Orthodontics and temporomandibular disorder: a meta-analysis
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Authors' objectives
To assess the relationship between traditional orthodontic treatment and the prevalence of temporomandibular disorders (TMD), and to answer the following questions.

Does traditional orthodontic treatment change the prevalence of TMD?

Does the use of a specific appliance change the prevalence of TMD?

Does extraction during orthodontic treatment change the prevalence of TMD?

Searching
MEDLINE was searched from 1966 to September 2000 using 'orthodontics' in the subject heading and crossing it with various combinations of the following terms: 'temporomandibular', 'craniomandibular disorder' and 'temporomandibular joint'. The reference lists in review articles were searched, as was a personal list of published and unpublished articles. Only articles published in the English language were eligible.

Study selection
Study designs of evaluations included in the review
Randomised clinical trials (RCTs), cohort studies, case-control studies, non-randomised prospective studies without controls, retrospective studies including post-treatment evaluation with or without controls, surveys and case series were eligible. Case reports and opinion papers were excluded. Where multiple publications were identified, only one representative article was included.

Specific interventions included in the review
Studies where orthodontic treatments were completed in each patient were eligible. Studies of orthodontic treatment and orthodontic surgery to treat TMD were excluded. The interventions included treatment with and without splints and no treatment. The types of appliances used were fixed appliance, functional appliance, headgear, chin-cup and protraction headgear.

Participants included in the review
The inclusion criteria were not defined in terms of the participants. The age at first treatment, where reported, ranged from 7 to approximately 55 years. The proportion of males, where reported, ranged from 0 to 83%.

Outcomes assessed in the review
Studies that clinically assessed TMD in each patient, including at least one clinical examination after treatment, were eligible. Imaging evaluations, occlusal inference evaluations, and electromyogram studies were excluded. The outcome measures used in the review were: temporomandibular joint (TMJ) sound; muscle tenderness; TMJ pain; pain on movement; limitation of opening; dysfunction index (Di Helkimo index); and anamnestic index (Ai Helkimo index). The outcomes were assessed from after treatment to 20 years.

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for the review, or how many of the reviewers performed the selection.

Assessment of study quality
A formal validity assessment was not undertaken, although the authors discussed the methodological flaws in the text of the review.
Data extraction
The data were extracted using a standardised form. The authors do not state how many of the reviewers performed the data extraction.

Data on symptoms, signs, or indices of TMD were extracted using a standardised form. The information tabulated included the following: the author and year of publication; overlapped sample; the number of patients; the presence of a control group or matched control; study design; gender ratio; age at first treatment; appliance type; drop-outs; time and type of assessment; extraction or not; and results. The latest TMD evaluations after orthodontic treatment were used to assess the outcomes.

Methods of synthesis
How were the studies combined?
A narrative synthesis was undertaken.

How were differences between studies investigated?
Where the data were available, statistical heterogeneity was assessed for each outcome using the methods described by Viana (see Other Publications of Related Interest); these involved calculation of the posterior probability. Homogeneity was indicated by a value greater than 0.8 for the probability of the posterior odds P(H), while a value of 0.2 was taken to indicate heterogeneity. Heterogeneity was explored by assessing the effect of sequentially removing one study at a time.

Results of the review
Thirty-one non overlapping studies were included: 13 were longitudinal studies (1 RCT with 191 patients, and 12 other longitudinal studies with approximately 2,000 patients) and 18 were cross-sectional studies or surveys (approximately 3,900 patients). The numbers of patients are approximate due to the population overlap between the studies.

Few studies investigated the prevalence or incidence of TMD in adult orthodontic patients post-treatment. The study populations differed considerably in TMD symptoms, signs and indices. Extreme heterogeneity was found, even when one study was sequentially removed at a time. For longitudinal studies, the P(H) across different measures ranged from 0.000 to 0.963 before treatment and from 0.000 to 0.787 after treatment. For cross-sectional studies and surveys, the P(H) ranged from 0.000 to 1.000 in controls and from 0.000 to 0.343 in cases.

The methodological flaws in the primary studies included the lack of control groups; even when control groups were used most were not strictly matched to the experimental group. In addition, most studies did not report the methods used to control bias, and some longitudinal studies had large drop-out rates.

Relationship between orthodontic treatment and TMD.

No study indicated that traditional orthodontic treatment, or the use of a specific appliance, increased the prevalence of TMD except for mild or transient signs (soft click, tenderness on palpation). Only one cross-sectional study with an unmatched control group (90 patients) showed that extraction during orthodontic treatment changed the prevalence of TMD.

Authors’ conclusions
Definitive conclusions could not be drawn from this review because of the unknown cause of TMD, methodological short-comings in the primary studies, and the lack of a widely accepted classification scheme. The data presented in this review did not indicate that traditional orthodontic treatment increases the prevalence of TMD.

CRD commentary
The aims were stated and the inclusion criteria were broadly defined in terms of the study design, interventions and
outcome. The inclusion criteria for the diagnosis of TMD were not defined for the review. The search was limited to studies published in the English language, as identified in one database, albeit supplemented by articles held in a personal collection. This strategy may have resulted in the omission of other relevant studies. The methods used to select the studies were not described and validity was not formally assessed. Relevant data were tabulated in the review, but the methods used to extract the data were not fully described. Heterogeneity among the studies was assessed for several outcomes and heterogeneity was explored. A narrative synthesis was appropriate given the heterogeneity among the studies.

In view of the considerable methodological limitations of the primary studies, the evidence presented is inadequate to reach any conclusion about the relationship between orthodontic treatment and TMD.

**Implications of the review for practice and research**

Practice: The authors state that definitive conclusions cannot be drawn from this review.

Research: The authors state that there is a need for a reliable and valid diagnostic classification system for TMD for future research.

**Bibliographic details**


**PubMedID**

12045761

**Other publications of related interest**


**Indexing Status**

Subject indexing assigned by NLM

**MeSH**

Adolescent; Adult; Child; Humans; MEDLINE; Orthodontic Appliances /adverse effects; Orthodontics, Corrective /adverse effects; Prevalence; Temporomandibular Joint Disorders /epidemiology /etiology; Tooth Extraction

**AccessionNumber**

12002001496

**Date bibliographic record published**

31/01/2003

**Date abstract record published**

31/01/2003

**Record Status**

This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.