Musculoskeletal Disorders and the Occlusal Interface

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Introduction

Temporomandibular disorders (TMD) are the musculoskeletal disorder most prevalent in the orofacial area. Several aspects of occlusion have been scrutinized in an effort to establish a link with TMD. These beliefs are mostly based on data that suggest a positive relationship between TMD and the occlusal parameter being studied, and on reports that signs and symptoms of the disorders improve with occlusal rehabilitation. A positive association between the signs/symptoms and the disease is a necessary, but not sufficient, provision for a causal relationship. In this article, the evidence for causality linking malocclusion and TMD will be assessed using the criteria suggested by Fletcher et al.¹

What Do We Know?

Malocclusion in its various aspects is highly prevalent in both sexes, and in all age groups. TMD and related symptoms are primarily a condition of young and middle-aged adults, mainly female, and their prevalence tends to diminish in the older age groups. Thus, the association between occlusion and TMD does not appear to make epidemiologic sense. Occlusal interferences are highly prevalent in both TMD patients and control subjects. Therefore, they lack sensitivity and specificity for identifying a TMD or control population.

The association between occlusion and TMD does not satisfy any of the criteria that are considered essential in establishing causal relationship. Pain and degenerative joint diseases can induce changes perceived at the occlusal level. There are emerging data on peripheral and central painprocessing mechanisms and their modulation by the reproductive hormones.

What Do We Not Know?

- Why do some patients tolerate acute changes in their occlusion while others do not?
- What are the musculoskeletal responses and adaptations to sensory inputs resulting from changes in occlusion?
- What is the influence of various occlusal schemes on function (eg, masticatory efficiency)?

What Research Strategies Are Needed to Link Occlusion and TMD?

A temporality relationship between cause and effect must be established. A test of temporality is positive if a consistent exposure to the cause is followed by the occurrence of the disease, ie, causes should precede effects. This fundamental principle can only be assessed with well-designed cohort studies and randomized controlled trials (RCT). The association between occlusal factors and TMD has been typically reported within cross-sectional (either case-control or case series) studies. With those study designs, the temporal relationship cannot be evaluated.

The strength of the association between the suspected cause (occlusion) and effect (TMD) must be determined. It is usually expressed in terms of the magnitude of the relative risk (in RCT and cohort studies) or relative odds (in either cohort or case-control studies) of developing the effect when exposed to the suspected cause. Although numerous papers have reported the association between various occlusal factors and TMD, only one cross-sectional population-based study that reports on the odds ratio² and one case-control study with discussion on odds ratios (ie, the amount that the independent variables, occlusal factors, can differentiate the dependent variables, disease versus health) were identified.³

A dose-response relationship must be established. This is present when variable amounts of the suspected cause are associated with increasing risk or severity of the effect. While there is no consensus about the definition of occlusal interferences, about which occlusal factor or a combination of these would play a determinant role in the development of TMD and should be appraised, most studies either do not include an assessment of risk or report the various degrees of TMD using measuring instruments with questionable diagnostic validity.

Reversible associations would have to be shown. A factor is more likely to be the cause of disease if its removal results in a decreased risk of disease.1 Attempts to show reversible associations are highlighted in RCTs that assess the efficacy of oral splints and occlusal adjustments in the management of TMD.⁴ The three RCTs that obtained the highest quality scores between 1961 and 2001 compared occlusal to palatal splints (0.60 to 0.78)5-7 and found no between-group differences if pain reports (rather than perceived relief) were used as the primary outcome variable. These results cast doubt on the therapeutic effect of splints and question the rationale of using splints to remove occlusal interferences in the management of TMD. In spite of their low quality scores (from 0.24 to 0.57), the RCTs on occlusal interferences reported a significant improvement of the TMD signs and symptoms over time, but no differences were found between the treatment and control groups. Removal of occlusal interferences does not appear to be any better than nonocclusal therapies or placebo intervention in the management of TMD.

Consistency must be established. Causation is particularly supported when studies using several different research designs all lead to the same results.¹ However, if more weight is given to case-control^{3,8} and population-based epidemiologic studies^{2,9-13} rather than case series or anecdotal reports, the consistent lack of association between various occlusal parameters and TMD becomes evident.

The concept of biologic plausibility is satisfied if the cause and effect is consistent with knowledge of the mechanisms of disease as they are currently understood. Biologic plausibility is not supported in the current context for at least 3 reasons:

- Malocclusion in its various aspects is highly prevalent in both sexes and in all age groups. Yet an appraisal of the epidemiologic literature on TMD and related symptoms from different population-based studies reveals consistently that it is primarily a condition of young and middle-aged adults, mainly female, and that its prevalence tends to diminish in the older age groups.
- Occlusal interferences are highly prevalent in both TMD patients and control subjects. Therefore, they lack sensitivity and specificity for identifying a TMD or control population.
- The current knowledge of pain mechanisms does not substantiate the association between occlusion and TMD.

What Needs Highlighting in Educational Programs?

- Clinical epidemiology on orofacial pain, identification of risk factors
- Misbeliefs about the causal role of occlusion in orofacial pain
- Differential diagnosis and management of orofacial pain, including behavioral and cognitive therapies
- Clinical applications of basic science knowledge about peripheral and central pain mechanisms

Conclusion

While a causal relationship often cannot yet be established, its strength increases if it satisfies a combination of the rules of evidence for causation. As reviewed above, the association between occlusal factors and TMD does not appear to satisfy any of the criteria that are considered essential in establishing causation. Furthermore, there is evidence that suggests that perceived changes in occlusion may be the consequence of pain rather that its cause. As a result, occlusal therapies cannot be justified, and prosthodontic treatment should aim at achieving improvement of the patient's orofacial comfort and function with optimal prostheses, but not as a specific therapy for TMD. This is consistent with the goals of managing TMD, which include palliation of the condition, pain control, and reestablishment of motor function.

The mechanistic occlusal view of the pathophysiology of TMD is being eclipsed by the evolving knowledge of the peripheral and central pain-processing mechanisms and their modulation. Future investigations on the pathophysiology of TMD need to mirror current developments in research on pain and its interaction with movement, rather than focusing on old concepts linking nonspecific dental structures to multiple disorders of the masticatory apparatus.

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