Prosthodontics at the crossroads: is this a ‘golden age’?

Oral health still needs to be integrated into general healthcare, and dentists need to advocate for that.

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FIGURE 1: Mandibular fixed implant prosthesis placed in 1987, showing extra-oral view (left) and occlusal view (right). Components have changed over the years but the survival of this type of prosthesis has not improved significantly.

Congratulations to the Cork University Dental School on its first 100 years of dental education and service to the community. It is important to celebrate the achievement of the Dental School, which is flourishing as never before, as well as recognising the many individual contributions on which the current successes have been built. Such an occasion invites reflection on where we have come from and, indeed, if we are going in the right direction. Looking at the areas of dentistry that have had the most impact in the scientific literature in the past 25 years, it is clear that the interface between oral health and general health still generates the most interest, as for example did the possibility of a link between periodontal disease and cardiovascular disease.1 Perhaps this is a lesson we have to keep re-learning. What happens in the mouth influences, and is influenced by, the body as a whole. Fundamentally, we should be taking care of people, not just their teeth.

The implant evolution

When we think of prosthodontics we tend to believe that it has undergone a sea change in the past few decades, with the development of dental implants having the greatest impact in the dental literature. Though the barrage of advertisements for dental implants suggests a revolution, the evidence would suggest more a process of evolution. The development of dental implants has been well documented in the scientific literature and successful treatment of edentulous patients by the Gothenburg group was recorded more than 30 years ago.2 Many patients are still treated according to these protocols with incremental improvements in technology (Figure 1). However, we have learned to extend the use of dental implants into more challenging situations, including immediate or early loading, and the boundaries of what is clinically predictable have become clearer.3 Notably, implant design has greatly converged over the years, suggesting that form is more closely fitting function than ever before. Despite this progress, we should bear in mind that technical and biological complications are a very common part of
Implant therapy, from the simple mechanical failures (Figure 2a) to the more intractable problems, such as peri-implantitis (Figure 2b). Far from being a once-off ‘repair job’, implant restorations themselves commit patients and dentists to a long-term care relationship. The very success of implant treatment should beg the question of why so many natural teeth need to be replaced. Why is it that periodontal disease still rages through the adult population, despite decades of research on its cause and prevention? How can it be that so many teeth are lost to dental caries, when we have long considered this to be a preventable disease? To any independent observer it would seem strange that so much time, energy and money has been invested in the replacement of teeth, rather than implementing the strategies to prevent their loss in the first place.

**Looking at the whole patient**

One of the positive developments in the past 20 years of restorative dentistry has been the consideration of the whole patient when assessing their oral status and, especially, the outcome of treatment. We have become much more aware of how oral health impacts on the daily activities of our patients, and this is particularly true of the elderly and the edentulous. We are learning that patient-centred outcomes are often the most important way to measure the success of treatment. It is now well documented that many edentulous patients suffer limitations in eating and speaking that can lead to wider psychological discomfort and difficulties with social interactions. The relative success of fairly simple treatments, such as implant-retained mandibular overdentures, has been demonstrated in alleviating many of these problems for patients and restoring some degree of confidence and independence. However, such treatment is still not available as part of our public health system, and so is denied to most of our elderly people. We have to ask ourselves how much of a success we can claim for treatment that is effective but is not available to those who need it most. This also frames the larger question of the place of oral health in our health service; who advocates for those most in need and how treatment priorities are derived. It does not seem that the implementation of oral healthcare has been keeping pace with developments in treatment.

**Future research and development**

Undoubtedly, we have seen significant improvements in the replacement of missing teeth over the past 20 years or so. The historic options of removable and fixed prostheses have been greatly expanded by the use of dental implants. Fixed implant restorations have the advantage of not directly involving the neighbouring teeth. Particularly in patients who have good supporting structures remaining, the use of implant restorations has achieved good aesthetic and functional success. Nonetheless, clinical complications occur frequently, and can be expected in about one-third of fixed implant restorations by five years. The use of high strength ceramic materials is increasingly common for implant abutments and restorations due to their aesthetic properties, patient acceptability and cost effectiveness. However, long-term clinical performance of these materials to support bone growth. Collagen-glycosaminoglycan scaffold seeded with bone marrow stem cells and incubated for one day (a) or 21 days (b). Sections are stained with Alizarin Red to demonstrate the formation of calcified tissue over the time period (arrows). Images courtesy of Dr Brendan Grufferty.
materials has yet to be proven. An even greater challenge for restorative dentistry is the replacement of deficient hard and soft supporting structures. Despite a greater understanding of the biology of oral tissues and a plethora of augmentation techniques, the regeneration of bone and mucosa after tooth loss remains unpredictable at best. Little long-term data exists on the success and stability of regenerated tissues and this is currently the weak link in oral rehabilitation.

In parallel with clinical research, basic science has sought to understand and improve approaches to tooth agenesis and loss. The use of bone precursor cells and bioengineered scaffolds shows some promise for the regeneration of bone to accompany implant placement (Figure 3a and 3b). A great deal of work has been done on understanding the development of the dentition, from the progenitor cells involved to the chemical signals that regulate cell growth and differentiation. It is encouraging that some genetic defects that lead to missing teeth (anhidrotic ectodermal dysplasia) have been reversed in animals by using recombinant proteins. The defects that lead to missing teeth (anhidrotic ectodermal dysplasia) have been reversed in animals by using recombinant proteins. Much progress has been made in demonstrating the feasibility of regrowing ‘bio-teeth’ from adult marrow-derived cells, though this has yet to be made a clinical or financial reality. Nonetheless, we must bear in mind that historically, clinically significant discoveries such as high-speed instrumentation, acid etching and osseointegration have taken several decades to enter clinical practice. Given the global research budgets and publications today, we should be optimistic about future advances in oral healthcare.

So, an assessment of the current state of prosthetics suggests a step in our evolution rather than a major turning point. On the positive side, the technology at our disposal is improving all the time and delivering better results for patients. Yet, our patients are still losing far too many teeth from preventable diseases and then are not able to avail of the treatment that would benefit them most. Oral health remains to be truly considered and treated as part of general health, and we must seize every opportunity to advocate for oral health.

References