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Review

A review of the oral health-related evidence that supports the orthodontic treatment need indices

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ABSTRACT

Background and objectives: To date, there is no evidence-based method of quantification for malocclusion. Consequently, how deviant occlusal traits should be scored and weighted relative to one another is a matter of serious debate. Orthodontic Treatment Need Indices (OTNI) use the subjective opinion of the experts, as their foundation, to define the pathological boundaries (cut-offs) of occlusal traits. This paper reviews the evidence relating malocclusions or deviated occlusal traits to oral health problems, and investigates if this evidence supports the cut-off points and the rationale used for OTNI.

Materials and methods: The relevant cited studies and reviews from the MEDLINE, Web of Science, Scopus, Cochrane databases, and scientific textbooks were used. The citation rate was confirmed by using the Google Scholar.

Results: So far, the evidence for harmful effects of deviated occlusal traits on oral health is either lacking or exists as cross-sectional (mostly) and longitudinal (a few and primarily short-term) studies. When an association was reported between a deviated occlusal trait and an oral health problem, either the strength of that association was weak, or due to methodological issues, findings were not conclusive. Consequently, establishing a cause and effect relationship is difficult. Further, commonly used OTNI do not record a full spectrum of occlusal traits, and relating their ranking or scoring systems to the available evidence is difficult. Therefore, there is little evidence to suggest that individuals with a high need (high score), as measured by OTNI, will necessarily put at risk their oral health if they turn down orthodontic therapy.

Conclusion: OTNI have a role in the epidemiology and can be used for resource planning, but their predictive value to detect the future objective functional deficits or oral health problems is questionable. OTNI will need revalidation overtime with emerging research findings.

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1. Introduction

For years, orthodontists have stood behind the idea that straight teeth contribute to healthy teeth and periodontium, enhancing the person's self-esteem, benefiting social and career success, and improve person's general attitude toward life.[1] The relationship between malocclusion and components of oral health is important, as there is no agreement on whether malocclusion is a physiological or a pathological condition[2–5] (Table 1). Malocclusion, a deviation from a construct called ideal occlusion, has been given a range of definitions[3,6–8] and, due to difficulties in defining[9], quantifying[10], and relating it to oral health problems,[11] the management cannot follow the conventional disease model. In contemporary orthodontics, management of malocclusion can be divided into two principal categories: Enhancement and Therapy, with some overlap between them.[12] In approximately 80% of the population, with normal oral function, orthodontic therapy is primarily orthodontic enhancement[12,13] aiming at improving the dentofacial appearance. Clearly, enhancement is subjective with regards to ethical and moral judgments.[12] The remaining 20% have developmental anomalies outside the normal range (clefts of lip and palate, severe skeletal deformities) that require simultaneous enhancement and therapy.[12,13]

The Orthodontic Treatment Need Indices (OTNI) record or weight occlusal traits such as overjet, overbite, crossbite, and crowding, generating a grade or score for a malocclusion, which reflects the susceptibility to health risk (oral or psychological). Epidemiological studies used OTNI to provide an estimate of treatment need; moreover, recent additions to OTNI may assess the treatment outcome and malocclusion complexity as well. The scoring or grading systems of OTNI reflect the opinion of index developer (s) on health risks of malocclusion (psychological or oral/dental) and the potential benefits of orthodontic treatment.[14,15] The question remains "How evidence-based are OTNI?". This paper had two main objectives:

- To review the available evidence relating malocclusion to the oral health problems, and
- To investigate if this evidence supports the grading or scoring systems of the most commonly used OTNI[23–34] (Table 2).

Table 1 – Examples of obstacles in the study of malocclusion.

1-There is no agreement on whether malocclusion is a physiological or a pathological condition[2,12]; various definitions exist for it.[3,6–10]
2-In general, the evidence for harmful effects of deviant occlusal traits on oral health is lacking; orthodontists do not claim to prevent caries, periodontal disease, dental trauma, and temporo-mandibular disorders.[16–22]
3-Determining the cut-off point beyond which a malocclusion becomes abnormal and induces a pathological function is difficult.[12,22]
4-There is no evidence-based method of quantification for malocclusion, i.e., how occlusal traits should be scored and weighted relative to one another?[14]
5-For the most part, the weak associations/correlations that exist between deviated occlusal traits and oral health problems stemmed from cross-sectional studies, not implying causation.

Table 2 – Examples of the frequently used orthodontic treatment need indices.

Handicapping Labio-lingual Deviation index (HLD)[23,24] and its modifications[25–28]
Swedish Medical Board Index (SMBI)[29–31]
Dental Aesthetic Index (DAI)[32]
Index of Orthodontic Treatment Need (IOTN)[33]
Index of Complexity, Outcome and Need (ICON)[34]

2. Materials and methods

Conducting a systemic review was not possible as material for this review was extensive and diverse. Therefore, the MEDLINE, Web of Science, Scopus, and Cochrane databases were searched (1960-February 2012) for the harmful oral health-related effects of selected occlusal deviations and their relationship with OTNI. Relevant materials were selected and as much as possible; consideration was given to select the material that had been cited at least once in the literature. This was confirmed by using the Google Scholar. Additional information was also derived from scientific textbooks. Exclusion criteria for the present narrative review were animal studies and studies on individuals with disabilities or specific craniofacial syndromes.

3. The oral health risks of malocclusion

The potential oral health-related risks of malocclusion could be summarized as follows.

3.1. *Malocclusion as a cause of tooth wear*

Tooth wear is the non-carious mineralized tooth surface loss as a result of physical or chemical attack.[35,36] A degree of physiologic tooth wear occurs within a lifetime, but sometimes reaches a severe and pathological level.[35,36] Malocclusions such as those with increased overbites and edge-to-edge or cusp-to-cusp relationship of teeth have been related to higher levels of tooth wear. Previous studies on this topic used study groups, not necessarily representing the general population, and observed a range of relationships between tooth wears and either malocclusions or deviated occlusal traits[37–45] (Table 3). It appears that malocclusions and normal occlusions present various patterns and degrees of tooth wear[46,47] and this should not be considered pathological, but a consequence of different inter-occlusal arrangements.[47]

Table 3 – Examples of reported relationships between malocclusions/deviated occlusal traits and tooth wear.

1-Most deviated occlusal traits have not been significantly associated with tooth wear.[37–39]
2-The anterior and unilateral posterior crossbites and anterior teeth crowding were protective of high occlusal tooth wear.[40,41]
3-The edge-to-edge[40] and cusp-to-cusp relationships[40] of teeth, overbites > 4 mm,[42,43] and the Angle Class II malocclusions[44,45] were associated with higher levels of tooth wear.