surface technology: Surface technology studies have shown improved implant stability at earlier stages of osseointegration with hydrophilic surfaces compared with the gold-standard hydrophobic surface type. Thus, conventional loading protocols have now been reduced from 3 to 4 months to currently 4 to 6 weeks in straightforward cases. Further loading protocol reduction may be seen in the future with biologic modifiers being added into the implant body surfaces.[2-4]

Smaller diameter (3.3-mm width) titanium-zirconium (TiZr) implants: These types of implants are now indicated in areas where primarily standard size implants were commonly used. This new material combines higher tensile and fatigue strengths without compromising osseointegration and is designed to increase reliability of small-diameter implants. This enables placement in more applications with the possibility of less invasive surgical procedures, prompting greater patient acceptance.[5]

Mini implants (1.8-mm to less than 3-mm width): This category of implants is still in need of solid clinical studies before mini implants can be definitively recommended as they have been to date. Clinicians have seen the positive use of mini implants in medically compromised patients, as well as in the aid of provisionalization of teeth and implants. The future of mini implant dentistry lies with good clinical studies that document their success and survival rates in multi-center studies.

CBCT: This technology is being used more effectively in planning cases. Its ability to also be used during a surgical procedure is an additional benefit if there is a question of proximity to a neurovascular or anatomical landmark of concern. For an experienced surgeon, partnering CBCT with "guided surgery" enables a more precise placement with reduced risk of complications.

Ultrasonic surgical instruments: Used for bone surgery techniques, ultrasonic surgical instruments provide high-precision, selective cutting; a blood-free surgical site; less surgical stress; improved surgical accuracy; and reduced patient morbidity. The significantly improved biologic healing with this new technology as shown in comparative studies is leading a change in the surgical approach due to its histologic improvement in early osseointegration.[6]

Prefabricated abutments: Offering prosthetic versatility, a selection of materials (titanium or ceramic), and reduced costs, prefabricated abutments for cement- or screwed-retained implant prostheses are now available for almost all clinical indications. The main advantage of prefabricated components is their ability of offer an optimal fit between parts due to their standard measurements.

Intraoral scanning (digital impressions): Intraoral scanning enables an in vivo capture of the tooth preparation, implant position, and bite registration

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into a digital file. The data file is then transferred via the Internet to a partnering lab as a milled model for conventional prosthetic fabrication or as a digital file for CAD/CAM prosthetic fabrication. Immediate feedback of potential inaccuracies is provided along with their correction without repeating the impression. The main advantage of digital impressioning is enabling the use a fully digital prosthetic fabrication line when combined with CAD/CAM technology.

CAD/CAM technology (in-office or in-lab): Computer-assisted design/computer-assisted manufacture (CAD/CAM) software allows for digital design of almost any type of prosthesis. This digital information is sent to a milling unit, where the prosthesis is fabricated based on different materials available. In general, this technology can be used in-office for small prostheses and, of course, in-lab for all prosthetic work.[7,8]

Ceramics materials: Ceramic materials like zirconium and lithium disilicate have marked a new era in implant prosthodontics. Due to zirconium's unique mechanical properties it has been a popular choice for implant abutments and framework fabrication. However, the use of such a material calls for an optimal abutment/framework design to avoid fractures/chipping and sufficient thickness for the ceramic veneering material. Lithium disilicate offers relatively homogenous strength between the framework and the veneering ceramic, low volumetric changes, and a fine shade selection system.[9]

TECHNOLOGY CONCERNS

Even with all the above technological advances, clinical concerns remain with the use of cemented dental implant prostheses. Cements can easily flow subgingivally and, due to their film thickness, are not radiographically detectable. The cement can become a reservoir for bacteria and behave like subgingival calculus, causing subsequent inflammation and bone loss.

When a cement-retained implant prosthesis is planned, the finishing line should be no more than 2 mm subgingival. This is the case in the esthetic zone where screw-retained restorations may help resolve the issue of cementation. Solving the problem of subgingival cementation has become a focal point, as many cases with signs of peri-implantitis are related to the painted-on appearance (thumbnail thickness) of these cements on abutments and crown margins viewed subgingivally at surgical re-entry. An aggressive early surgical approach is recommended, as cement removal nonsurgically can be difficult.[10]

LONG-TERM OUTCOME

In conclusion, this is an exciting time in implant dentistry because of the many technological advances and scientific evidence from longitudinal studies. It is important that independent clinical and university trials are conducted to support these emerging technologies and materials. For dental implant therapy to continue in its present rapid growth, the industry must remain on the "evidence-based" road where scientifically validated procedures can be improved upon through emerging technology.

DISCLOSURE

The authors have received an honorarium from ITI and Straumann.

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