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The Challenges of Research in Occlusion and Temporomandibular Dysfunction

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The terms occlusion and temporomandibular dysfunction (TMD) elicit various emotions when discussed by oral health care practitioners. All clinicians responsible for direct patient care recognize the importance of occlusion in dental restoration as well as the existence and need to treat TMD in their patients despite the controversies.

It is critical that we use the best evidenced-based research in designing and implementing our therapies. The predicament is: how can we ensure that we apply sound scientific principles in our patient care with the plethora of misinformation and dogma that exists? Avoidance of these topics because of lack of understanding of occlusion and TMD can ultimately serve no purpose. Our goal must be to seek the ideal. To accomplish this we must appreciate the challenges of research in Occlusion and TMD from a historical perspective and apply current research standards in our new study designs.

As clinicians, it is important that we understand what the term evidence-based dentistry (EBD) means. The American Dental Association (http://ebd.ada.org/about.aspx 2010) defines EBD as "an approach to oral healthcare that requires the judicious integration of systematic assessments of clinically relevant scientific evidence, relating to the patient's oral and medical condition and history, with the dentist's clinical expertise and the patient's treatment needs and preferences" (http://ebd.ada.org). It is clear that to properly implement EBD in our patient care necessitates an individualized approach that takes into account our patient's desires and values, our education and clinical experience, and an excellent understanding of the available research.

Perhaps the most difficult conundrum that we face is the need to provide EBD that relies on statistically significant results when the nature of occlusal/TMD research is fraught with statistical "hazards" in both research design and measurement. The potential of bias occurs in any investigation due to the difficulty of double or triple blinding. Confounding factors may influence the results in an unknown way. For example, a study of cuspid guidance may determine that it is appropriate in the population studied. However, it is possible that on closer investigation, other factors (e.g., skeletal type, intercondylar distance, horizontal condylar inclination, etc.) may have a positive or negative influence. The determination that cuspid guidance is appropriate may in itself be too simplistic. How much guidance is appropriate? Is there a point where too much of good thing actually creates pathology?

EBD aims for the ideal that oral health care professionals must use the best evidence currently available in their everyday practice. This evidence is available from a variety of sources ranging from case reports to scientific papers. In the hierarchy of evidence, reliability is ranked depending on the type of research completed. Level one reliability of results comes from systematic review of well designed randomized controlled trials (RCT) and is ranked highest. While systematic reviews are considered the most reliable evidence, they are still only as reliable as the evidence assessed. Level two evidence comes from at least one well designed RCT with an appropriate sample size (n). Trials without randomization that are well designed

constitute level three. Expert opinion and anecdotal findings through case reports remain at the lower end of the ladder of evidence (Evidence-Based Nursing Practice http://www.ebnp.co.uk 2010). Ideally, experimental design attempts to minimize both Type I and Type II errors, although this is not always possible. Type I errors (rejection of the null hypothesis when it is actually true) are affected by the level of significance of a study. In most studies, there is usually less than a 5% chance that the null hypothesis will be rejected when it is true (significance level less than or equal to .05). Normally, significance levels vary between 1% (.01) and 5% (.05). If the null hypothesis is rejected, it is rejected in favour of the alternate hypothesis. Type ll errors are the probability of retaining the null hypothesis when it should be rejected because the alternate hypothesis is true. Strategies such as decreasing the standard deviation of the sampling distributions by decreasing score variability (more experimental control) or by increasing sample size will reveal a minimal meaningful difference. While these steps will increase the power of the study (reducing the possibility that the null hypothesis will be erroneously retained), they are challenging due to the nature of the human stomatognathic system. The system is inherently complex and, in our attempt to simplify it for study purposes, we run a major risk of missing the very nature of the system. It exists as a complex inter-relationship of different parts that are uniquely combined in each individual and, therefore, must be understood by looking at the whole. In order to provide proper evidence for scientific review, research design must pay particular attention to selecting the most homogeneous variables possible to allow clinically useful conclusions to be drawn. It is necessary for all oral health practitioners to recognize that in a structure as complex as the stomatognathic system, it is impossible to define a cause and effect between altering one variable and the resulting outcome. Any procedure that alters even one variable in the system will subsequently influence many other structures.

With this understanding of current accepted research criteria in mind a review of historical investigations reveals a lack of standardization of methodologies, inconsistent terminologies, and a significant risk of bias in study design. Most importantly, standardized research via clinical trials with respect to occlusion and TMD is virtually non-existent. This makes systematic reviews and meta-analyses using internationally recognized systems (Cochrane or Grade) impossible to complete.

The inherent paradox that unfolds as we study the difficulties in researching occlusion and TMD present practicing clinicians with a challenge. How do we best treat the person that is seeking our expertise? Perhaps the answer lies in understanding that each of our patients is an individual who must be assessed in a very comprehensive way. EBD dictates that we must combine our clinical judgment based on our experience, the patient's values and desires, and the available scientific research. Research, therefore, must concentrate on developing the means of identifying and better assessing all of the factors that are important to our patient's presenting situation. We, as clinicians, must perfect our skill at compiling the myriad of information that we obtain to produce a proper diagnosis and appropriate treatment plan. The ultimate goal must be to improve function. Finally, we should not ignore the past. A review of the history of occlusion and TMD is necessary to ensure that useful information from past research is not lost. An understanding of where we have been can help shape future research protocols to provide the answers that we must have to treat our patients effectively in an evidence-based manner.