"Prosthodontics is often overlooked"  

An interview with congress chairman Prof. Brian O’Connell, Ireland

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Prof. Brian O’Connell: We are very happy with the early registration for the congress, which is similar to recent years. We expect around 2,000 delegates to come to Dublin, and it is not too late for those who have not yet decided to attend the event.

Of all past host countries, Ireland probably has the smallest dental workforce. Are there any statistics on how many dentists in the country perform implant surgery, and is this a number relevant to the congress whatsoever?

Prof. Brian O’Connell (DTI/Photo courtesy of Trinity College, Dublin)

By Dr Isabella Rocchietta, Italy

Creating a new paradigm

Three-dimensional tissue regeneration could soon be clinical reality

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It is an undeniable fact that implant treatment has modified treatment planning and outcomes dramatically. Implant treatment has been modified over the years, from surgical techniques to material, all of which aim at a theoretical perfection of treatment. However, one of the major endeavours in implant dentistry is still the aesthetic result, which aims at a final prosthetic restoration.

Therefore, implant positioning is now driven by prosthetic demands and requirements rather than the quality, quantity and morphology of the available bone.

In view of this, a correct diagnosis based on a multidisciplinary approach, particularly considering the aesthetic and surgical parameters, is crucial, as well as the assessment of the anatomical site where the implants will be placed. We are faced with a high number of alternatives when it comes to treatment planning and often we find ourselves confronted with the dilemma of whether the treatment plan should contemplate bone regeneration after a meticulous diagnosis. If we decide on it, questions about the appropriate technique and material remain. This is particularly applicable to borderline cases, where the final aim may be achieved via a more pragmatic approach than bone regeneration. However, there are clinical conditions or anatomical sites where an adequate volume of bone is mandatory in order to allow implant treatment. Such areas include the maxillary molar and premolar region, where only a reduced alveolar process may separate the maxillary sinus from the oral cavity, and the corresponding mandibular region with its mandibular nerve canal.

Moreover, a large interarch space alters coronal length and form, and produces an unfavourable crown-root ratio in the final prosthetic reconstruction. The latter may result in an aesthetically unacceptable final prosthetic restoration, and/or lead to difficulties in performing adequate oral hygiene regimes, hence potentially jeopardising the long-term prognosis.

In the past decade, many predictable techniques have been proposed in the literature to augment deficient alveolar ridges both horizontally and vertically, and/or to enhance bone deformities in conjunction with or prior to implant placement. Bone regeneration has been further improved through the introduction of barrier membranes that are more effective and osteoconductive/osteinductive biomaterials and the development of new surgical procedures, allowing further controlled bone regeneration in challenging cases still remains unsolved.

Bone regeneration has embraced tissue engineering to overcome demanding cases. The concept lies in having a 3D scaffold that holds specific signaling molecules in situ, which attract the host cells that form the tissue, that is, bone. It has been demonstrated that alveolar bone regeneration is possible following this concept. The principal aim in hard tissue regeneration is to eliminate the need for autogenous bone harvesting and possibly eliminate the non-resorbable membrane, which consequently leads to less demanding surgical procedure and a significant improvement in patient morbidity.

Moreover, the advent of digital technology, with the growth of 3D printing technology, has the potential to revolutionise the field of implantology in the near future. The use of 3D printing in oral implantology is highly promising, offering significant advantages over conventional methods. First, it enables a highly accurate and customised design of the implant, allowing for a precise fit and easier integration into the oral environment. Second, 3D printing can reduce the surgical time required for implant placement, as the implant can be pre-manufactured, thereby eliminating the need for intraoperative adjustments.

In conclusion, the use of 3D printing in oral implantology has the potential to revolutionise the field, offering significant advantages over traditional methods. As technology continues to advance, it is likely that 3D printing will become an increasingly important tool in the armamentarium of dental professionals, enabling them to provide more precise and effective treatments to their patients.
The periodontal ligament (PDL) is the natural connection between the tooth root, the alveolar bone and the gingiva. It has several biomechanical characteristics that osseointegrated implants do not have. For example, its flexibility provides a damping effect, which protects the enamel from occlusal shocks. Furthermore, the PDL helps to avoid overloading by distributing the masticatory pressure over groups of teeth. When overloading occurs, its proprioception blocks the muscular action by a neuronal reflex.

Periodontal cells possess the best capacities for physiological tissue remodelling of all structural tissue cells. This characteristic is important to adapt the position of teeth during growth or orthodontic treatment continuously, as well as for compensation of occlusal and proximal enamel attrition over the entire lifetime. Histological studies about tooth orthodontic displacement and tooth transplantation have demonstrated the biological dynamism of the PDL. The tissue can be destroyed and rebuilt in three weeks. Tooth transplantation with double PDL stimulation is one of the best examples of its healing capacity. Fourteen days before the transplantation, the donor tooth is extracted and immediately replanted in its original alveolus. This deliberate trauma triggers a healing process within the PDL, which includes cell proliferation and differentiation. The in vivo cell culture reaches its peak of activity after 14 days, after which the transplantation of the tooth can be performed with millions of cells in full activity attached to its root by new Sharpey’s fibres.

The success rate of tooth transplantation with double PDL stimulation is 95% after ten years. With the activated cell population holding great capacity for the regeneration of bone and gingival attachment around the transplanted tooth, this surgical procedure fulfills all the criteria for good tissue engineering. Using this model in its biological and clinical aspect, we think it is now possible to obtain a similar cell culture around an artificial root using tissue engineering techniques. These cells are easy to sample from the root surface of a compromised and extracted tooth, as well as to harvest in vitro. The cells used are autologous and each implant with its own cell population is prepared in a laboratory. The cell culture needs about four weeks to grow, and enables the alveolus of the tooth to be replaced. A preliminary experiment on athymic mice with human PDL cells around porous hydroxyapatite blocks in subcutaneous localization demonstrated that the bar-
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**Micro-motion, torque, and ISQ – How do you want to diagnose your primary stability?**

**Dr. Michael Norton**  
BDS FDS RCS(Ed) Specialist in oral surgery, UK

**Resonance frequency analysis of dental implants in simultaneous sinus floor elevation after eight weeks.**

**Dr. Ulrike Kuchler**  
MD, DMD Klinik für Oralchirurgie und Stomatologie Zahnmedizinische Kliniken der Universität Bern

**MODERATOR**

**Prof. Wilfried Wagner**  
Department for oral and maxillofacial surgery - plastic surgery Medical Center University of Mainz

Friday Oct 17  
7.45 am - 8.45 am at the EAO in Dublin Liffey Hall 2
“Human error is inevitable”
An interview with EAO presenter Dr Mark Pinsky, USA

New in vitro and canine experiments were carried out after the clinical experiments. The objective was to find superior surface treatments and culturing techniques that would allow a better differentiation of the cells. Knowledge in cell biology and tissue engineering techniques is showing rapid development, and the possibility of using periodontally integrated implants could become a clinical reality within the next ten years.

Newly generated human bone is indeed important for potential implant success. There are potential other risk factors as well, of which one must always be aware. They can be thought about as something determined at the population level and not at the individual level. For example, a typical risk factor statement would take the following form: when we looked at a number of patients that we did y to, we found z. The individual operator then can make decisions armed with this knowledge.

The interesting thing about risk factors is that there is an implied uncertainty associated with the term. Risk cannot exist without uncertainty. It is up to each operator to ensure that risk is identified and quantified prior to a procedure, and then all effort is made to mitigate that risk during a procedure. This will ensure a more predictable outcome.

Has there been more generally focus on prevention of these risks?
So far, it is intuitively obvious that prevention is the key, as it minimizes the longer-term exposure to the risk associated with more significant procedures. The logic goes like this: if you prevent periodontal disease, you will prevent bone loss, which will prevent the loss of a tooth, which will prevent the need for an implant, which most likely will, but may not, work. This will never change. The better the long-term data, the easier it will be to incorporate that information into the early phases of a well-thought-out approach.

As a full-time A330 airline captain who flies internationally, former dentist Dr Mark Pinsky from Ann Arbor in Michigan knows a great deal about errors and their possible consequences. Although piloting a plane and performing dental procedures require completely different skill sets, they have common ground when it comes to application of these skills, he says. Today international has the opportunity to speak with him about the sources of error in implant dentistry and the tools currently available to minimize the risks.

Numerous biomaterials have been tested and found to be the most suitable, among them bio glass, alumina, zirconia, plastics and titanium. Tests have also been conducted on surface preparations. In a human trial, a regular hydroxyapatite layer was created by crystallisation in a simulated body fluid and performing dental procedures. The reality is that errors can occur at any phase of implant placement. They vary in degree of severity and effect on long-term survival, but it is in the constant study of the elements that make up the field of human factors related to error that threats will be trapped at a stage where the long-term consequences of an error are less significant or mitigated.

A US study from 2012 has suggested that errors are more likely to occur when clinicians have less than five years of clinical experience. How relevant are operative procedural errors compared with other errors?
There are actually a number of studies on error, and experience should definitely be considered a component. However, there is a paradox that says, if you look at the way that the operator does not know what he is doing, or it may mean that he slows down and is more careful. Conversely, the experienced operator may know what he is doing, but be more prone to error.

Human error is inevitable. No amount of experience or lack of it can change this fact. Do you consider behavioural patterns a significant risk factor?
I would prefer to use the term “human factors”. One must identify individual behavioural patterns, both good and bad, to construct a procedure into its individual components and identify areas of risk. Furthermore, one must look at the surgical implant team and its dynamics, breaking it down into small units to aid in potential risk mitigation.

“Human factors” par excellence are the professionals who perform the actual work. The interesting thing about risk is that there is an implied uncertainty associated with the term. Risk cannot exist without uncertainty. It is up to each operator to ensure that risk is identified and quantified prior to a procedure, and then all effort is made to mitigate that risk during a procedure. This will ensure a more predictable outcome.

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Successful prevention depends to a large extent on better diagnostics. Are dentists currently up to date in this field, and what tools are available to avoid potential errors before treatment even begins? I only partially agree with this assertion. Better diagnostics is simply a group of better informational tools that presents some aspect of specific information better than before to the dentist. Successful prevention really depends on what the practitioner does with that information. Better information will only make for improved prevention if there is a system in place to capture the information and ensure its use every time. How many of the people reading this have a drawer somewhere in their office full of new items that they tried but no longer use?

Implant planning with CBCT has become very popular and an increasing number of dentists have access to it. Would you consider the technology to be such a system? The product that CBCT provides is information. Some of the information comes from what a dentist can determine through conventional methods, while some is unique to CBCT. The ALARA principle dictates that CBCT be used when the information gleaned from the radiation exposure outweighs the risk.

The information potential from a CBCT scan is truly remarkable. Since CBCT has a risk associated with it, it should be incorporated into the overall risk management strategy. The potential advantages lie in its proper use of the vast amount of single-source information it potentially has. The risk is that CBCT becomes the default standard for every issue without proper consideration for each specific case.

Risk assessment protocols are becoming increasingly important in general dentistry for identifying and managing oral diseases like caries. Should the same principles be applied to dental implantology as well?

Absolutely. It is through the identification and subsequent mitigation of risk through robust risk management strategies that success rates will improve. Risk assessment protocols, like CBCT, are a tool in the bag of tricks a dentist uses to narrow the variability and make an outcome more predictable.

Speaking of risk assessment protocols, there really is one risk factor that is more important than any other with regard to dental implantology. That is how the operator feels at the time she is placing the implant. This is closely related to the concept of situational awareness. While this may seem a bit abstract, it is through the loss of situational awareness that one will not recognize or react inappropriately to all other risk factors. Examples include when the operator is in a hurry, or is tired, or is worrying about the next case, or anything else that takes away from the focus at hand.

How can loss of situational awareness be minimized?

In an article in the Journal of the American Dental Association on which I was lead author, we introduced a universal dental checklist. No professional pilot would ever take off or land a plane without using a checklist, no matter how many times she has done it. The World Health Organization has promoted a surgical checklist to be used in hospital operating rooms with great success. The same should hold true for dentistry as well. Consistent use of a dental checklist is a good start at recognizing the human aspect of providing dental care. The checklist makes a procedure more standard for every issue without proper consideration for each specific case.

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Thank you very much for the interview.
CAD/CAM and growth factors—Key areas of dental innovation

By Dr Nilesh R. Parmar, UK

Dentistry has come a long 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 trade shows such as the International Dental Show (IDS) where the development 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, 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 finalized 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 laboratory-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

Computed tomography (CBCT) scans are now common-place 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 short-fall 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. This data can mean the implant is placed in the ideal location. 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 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.

By taking this one step further, guided implant surgery now allows us to not only plan implant placement using ideal restoration 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 (Farmar 2009) and accelerate soft tissue healing. Companies are now offering clinical courses for dentists to make, produce and use FRP in their own surgeries within 15 to 30 minutes. The main advantage of FRP is that it’s free; it 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, FRP use will increase in all aspects of invasive dental surgery.

“The popularity of chairside CAD/CAM units has never been greater.”

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. He can be contacted at drnileshparmar@gmail.com. More information can be found on his website, www.drnileshparmar.com; Twitter: @DrNileshRParmar; or Facebook: Dr Nilesh R. Parmar.