Dental Implant Research: Are We Focusing Too Much on the Dental?

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Dental (den't'l), *adj*. 1. of or for the teeth ....

Webster's dictionary

Application of the principle of osseointegration has had a monumental impact on the modern practice of dentistry. The increasing acceptance of osseointegration by the profession and the public during the past decade has also had a parallel effect on dental research. Those of us actively involved in dental research know this to be true. The widespread dissemination of osseointegration over the last 10 to 12 years has had a significant impact on the scientific literature of dentistry. Entire research programs now focus on dental implants from both basic science and clinical perspectives. The fact that most of us now conducting implant research were conducting *dental* research before implant research may be looked at as a double-edged sword. The problem is one of perspective.

The availability of funding for dental research, or medical research for that matter, has not grown at the same rate as most other segments of the economy. The pot of gold has become more and more elusive to the researcher in the biologic sciences. At the same time, our research methodologies and the facilities we carry research out in have become much more expensive. It would seem to follow that large-scale expansion of dental research into the realm of dental implants would be confronted with minimal available financial resources for this new direction. Current dental research literature does not seem to indicate this. Implant-related research is the primary investigatory focus of periodontal, prosthodontic, and oral and maxillofacial surgical departments at most universities. Increasing numbers of basic science researchers are being attracted to the dental implant research arena. The reason for this seems, at least in part, to be due to the gradually changing emphasis of funding agencies for dental research, as well as the increased overlap of dental implant research and orthopedic research, which allows dental researchers to compete for funding traditionally unavailable to them. As a prosthodonist, I have always been aware of the fact that federal funding sources, primarily the NIDR, have emphasized the etiology and treatment aspects of dental disease as the primary focus of dental research initiatives. This is as it should be. However, research into those areas of dentistry that have dealt with the restoration or replacement of structures lost to disease has lagged far behind in funding priority. That tendency to deemphasize research aimed at replacing and restoring missing tissue appears to be decreasing, primarily because of the universal interest in dental implants. It must be kept in mind that the ultimate goal of all dental implant research is replacement of missing structures with the most predictable, natural, safe, and economical method

possible. This goal is shared by many more people in many more disciplines now than when our only options were traditional prosthodontic solutions. We must remember that dental implant surgery is nothing more (and nothing less) than preprosthetic surgery.

Back to the issue at hand. Are dentists the best people to do research on dental implants? The reason for asking this question is very simple. Is our knowledge, understanding, and experiential background as dentists and dental researchers leading us to assumptions about dental implants that are hindering our progress toward understanding the phenomenon of osseointegration and all it includes? Put another way, are we looking at implants the same way we look at teeth? I would suggest that we are. We are encumbered with our training and knowledge of dentistry and we are trying to stretch it to include this new concept of osseointegration.

An example of this problem is the premise that axial loading is necessary for long-term maintenance of the osseointegrated interface. Where does this axiom of implant dentistry come from? We read it and hear it constantly. Perhaps it is derived from the time-honored principle that nonaxial loading of natural teeth (at least posterior teeth) is traumatic to the periodontium and may precipitate tissue damage. While the validity of this principle for natural teeth is not being challenged here, it must be challenged when an osseointegrated interface is involved. It seems obvious from overwhelming empirical evidence that nonaxial forces are indeed damaging to the longevity of mechanical components in an implant-restoration pillar. There is, however, no objective evidence to be found anywhere in the scientific literature that the bone-implant interface of osseointegration responds differently to nonaxial loading than to axial loading. We all assume that nonaxial loading is undesirable for health of the interface, but we have no evidence to support our assumption. If there is no periodontal ligament involved, we cannot assume that forces unacceptable to the natural periodontium are at all detrimental. This is an important area needing further investigation. If, indeed, nonaxial forces are of no consequence to the maintenance of osseointegration, perhaps there are many more applications of the phenomenon available to us than we currently realize, assuming mechanical weaknesses of components can be overcome.

Another axiom we adhere to when restoring dental implants is the necessity to avoid occlusal overload on implant-borne prostheses. As one who advocates meticulous attention to the occlusal aspects of all dental restorations, it is particularly difficult for me to acknowledge that there is absolutely no objective evidence that occlusal design, concept, material, or pattern is of any consequence to the health of an osseointegrated implant. In fact, recent evidence in the literature casts doubt on the importance of implant occlusion and, more specifically, on the need or desirability of "progressive loading," which is a practice that has assumed almost religious stature in prosthodontic/restorative circles. This is an area of implant

dentistry that has been overlooked because of our assumptions that occlusion for implants should be the same as occlusion for natural teeth. The area of implant occlusion needs well-conceived and well-funded research to define the significance of occlusion for implant-supported restorations.

A final issue that needs to be removed from the realm of "dental" knowledge and explored separately is the concept of "peri-implantitis." As David Cochran, Chair of Periodontology at the University of Texas at San Antonio School of Dentistry, has said many times, "periodontitis is a disease of a specific organ, the periodontium." To assume that the interface between an osseointegrated implant and surrounding tissues is vulnerable or even susceptible to the same disease process is, perhaps, the ultimate *dental* assumption in implant dentistry. The issue seems largely to be one of the chicken and the egg. Does the presence of *periodontal* pathogens in an otherwise clinically healthy peri-implant sulcus signify that a disease process is imminent or already underway? Does ligature-induced inflammation of the peri-implant sulcus in an animal model provide the clinician with useful information? Does peri-implant inflammation result directly from microbial infection, or is the infection secondary to some other factor that has initiated tissue breakdown? What clinical measurements do we have to "diagnose" this disease? Why is it so rare, to the extent that I haven't seen an occurrence in over 10 years of high-volume implant practice? If peri-implantitis is a truly specific disease that is initiated solely by microbiological etiology, it must be defined and proven to be such, separately from its assumed similarities to periodontitis.

The point to be stressed is that, as dentists, we may at times be missing the forest for the trees. The issue is not for you to believe my opinions or I yours. My plea is for us all to examine our opinions objectively and honestly and then to carry that objectivity into the research arena and address the important questions facing us without preconceived notions of why things are the way they are, rather than the way they should be.