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The Interface of Occlusion as a Reflection of Conflicts Within Prosthodontics

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It was interesting to read the papers of the occlusal interface section with the eyes of both a clinical teacher and researcher. The conclusions that these 2 groups would draw from the same papers would most likely be diametric opposites. The clinical teacher would be left with a lot of unanswered clinical questions and probably would think, despite all the skepticism of the academicians, that most of the therapies he uses in daily practice are efficacious in the vast majority of cases, provided that certain basic biological rules that are a common denominator for most occlusal philosophies are taken into consideration. Thus, he would consider the interface of little value, as it does not solve his daily problems. The clinical academic, on the other hand, would conclude that we do not know very much about the importance of the occlusal interface for the long-lasting health of the stomatognathic system or the patient's quality of life. This dualism well represents the gap that exists between the university and the clinical settings, and I fully agree with the statement "there is a gap between the clinician who performs prosthodontic treatment as a matter of routine using (mostly) reliable conventional techniques and the scientist who is preoccupied with problems that do not occur in the dental office."[1] If we want to progress in prosthodontics, it is of utmost importance that this gap disappears. Clinicians must be involved in the formulation of clinical questions, the dental office must be considered by academics as a resource for clinical knowledge, and the university must not be regarded any longer by dental practitioners as the "ivory tower." Thus, a better way of communicating between those who perform dental care and those who perform dental research is necessary.

Occlusal Interface Pivotal?

In the study group report and discussion, Klineberg and Stohler pointed out that "the occlusal interface is pivotal to successful prosthodontic treatment."[2] Although as a prosthodontist I would like to agree with them fully, I think that, in light of the knowledge we have today, the sentence must be rephrased as follows: "Occlusion is an important aspect of prosthodontics in its broadest context. However, its significance on treatment outcome and the longevity of the patient's health and quality of life is still far from clear." Indeed, except for technical failures, the long-term success of at least fixed prostheses depends in the first instance upon the prevention of infection and thus upon the maintenance of oral health.[3] Occlusal features also seem to be of little or no importance in regard to the long-term success of implant-supported reconstructions,[4] and this is the case for complete dentures too, as pointed out in an extensive literature review conducted almost 10 years ago whose conclusions are still valid: "Occlusion is an important aspect of the technical process of denture fabrication, as it is closely related to the physical aspect of load distribution, denture retention, and stability. Despite its biomechanical importance, occlusion, as well as the technical quality of the denture, plays only a minor role in determining success or failure of a denture treatment. A number of psychosocial factors are likely to be more important than the prosthodontic factors for a positive outcome."[5]

The Term "Malocclusion"

This is a plea for erasing the term "malocclusion" from the dental literature, as there is no scientific evidence that a particular type of occlusion—natural or restored—is detrimental for the masticatory system or the subject's health. The use of the term "malocclusion" certainly helps, at least at a subconscious level, to sustain the belief that certain types of occlusion or a reconstruction with an incorrect occlusal fit may be "bad" and lead to pathological alterations. Furthermore, the term implies the existence of a good or ideal occlusion. "Ideal" occlusion is the exception (approximately 70% of North American youths supposedly have a "malocclusion").[6,7] In reality, ideal occlusion is simply a theoretical construct created by dentists in order to simplify the technical part of prosthodontic work. Furthermore, the term *ideal occlusion* is not synonymous with physiologically correct occlusion. Indeed, individuals tend to adapt well to various occlusal forms, even in extreme cases such as Angle Class III malocclusion or severely compromised dental arches.

Occlusion and Craniomandibular Disorders

The relationship between occlusion and craniomandibular disorders (CMD) is still a matter of controversy and will probably remain one if we continue asking the question "Is there an association?" without considering the complexity of the problem and the fact that in a biological system no single factor is capable of causing a disease or a functional disturbance on its own. Factors that produce a disease or a functional disturbance under one set of circumstances may not under others. Thus, occlusal factors may have different effects in different subjects, as suggested by the results of a randomized double-blind study that showed that the introduction of centric relation and balancing-side interferences was associated with significantly more clinical signs in subjects with a CMD history than in those without a CMD history.[8] Furthermore, a double-blind randomized crossover study conducted on healthy female subjects without a history of CMD indicated that after the introduction of a centric interference for 8 days *(1)* none of the subjects developed CMD symptoms; *(2)* the number of contraction periods of the masseter muscle during awakening dropped in the first 2 days after application of the interference and increased gradually thereafter, up to the levels recorded during noninterference conditions; *(3)* the number of occlusal contacts also was significantly reduced after insertion of the interference but increased thereafter; and *(4)* the occlusal interference initially created tooth discomfort.[9] Thus, under the conditions of this experiment, healthy subjects adapted to the interference by reducing the number of muscle contraction episodes. A behavior that could be interpreted as an avoidance behavior developed in order to avoid tooth contacts and therefore the perception of the tooth/occlusal discomfort.

How can we combine the results of these 2 studies? A possible explanation may be provided by the results of an investigation conducted at our institution that indicates that CMD patients have the teeth in contact significantly more often than non-CMD patients. This has been the case for all subjects analyzed so far (unpublished data). Thus, it may be inferred that occlusal interferences may be of more significance in subjects who tend to keep the teeth in contact, ie, in subjects who are occlusally active. The results of Michelotti et al[9] also indicate that one of the requirements for a cause-effect relationship, ie, that an increase in exposure should lead to increased frequency or severity of disease (biological gradient), may not be necessary to prove a causal relationship between occlusal factors and CMD, as subjects may adapt to occlusal disturbances by an avoidance behavior.

What Needs Highlighting in Educational Programs?

Dental educators are faced with a significant dilemma. They must teach according to the principles of evidence-based dentistry, although there is not much evidence regarding the role of the occlusal interface in the long-term success of a reconstruction or maintenance of the health of the masticatory system. On the other hand, they must teach clinical skills in order for the dentist to provide teeth replacement and prosthodontic services. How can we solve this dilemma? After many years of teaching I am more convinced than ever that this dilemma can only be solved with a paradigm shift in dental education. This would require that dental education be based on a sound education in biomedical sciences and molecular biology and that basic science knowledge be integrated into daily clinical practice. The focus in dental education must shift from teaching clinical skills to educating students about how biological processes work. The advent of molecular biology has profoundly changed our understanding of the mechanisms that are the bases of diseases and/or adaptation processes. Only if students learn these biological mechanisms will they develop the critical analytical thinking skills and begin the life-long learning process necessary to understand why an occlusal reconstruction works. An environment determined by tissue remodeling as well as psychological and neurophysiological adaptation, prosthodontics is not, except for its esthetic component, a mere dental art but a biological science, one wherein the required technical interventions should be viewed within a biological context. It is of paramount importance that the teaching of this knowledge not remain limited to the preclinical years but be continuously integrated into clinical teaching in order to make the student intellectually eager to understand what is happening at tissue level and not simply to learn the technical skills needed to treat a patient. Dental schools need to be dedicated to the education of oral physicians rather than "dentists." The integration of the teaching of manual skills within the biomedical framework will remain the biggest challenge that prosthodontics will meet in the near future. If we can succeed in meeting this challenge, prosthodontics will no longer be "marooned at the bottom of the dental scientific heap."[10]

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Significance of the Occlusal Interface

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Highlighting Essential Results

Outstanding specialists from different areas of dentistry assembled for the Interface of Occlusion at the symposium "On Biological and Social Interfaces in Prosthodontics." The importance of occlusion for oral health was then examined from diverse relevant perspectives. One point of emphasis was the description of the scientific evidence for the significance of occlusal factors. Most authors concluded that there is little scientific evidence that occlusal factors are important in the pathogenesis of temporomandibular disorders (TMD) and the simple cause-effect relationship between malocclusion and TMD cannot be scientifically demonstrated. In fact, the results of studies on occlusion-oriented therapies with occlusal splints or occlusal contouring have been inconsistent. The gaps in our understanding of healthy occlusion and the effects of malocclusion on oral health were described, as were research strategies that could contribute to our knowledge of basic scientific principles. The published proceedings of the conference can therefore serve as a basis for planning future research and motivating young scientists to close the gaps in our knowledge of occlusion. In addition, the necessity of improving research methods was emphasized.

Discussion of Research Strategies

Beyron's concepts of occlusion are the basis of the prosthodontic and orthodontic therapies used in day-to-day practice.[1] The lack of scientific evidence for the usefulness of these concepts raises numerous questions:

- Why do we lack compelling scientific evidence for the effect of occlusal factors on the emergence of TMD or on TMD therapy?
- Do occlusal factors really only have a subordinate role in oral health, or have research methods often been inadequate?
- Are there subgroups of patients for whom occlusal factors do play a more important role, as demonstrated in a previous splint study?[2]
- TMD studies are often based on the outcome variable of "pain intensity." Is this the best target variable to investigate connections between TMD and occlusal factors?
- Have researchers examined the decisive occlusal parameters, and how exactly and reproducibly have occlusal variables (eg, occlusal interference or occlusal stability) been diagnosed or measured?
- How can the long-term effects of occlusal factors on oral health be evaluated if these factors can change continuously as a result of adaptation processes such as wear and displacement?
- How can we avoid methodological errors when performing studies, keeping in mind clinical issues and ethics committee policies that do not accept untreated control groups suffering from pain?

Numerous clinical studies have examined the efficacy of occlusal interventions in the treatment of TMD. High-quality randomized and blinded studies have employed validated pain scales to describe outcome variables.[3] However, TMD is a collective term for different functional diseases accompanied by acute or chronic jaw or facial pain, pain on palpation of the masticatory muscles, specific diseases of the