# Bioengineering

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This is a special opportunity in Dentistry to expand our horizons and for scientists and clinicians to undertake exploration of the future on issues of bioengineering, growth and differentiation factors. In the past, some scientists were accused of providing a futuristic vision of the clinical impact on the biological and technological advances under the perspective of their specialties. This reminds me when I, a freshman at the college of Dentistry, heard a global specialist in Cardiology, telling us that we had made a mistake in choosing Dentistry as a profession, because within 18 months, the market would have a vaccine for caries. I suggest that each one treasure the information that will get today, as I should have done at that time based on what I heard. This is related to the need of pre-marketing research on new products. In the early osseintegration, much time was spent before there were changes in the products. Contemporary system reversed the process in a way that new products are routinely available to the professional with an inadequate investigation. It is often asked to dental professionals to use new devices and report the success of their treatment results without having informed the patient about researches including them. This is an unscientific approach that does not bring anything good to the implantologist.

Bioengineering is a conglomerate of all technologies and for it we had some overlap in all these sectors. That is the reason why they obtained very similar results in their reports. However, in a short-term, we are seeing today what we will likely see over the next 5 to 10 years, with no considerable increase in the application in our offices.

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Bioengineering reaffirmed that the patient's characteristics must be considered when we repair any tissue. Size and volume of the defect must be determined. Regardless the excellence of the material, the nature of the recipient site should be considered in order to increase the quality and have a good result. For example, vascular supply can be changed due to the formation of scars at the recipient site. In addition, inflammatory changes resulting from local impact caused by the oral biofilm must be controlled preoperatively, at the surgery, and during the post-operative phases to optimize the cascade of repair process.

Current and future application of growth and differentiation factors or signaling molecules in the regeneration of hard and soft tissues needs to be revised. This focuses primarily on bone morphogenetic proteins after bringing a comprehensive view of growth differentiation factors currently investigated. These include platelet-derived growth factor, vascular endothelial growth factor, transforming growth factor beta and growth hormone. A differentiation factor, the recombinant bone morphogenetic protein factor-2 (rhBMP-2) is commercially available and is approved by FDA and ANVISA for marketing. Its indication is for increased maxillary sinuses and reconstruction of the dental alveoli. The use of bone morphogenetic proteins is expanding in therapies that are off-label (when the clinicians chooses to use the therapy with product in indication which differentiation has not been fully evaluated, or the risk/benefit ratio is uncertain). It needs controlled clinical tests. For example, can the rhBMP-2 be combined with different carriers and be used in different supports? This would be a benefit to obtain more clinical data on the application for the use of this molecule. My opinion is that the objective should be to provide a biological material/device resulting in a physiological response with symphonic coordination of multiple factors in order to optimize the response of the tissues, especially in severely compromised sites. When we consider the application of new technologies in clinical practice, its use requires the development in the current regulatory and ethics environment. Development with transfer to the clinical practice, the establishment of effectiveness, including the education both of health professionals and community to use a new biological material may take 10 years or more. There will always be overlap of current, new and developing materials.

Rationalization of the development process can be the key to avoid excessive delays. This may require not only the university and industry research, but counting on consortia of clinical investigators through networks based on research practice and collaborative efforts, such as multicenter researches and development organs (CNPQ, CAPES, FAPESP, etc.). New technologies should be critically evaluated for effectiveness, safety, efficiency, cost and outcomes in patients compared to current therapies. Consortia of multiple excellent centers can be used to generate significant data based on evidence in order to recommend the use of a new product or therapy. It is important to notice that Dentistry is an industry without federal funding and it seems to be minimal third party involvement for sponsoring these procedures. Therefore we can find significant resistance from professionals for keeping records of their procedures. This has been an extraordinary opportunity to look into the crystal ball. Having the opportunity to participate in initial clinical research with a growth factor that is available today. I thought in the words of William James, a philosopher in the late 19th century. He noted that the true rewards are not only result of reasoned analysis, but they include intuition, impulse, and capacity to go straight to the point. It is surprising that 110 years later, these same skills have

been significant in expansion of the successful use of dental implants. What will be the future for regenerative technologies? It seems appropriate to share our clinic's results with the research sponsoring organizations. This will require the dedication of subjects who are willing to donate their time to organize and prepare technical documents to discuss current evidence and schedules, considering the availability. Most patients do not thank us for the volume of bone growth that was promoted, nor for successful implants. They appreciate a comfortable procedure that is not as complicated as they thought it was. This provided an opportunity for us all reexamine our deepest beliefs. Our horizons have expanded, and we have had an opportunity to advance in an important direction.

The confidence between dentists and patients also occurs in the science. I strongly feel that clinicians make out of their routine, in offices or classes, a laboratory for technology evaluation. We must be more judicious in our acceptance of new products and therapies based on new technologies so that our patients are well served, and therefore mutual confidence will be a guaranteed and rewarding outcome.

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