EDITORIAL

Does Disruptive Innovation Enhance Our Paradigm Shifts?

If one were to consider the history of dentistry, it would probably be described as a series of evolutionary steps followed by the occasional revolutionary change. In science, descriptions of revolutionary science are often termed "paradigm shifts."

Perhaps the best example is that of the public health approach that resulted in fluoridation of drinking water. The addition of fluoride to drinking water resulted in a tremendous reduction in the dental caries rate. In fact, fluoridation of the water resulted in a greater reduction in the caries rate than any other single active or passive intervention. Even in medicine, there is likely no other more impactful public health measure with the possible exceptions of hand washing and the simple assurance of a safe water supply.

Indeed, fluoridation represented nothing more than an addition to the public water supply. The only requirement for it to be effective is that people consume water from the public water systems. Since water consumption is essential for life, the benefits of this endeavor are achieved with little effort on the part of the patient. It is not, however, an active therapeutic intervention. An example of an active therapeutic approach might be the application of topical fluoride to the teeth of children. This active therapy would not be considered to be a revolutionary intervention; the true paradigm shift came with the public health approach.

Scrutiny of public behavior, however, demonstrates reluctance on the part of the populace to consume tap water. Indeed, it appears to be the rare person who fails to drink the occasional bottle of water. Despite the benefits of and paradigm shift associated with fluoride, the disruptive innovation associated with the development of a bottled water industry could negatively affect the gains that have been achieved through the fluoridation process.

There certainly are examples of other shifting paradigms that coexist with periodic disruptive innovation. Acrylic resin denture bases and dental composite restorative materials may be two such examples. In the days of vulcanite dentures, the fit and dimensional stability of this material was quite good, but the appearance of the material, especially after years of use, was less than satisfactory. Vulcanite was a material that did not mimic the natural gingival tissue when new, and the situation deteriorated as the material discolored over time. The treatment paradigm shifted away from the use of vulcanite primarily because of esthetic concerns.

The situation with dental composite restorative materials exemplified an adoption process of fits and starts. Indeed, composite materials quickly replaced silicate restorations because they were more easily handled and more color stable, although they did have physical characteristics that were not as favorable as the previous generation of silicate materials. Dental composites tend to be water absorptive and lack the therapeutic advantage associated with fluoride leeching, something that was found with silicate materials. During the first few decades with dental composite, it was primarily used as a restorative material in anterior teeth. Gradual development of materials with more favorable physical properties has resulted in an increased acceptance of this material as a replacement for dental amalgam as a posterior tooth restoration.

Considering these two examples, one might suggest that the common disruptive innovation was related to cosmetic concerns. The treatment paradigms shifted from one material to another (vulcanite to acrylic resin and silicate and amalgam to composite) because the innovations paralleled a societal demand for more esthetic materials.

Implant dentistry likely represents the largest paradigm shift in the history of dental therapy. In the early days of implant dentistry, paradigms were not changing. The use of subperiosteal and blade implants, beginning in the late 1930s, failed to create fundamental changes in dentistry primarily because these early designs lacked predictability. The situation changed following initial human studies in the mid- to late 1960s when the concept of osseointegration or functional ankylosis was recognized. The biocompatible implants of the osseointegration era that were placed and restored using appropriate surgical and prosthetic techniques demonstrated a clinical predictability that often equaled or exceeded that seen with traditional treatment of advanced dental disease.

The revolutionary science associated with the recognition of the material, the host response, and the therapeutic techniques ensured that this paradigm shift would be dramatic. Over the years, there have been evolutionary changes in the surface of dental implants, the connection of implants to prostheses, and the loading protocols applied to implants. Implant dentistry today differs from what was described in the mid-1960s, but most of the originally described concepts remain valid.

Although osseointegration is now in its sixth decade, it is no longer in evolution mode. Instead, the field is filled with disruptive innovations that are poised to revolutionize the discipline. Technology is producing fundamental changes in the way that we look at diagnosis, treatment planning, site preparation, implant surgery, impression making, and prosthetic fixation. It looks like all aspects of implant dentistry are being disrupted.

Think about it: At the initial evaluation of patients, we have to consider their current situation but also must predict the future if appropriate recommendations are to be made. A patient with 50% bone loss, one who would traditionally be maintained as long as possible through periodontal therapy, must be evaluated for anticipated residual bone volume and quality now and into the future. Traditional treatment, in some instances, may be absolutely correct or it might prove a disservice if, upon failure of the teeth, implant replacement is no longer possible or only possible with more complicated and less predictable intervention.

Three-dimensional imaging, a rarely employed diagnostic tool in the early years of osseointegration, is ubiquitous today. The diagnostic and treatment planning advantages when using imaging are obvious, but there are also advantages in terms of guided surgery and surgical guidance, both of which fit the bill as disruptive innovations. Likewise, when considering digital impression making, the defined nature of the implant restorative platform makes the use of digital scanning simpler and more predictable than with traditional tooth preparations. Perhaps the most intriguing innovation relates to the methods used to retain dental restorations. In fixed prosthodontics, cement is used, while early implant dentistry depended upon screw retention. Today, we are seeing technological innovations that may allow restoration retention without screws or cement. You can expect to read more about all the disruptive innovations in JOMI.

The answer to the question posed in the title of this editorial is that we do indeed find disruptive innovation enhancing the treatment paradigm of implant dentistry. Although this may have taken more time than might have been anticipated, the disruptive innovations that we are seeing today will redefine treatment paradigms for today and the future.

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