Introduction to Study Group Reports

Iven Klineberg, AM, RFD, BSc, PhD (Lond), MDS, FDSRCS (Lond, Edin), FRACDS, FICD
Christian S. Stohler, DMD, Dr Med Dent

The Context

The occlusal interface is integral to the functional interrelationships of the teeth, jaw muscles, and temporomandibular joints. The individual and overall tooth relationships are a component of management of the occlusion and are especially relevant to restorative, prosthodontic, and orthodontic rehabilitation. However, static and dynamic tooth relationship need to be considered within the context of the broader issues of occlusion and its biological basis, ie, esthetic and functional rehabilitation must be undertaken within the context of the patient-specific psychosocial profile. These interrelationships have a powerful influence on each patient's general well-being.

Esthetic and functional rehabilitation are closely integrated, as the well-recognized link between form and function implies. *Form* embraces shape and size, with an emphasis on facial form (proportions), including vertical dimension (lower facial height). Patient care should ideally be based on each patient's wishes and understanding of "form and function." In addition to meeting the esthetic requirements (ie, form and patient satisfaction), treatment must meet psychosocial needs and satisfy informed consent for each patient-specific management plan.

In a clinical management context, the occlusal interface requires a broad approach with a focus on the whole patient. Of course, attention must also be paid to the specifics of tooth preparation and the refinements of "form" to optimize each restoration or rehabilitation procedure.

Tooth Form and Jaw Relationships

There is no validated evidence from long-term, carefully designed clinical trials to indicate that a particular occlusal form and tooth inter-relationship is superior. There are strong opinions, which have polarized clinical protocols based on the dictum "it works in my hands." The lack of clinical evidence is not unexpected within the context of the biology of the jaw muscle system, since the form of tooth contacts (tripodized, cusp-fossa, etc) is unrelated to the patient-specific expectations of an appropriate blend of form and function to satisfy psychosocial needs, and thereby enhance patient satisfaction and well-being.

Jaw relationships and clinical recording of transfer records for rehabilitation, have been studied, and jaw guidance techniques have been compared and contrasted. No clinical research evidence has been reported to indicate that a particular clinical technique has superior reproducibility for transferring jaw relationship from the clinic to the laboratory for rehabilitation planning and construction. As with tooth form and jaw relationships, strong clinical opinion, personal preference, and perceptions of greater accuracy using one method or another have polarized clinical treatment philosophy.

Both tooth contact relationships and jaw recording techniques are requirements for patient-specific treatments. However, they need to be recognized within the hierarchy of importance in patient management, where clinical outcomes do not depend on a particular tooth contact arrangement or jaw recording technique.

Contemporary healthcare places the patient at the "center" and requires assessment of the patient's needs and expectations within the context of his or her life experiences. The astute clinician recognizes this need to focus on the patient and his or her expectations as well as the need to develop an informed partnership in treatment. This contrasts with clinician-focused decision making of the past. Contemporary partnerships in health care focus on the patient. Where appropriate, contemporary caregivers provide clinical management by using interdisciplinary consultations to achieve the most effective and sustainable patient-specific outcomes.

As indicated, the occlusal interface is pivotal to successful prosthodontic treatment. However, our understanding of the implications of occlusion for the individual, and what constitutes an acceptable range of variability for the natural and restored dentition for optimal function, is not defined. Further, the validity of a possible link between occlusion and temporomandibular disorders remains controversial. In an attempt to address these issues, the occlusal interface was considered within the framework of 4 overlapping determinants:

- Biologic adaptation and normative values as defining the biologic elements and their interrelationships. Normal determinants for the healthy young dentition with its adaptive potential, the biomechanical rationale for providing therapeutic changes in response to morphologic variations, and orthodontic and surgical management of developmental anomalies were considered.
- Beyron's[1] determinants of a healthy aging dentition as a foundation for prosthodontic treatment (maximum number of bilateral centric stops, adequate vertical dimension of occlusion, freedom in the retrusive range of occlusal contact, and multidimensional freedom of contact movement), and whether alternative or additional determinants might be considered to replace or modify Beyron's guidelines for treatment efficacy and effectiveness in the context of the biology of the system.
- Musculoskeletal disorders and the relationship of the occlusal interface for individual patient's needs, which were appraised on the strength of research evidence.
- Parafunction and the occlusal interface as defined by local and systemic factors and their implications in the short and long term for prosthodontic treatment planning and long-term treatment outcomes.

The presentations reviewed the clinical and biologic research evidence and considered the strength of evidence for each topic and the implications for clinical prosthodontics. It

became apparent that:

- The strength of evidence as to why specific treatment philosophies and/or concepts are advocated is weak
- The basis of current treatment philosophies in prosthodontics has arisen through progressive clinical knowledge and clinical convenience
- This has centered on clinical experience (or "it works in my hands"). These views have not been subject to the systematic testing of hypotheses through controlled clinical trials and long-term follow-up of operationally defined treatment outcomes and valid assessment measures and/or techniques.

The plenary discussion summary highlighted three broad areas of relevance for prosthodontic treatment:

- The population that requires prosthodontic services, recognizing the changing community demographics and increasing sociocultural diversity
- The occlusal interface, as defined within the biologic framework, acknowledging adaptation with time but recognizing that there are limits to this adaptive potential
- Tooth surface loss, considered on the basis of attrition and erosion, recognizing the context of the maturing dentition and the intrinsic and extrinsic factors that require consideration in clinical treatment

Research topics were proposed to encourage preclinical and clinical research in specific areas. These should address the current lack of knowledge of cause-and-effect relationships and provide, over time, a scientific basis to justify clinical decision making in prosthodontics. Educational issues were proposed to be linked with research data. The limited but emerging evidence of clinical outcomes based on long-term follow-up of specific treatment procedures was acknowledged. Undergraduate and graduate programs are now beginning to embrace evidence-based procedures for clinical decision making. This will be a stimulus for questioning much of what in the past has been the basis of prosthodontic education.

Population for Prosthodontic Services

All community groups, irrespective of age or social circumstances, have a justifiable expectation for prosthodontic care. The following issues are a responsibility of the prosthodontist and graduate prosthodontic programs.

- *Increasing life expectancy*. The encouraging development of the "graying" of the community in industrialized economies, through improved affluence, lifestyle, diet, and nutrition brings new challenges and demands. Education, prosthodontic care, and research must address social and medical consequences that will influence management strategies and the environment within which such care is offered.
- *Special-needs groups*. The varying complexity of prosthodontic care includes developmental anomalies, genetic defects, and socioeconomic influences.
- *Lifestyle and cultural needs*. Different expectations in developing economies need to be recognized and reflected in training programs that are designed to meet regional requirements.

Research issues include access to care, recognizing the unique situation (cultural, environmental, socioeconomic) of the target population.

What is the Occlusal Interface?

The following acknowledges the working scheme of biologic determinants and adaptive potential of the stomatognathic system.[2]

Occlusion in the Natural Dentition

Functional determinants are based on several factors:

- Sensory-motor interaction and phonetics are the basis of optimal orofacial function.
- Esthetics is a major focus of psychosocial well-being.
- Psychologic and psychosocial influences are crucial for optimum function and general health.

There is a range of variability form and function. These variations meet the comfort, physiologic, and esthetic needs of the individual. There is little evidence that the variations, or even the extremes, lead to bad outcomes or do not meet individual (comfort, physiologic, or esthetic) needs. Prosthodontic treatment within this framework needs to be emphasized in clinical practice.

Occlusion in Prosthodontics

In management of the occlusion, the restoration of form and function must be achieved, recognizing

- The broad range of variability that exists in dentitions
- That adaptation to an altered dental environment takes time
- The demands of restoring an occlusion, which vary with the complexity of the case, including complete-mouth reconstruction and periodontally and medically compromised conditions.

The framework for restoring the occlusion requires a "prescription" to increase the probability of a successful long-term outcome. It is recommended that the design characteristics take into account those features for which there is clinical research evidence.

- The need for a bilateral distribution of posterior tooth contacts in intercuspal contact positions has implications for individual tooth stability and each patient's perceived comfort.
- In the absence of clinical research evidence, accepted best practice suggests that the restorative design meets individual patient priorities and expectations for self-esteem, phonetics, esthetics, arch form (proximal tooth relationships), anterior tooth arrangement, lower face height, and occlusal vertical dimension.

Attrition and Erosion

The resiliency of the jaw muscle system is demonstrated by its accommodation to the continual changes in the stomatognathic system as a result of attrition and erosion. The graying of the community increases long-term demands on the system.

Parafunctions are orofacial motor behaviors (aside from function) that are not well-understood and may occur either during the day or at night. With respect to the occlusal interface, the tooth wear component is difficult to define and quantify reliably.[3] It is recognized that the individual adaptive capacity varies and may lead to undesirable sequelae, including unwanted wear of tooth structure, increasing tooth mobility, pulpal involvement, and failure of restorative work.

Tooth surface loss may also be attributed to erosion (accepting that dental caries is a major cause of tooth surface loss). It is recognized that *(1)* the extent to which attrition and erosion influence dentition is linked with factors such as diet, gastric disorders, oral dryness, medication, and enamel structure; and *(2)* habits, lifestyle, and occlusal morphologies vary greatly and are perceived differently among people of varying ethnic and racial backgrounds.

In future research, descriptions of parafunction and processes that lead to tooth erosion, including the identification of populations that show increased vulnerability, should be undertaken. The degree of parafunction that constitutes a risk for prosthodontic treatment (including implants) and the functional state of the stomatognathic system should be identified.

Conclusions

Clinical Evidence

It was recognized that the clinical and biologic research evidence that supports our fundamental understanding of the occlusion and best practice prescription for occlusal management is not strong. This was a major focus of the discussion that needs to be acknowledged. It was accepted that the variation in treatment philosophies proposed for optimal restoration of the occlusion evolved from clinical treatment experience and, with few exceptions,[4] has not been systematically studied to determine long-term outcomes.

Biology

The opening paper reviewed the biologic determinants and adaptive potential of the complex stomatognathic system. This desirably focused the discussion on the pivotal importance of functional adaptation and the range of variability of form and function that should be recognized as acceptable for individuals. Stylized diagnostic and treatment prescriptions, often advocated as an "all or none" essential requirement, lack scientific validity and clinical justification.

Clinical Prosthodontics

It is strongly recommended that the discipline of prosthodontics, through a commitment to prosthodontic education and best practice, takes the opportunity to plan for the future. It needs to be acknowledged that prosthodontics evolved within a mechanical era when biologic factors were poorly understood. There is a need to critically review core values of prosthodontics as a biologically based discipline with variable but profoundly significant psychosocial, functional, and esthetic implications for each patient.

There is a range of normative values of anatomic (form) and physiologic (function) and esthetic variations, in addition to the impact of parafunction and aging. It is within this framework that clinical prosthodontic restoration must be blended, in recognition of its unique role for maintenance of functional integrity. In the absence of long-term outcomes data on clinical procedures, the preparation of a therapeutic occlusal scheme should acknowledge the determinants of a healthy aging dentition as proposed by Beyron[1] as the basis for occlusal scheme design.

Education

Prosthodontic education for undergraduate and graduate programs must be given appropriate recognition and time in curricula. Educational programs need to focus on the importance of this discipline (as defined above) for a contemporary understanding of treatment responsibility to optimize outcomes for the benefit of the community.

References

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Iven Klineberg graduated from the University of Sydney and London, and holds Dental Fellowships with the Royal College of Surgeons of England, Edinburgh, and the Royal Australian College of Dental Surgeons. He has served as dean of the University of Sydney, Faculty of Dentistry, from 1991 to 1998 and 2003 to 2004, where he has also been professor and head of prosthodontics since1978. He established a jaw function and orofacial pain research unit, and a referral clinic for orofacial pain management in 1980. His research and clinical interests are in the fields of orofacial pain, TMD, and implant prosthodontics.

Christian S. Stohler received his dental degree, his doctoral degree, and certificates in oral surgery and prosthodontics from the University of Bern, Swizerland. In 1979, he joined the University of Michigan, where he was promoted to professor in 1990. He was a research scientist at the University of Michigan's Center for Human Growth and Development from 1991 to 1999. He was the school's director of research from 1994 to 1997 and served as chair of the Department of Biologic and Materials Sciences from 1995 to 2002. In 2003, Dr Stohler was appointed dean of the Dental School of the University of Maryland.