Dental crowding as a caries risk factor: A systematic review

Hend Salah Hafez,[a] Sherif Mohamed Shaarawy,[b] Ahmed Awadh Al-Sakiti,[b] and Yehya Ahmed Mostafa[c]
Giza and Cairo, Egypt

Introduction: The association between dental crowding and dental caries has long been accepted because of increased food accumulation and plaque retention in areas of crowding. The aim of this review was to evaluate this potential causal relationship systematically. **Methods:** Six electronic databases were accessed, supplemented by manual searching of the references of the relevant retrieved articles, peer-reviewed orthodontic journals, and gray literature. Search terms included *caries*, *decay*, *crowding*, and *irregularity*. Non-English articles were excluded from the review in the study-selection stage. Data extraction and evaluation of primary studies were performed independently by 2 reviewers. **Results:** The initial search retrieved 6914 citations. However, only 18 articles met the inclusion criteria. The qualitative systematic review included 8 studies, with articles of low or moderate quality. No association between crowding and caries was reported in 4 studies, a significant negative correlation was found in 2 studies, 1 study showed a direct and significant relationship, and another study showed a positive association in the mandibular anterior region but an inverse correlation in the maxillary posterior region. **Conclusions:** To date, there are no high-quality studies to resolve the possible association between dental crowding and caries; further high-quality longitudinal studies are needed to clarify this relationship. (Am J Orthod Dentofacial Orthop 2012;142:443-50)

The assumption that dental crowding is a risk factor for dental caries has long been made. Crowding disrupts normal proximal and occlusal dental contacts that provide proper embrasures, spillways, and self-cleansing. In turn, crowding leads to food accumulation and plaque retention.[1,2] It is therefore intuitive that crowding will increase the incidence of dental caries. However, this belief has not always been supported by the literature.[1,3]

Studies evaluating the relationship between crowding and dental caries have shown contradictory results. Some authors have reported a positive correlation between malocclusion and the incidence of caries.[2,4,5] Contrary to

these findings, other authors failed to identify an association between crowding or its severity and dental caries.[6,7] Others have even reported a negative correlation between crowding and caries, with a lower incidence of decay in subjects with crowding.[8,9]

Caries is a common oral disease, and its rehabilitation is a costly and time-consuming procedure.[10] Strong evidence linking crowding and the development of dental caries would prioritize orthodontic treatment as a measure for caries prevention and improved oral health. If evidence were found to support this contention, dental health personnel—including general dental practitioners, pedodontists, and orthodontists—would assume a preventive role. Consequently, decision makers would be required to reevaluate orthodontic treatment needs of dental patients with crowding.

The aim of this systematic review was therefore to assess the relationship between dental crowding and the development of dental caries.

MATERIAL AND METHODS

This systematic review was performed in accordance with guidelines recommended by the Meta-analysis of Observational Studies in Epidemiology Group.[11] Study designs included were observational studies analyzing the association between crowding and caries. Participants (intervention and control groups) included

[a]Researcher, Department of Orthodontics, Oral and Dental Research Division, National Research Center, Giza, Egypt; member, International Clinical Research Group, Department of Orthodontics and Dentofacial Orthopedics, Faculty of Oral and Dental Medicine, Cairo University, Cairo, Egypt.
[b]Orthodontic resident, International Orthodontic Program, Cairo University, Cairo, Egypt.
[c]Professor and director, International Clinical Research Group, Department of Orthodontics and Dentofacial Orthopedics, Faculty of Oral and Dental Medicine, Cairo University, Cairo, Egypt.

subjects with no crowding or crowding of various degrees. Eligible studies were intended to evaluate caries as an outcome measure.

To identify all studies examining the relationship between crowding and the incidence of caries, the following electronic databases were searched with no restrictions: Cochrane Library (May 9, 2011), NLM Gateway (searches Pubmed and Medline, from 1950 to May 15, 2011), LILACS (from 1992 to May 20, 2011), Google Scholar (from 1993 to May 20, 2011), and ISI Web of Science (from 1945 to May 27, 2011). The search terms were the following.

Search 1: Dental AND (crowd* OR irregular* OR imbricat* OR "arch alignment" OR malalign*).

Search 2: (crowd* OR irregular* OR imbricat* OR "arch alignment" OR malalign*) AND (caries OR demineraliz* OR decay).

Search 3: Search 1 OR search 2.

A manual search was performed of dental and orthodontic peer-reviewed journals (*Journal of Dental Research*, from 1960 to May 2011; *Community Dentistry and Oral Epidemiology*, from 1973 to May 2011; *American Journal of Orthodontics*, from 1980 to June 1986; *American Journal of Orthodontics and Dentofacial Orthopedics*, from July 1986 to May 2011; *Angle Orthodontist*, from 1980 to May 2011; and *European Journal of Orthodontics*, from 1980 to May 2011. The references of these articles were evaluated for relevant citations. Authors of studies requiring further clarification were contacted.

The search and article selection were performed by 3 researchers (S.M.S., A.A.A., and H.S.H.). Data extraction sheets were created. The primary studies were assessed independently by 2 reviewers (H.S.H. and Y.A.M.). Inconsistencies arose just twice. The first was a disagreement among 2 of the 3 researchers on the decision to include 1 article; the third researcher suggested excluding this article. The second was to assess whether the conclusion of 1 article represented the results reported. This was resolved by referring to the data extraction sheets and discussing the point of controversy until agreement was reached.

The inclusion criteria were (1) human studies; (2) studies reporting on the prevalence or severity of dental crowding and dental caries, and assessing the association between them; (3) only studies including a comparator, a control group with no or minimal crowding, or a comparator of varying severity; and (4) studies with statistical analysis.

The exclusion criteria were (1) animal studies; (2) literature reviews, books, and articles of expert opinion; (3) studies reporting on the prevalence of crowding or dental caries or both without assessing their associations; (4) studies using a nonspecific index of outcome measurement for caries or crowding (eg, dental aesthetic index of orthodontic treatment need, or collective index of malocclusion); (5) studies evaluating white lesions; (6) subjects with systemic diseases or dental or craniofacial anomalies that could affect the susceptibility to caries; and (7) non-English articles.

Quality assessment of the 8 included articles was performed. Points were allocated for the following criteria: study type, blinding, adequate reporting, comparator (group with no or minimal crowding), validity and reliability of recording method and index used for measuring crowding and caries, effect of confounding factors, and coding of subjects. The maximum quality score for any article was 24. Articles were designated as having low, moderate, or high quality according to their scores (low, 1-8; moderate, 9-16; high, 17-24). A detailed quality assessment is given in Table I.

No meta-analysis was performed because of the heterogeneity of these studies, inadequate reporting of the study designs, and other limitations in the quality of the articles (Table I). Also, a wide range of indexes was used to measure crowding and the prevalence of caries (Table II).

RESULTS

The initial number of retrieved citations was 6914; 6911 were derived from electronic databases and 3 from manual searching. A total of 3094 duplicates were removed (3079 internal and 15 external duplicates). The titles of 3820 articles were evaluated for relevance; abstracts of unclear studies were evaluated. After removing 3727 irrelevant citations, 93 articles were screened for eligibility.

The full texts of 19 articles were assessed. One article was excluded because it lacked a comparator.[12] Therefore, only 18 articles met the inclusion criteria. Ten studies were subsequently excluded[2,5,7,13-19]; the reasons for the exclusion are outlined in the PRISMA flowchart (Fig). Therefore, 8 cross-sectional observational studies were included in the qualitative synthesis.[1,4,6,8,9,20-22]

No association between crowding or irregularity and caries was found in 4 studies.[1,6,20,21] Significant negative correlations were reported in 2 studies.[8,9] One study showed a direct and significant relationship between crowding and proximal caries scores,[22] whereas another showed a positive association between crowding and proximal surface caries in the mandibular anterior region and an inverse correlation in the maxillary posterior region.[4] The quality scores for the 8 studies are given in Table I.

DISCUSSION

According to the guidelines of the Meta-analysis of Observational Studies in Epidemiology Group,