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Original Article

Epidemiological and etiological considerations in dental occlusion as a cause for temporomandibular joint disorders: Systematic review & Meta analysis

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ABSTRACT:
Introduction: In this study we aim to conduct a systemic review and meta analysis of the epidemiological and etiological considerations in dental occlusion as a cause for temporomandibular joint disorders (TMDs). **Material and methods:** An Electronic searching of Pubmed, ScienceDirect and institute library databases to identify studies reporting the epidemiological and etiological considerations in dental occlusion as a cause for temporomandibular joint disorders (TMDs). **Results:** Six articles were finalised. We observed that static occlusal factors had no significant association with TMD. Of the dynamic occlusal factors assessed, only the absence of canine guidance, laterotrusive interferences, and retruded contact position to maximal intercuspation slide length ≥2 mm demonstrated significant ORs. **Conclusion:** From our study it can be concluded that Quantitative results from the current study should be interpreted with caution. Our results suggest that dysfunctions of dynamic occlusion may act as risk factors for TMD.
Key words: Temporomandibular Disorders, Malocclusion, Meta Analysis.

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INTRODUCTION

Previous studies have attempted to revisit the updated literature and review the interactions of morphological and functional occlusal factors and TMD. With large prospective efforts, like the OPPERA study [1-5], the research community is moving toward a systemic model of TMD and focusing on the comorbidities. Though, within orthodontic community, the concept of TMD as a result of malocclusion is still promoted not only in academic circles, but also clinically [6, 7]. This divergence poses a major limitation to both dental clinicians and educators. Within orthodontic training, there does not exist a standardized case-finishing protocol for TMD cases, primarily because there is no standardized curriculum or consensus school of thought [8].

Since the institution of the RDC/TMD diagnostic criteria, researchers have begun making efforts to standardize their case definitions of TMD, and as a consequence it is of clinical interest to revisit the associations of malocclusion characteristics with TMD given the improved materials and methods of TMD research over the past twenty years. Hence in our study we aim to conduct a systemic review and

meta analysis of the epidemiological and etiological considerations in dental occlusion as a cause for temporomandibular joint disorders (TMDs).

METHODS AND PROCEDURES

A comprehensive search of the literature was undertaken. This included electronic searching of the Pubmed, ScienceDirect and institution library. Keywords used in the electronic searches were Systematic Review, occlusion, malocclusion and TMD and temporomandibular joint (TMJ) search terms. The studies from 1995 to 2020 were included. English articles were considered for the studies.

Full-text versions of all the remaining after duplicate removal, potentially eligible studies were retrieved, and two independent reviewers evaluated the articles for compliance with the selection criteria. The following data were extracted: study design, diagnosis, number of patients, epidemiological and etiological, results, quality score, and author's conclusion. This review aimed to include randomized control studies (RCTs), cohort studies, and case/control studies conducted with adults populations that defined TMD as a dysfunction of myofascial pain with the assistance of a clinical examination.

RESULTS

From a total of 815 publications six were finalized. Figure 1

Figure 1: Flow chart describing systematic research search

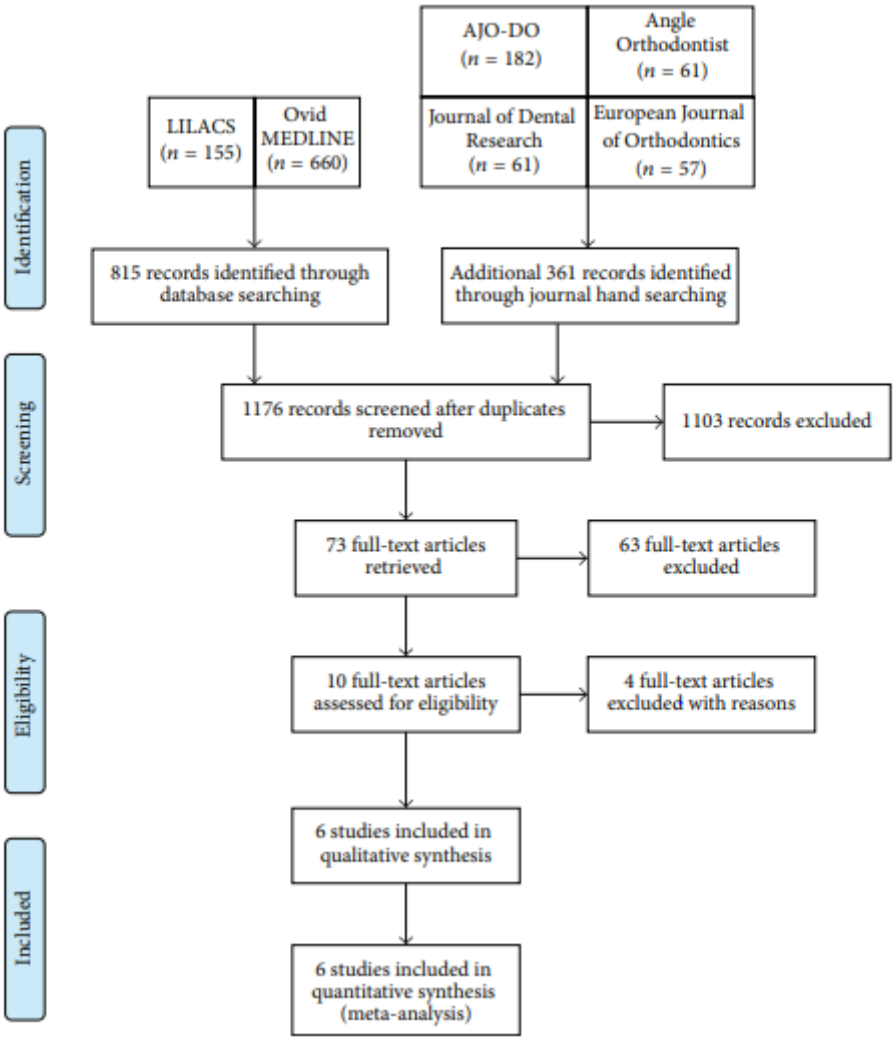
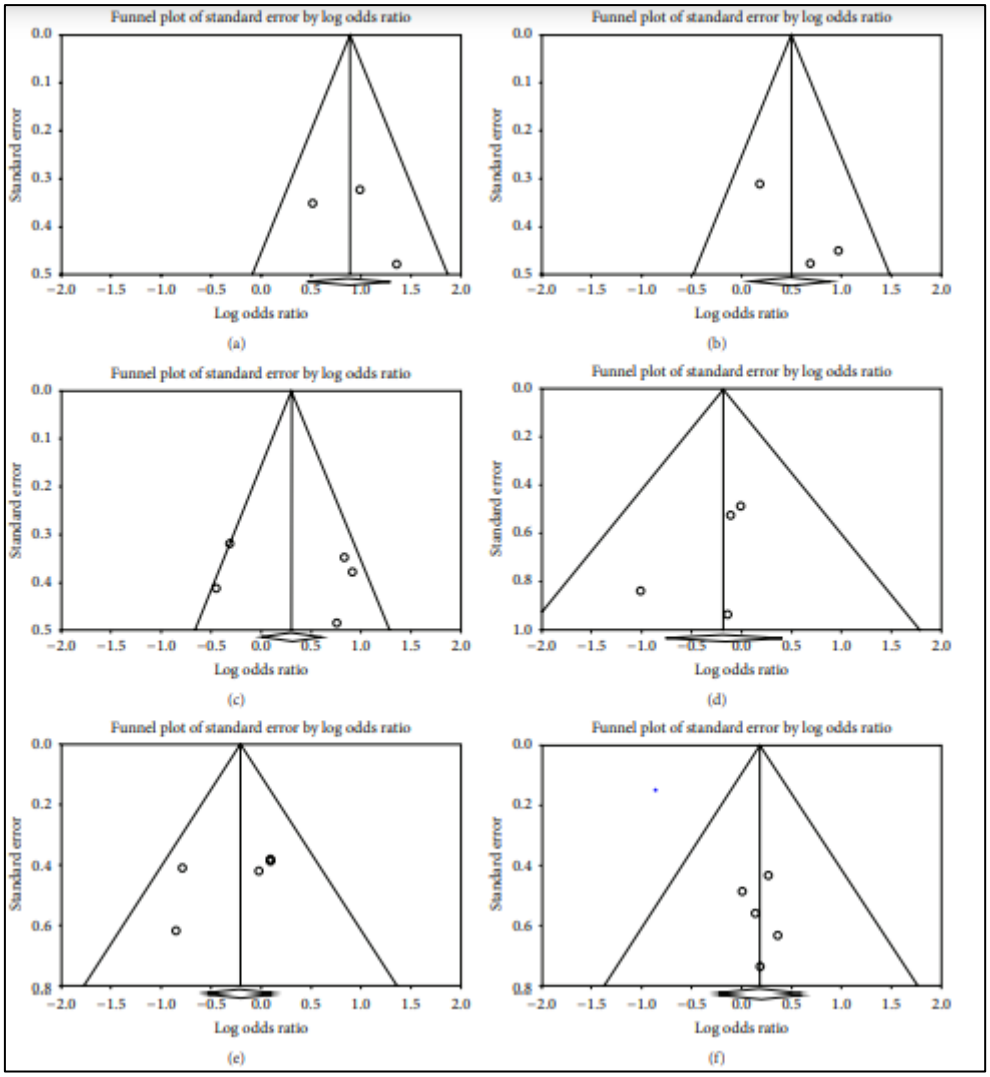


Table 1: **The characteristics of the included studies**

Study	Sample	Age (y)	Diagnostic criteria	Result	Potential biases and weaknesses
Fantoni et al., 2010 [9]	*n* = 238; 100% female; 156 TMD	Case = 35.4 ± 13.6; control = 35.4 ± 15.9	CE; RDC/TMD Axis I group I	Few occlusal features show a significant predictive value for myofascial pain	"All clinical examinations were performed by the same [5] trained operators"; interrater consistency was deemed sufficiently acceptable for TMD diagnosis, but there was no interrater assessment for risk factor measurements; no mention of measures to blind clinical examiners to the subjects' case/control status; cases and controls were subject to the same inclusion criteria (which included no dental/TMD treatment in the past 6 months) and gender- and age-matched
Landi et al., 2004 [10]	*n* = 81; 100% female; 53 TMD	Mean 37.2; range 20–71	CE; RDC/TMD Axis I group I	Occlusal features showed a low predictive value to detect muscle disorders of the stomatognathic system. Multifactorial complex pathologies, such as TMD, should be studied using multivariate statistical analyses, as univariate models may overestimate some resulting associations	Single trained operator performing clinical exam; no mention of operator blinding to case/control status; presumably complete occlusal analysis was performed at the same time as case/control diagnosis; no mention of operator training to ensure proper RDC/TMD diagnosis; cases/controls subjected to the same exclusion criteria and the only comparison between cases/controls showed that controls were on average 2.6 yrs younger
Marinho et al., 2009 [11]	*n* = 103; 66% female; 51 TMD	Range 19–54	CE; RDC/TMD Axis I	It was concluded that the occlusal factors have no association with temporomandibular disorders	Two operators performed clinical exams with good interrater agreements and standardized measurement methods; no mention of operator blinding; control group was roughly 1/2 female while the case group was roughly 3/4 female; cases/controls were age-matched, but other than age and gender no other characteristics were compared between cases/controls
Marklund and Wänman, 2010 [12]	*n* = 371 at baseline; 75% follow-up rate at end of 2nd year; 65% female; dental students	Not reported	Questionnaire + CE; case = 2-year persistent jaw muscle (JM) signs OR symptoms; classification assisted by RDC/TMD Axis I group Ia and group 3a	Analyses between cases and controls revealed that self-reported bruxism and crossbite, respectively, increased the risk of the incidence and duration of TMJ signs or symptoms. Female gender was a risk indicator of developing and maintaining myofascial pain. Signs of mandibular instability increased the risk of long-standing TMD signs and symptoms	25% of baseline sample dropped out at follow-up and dropouts were similar to nondropouts except that greater proportion of dropouts were men; TMD defined as JM signs OR symptoms at both baseline and follow-up, so some TMD cases could have been lost from dropouts; 2 blinded and calibrated operators performed clinical examinations; women composed roughly 2/3 of total subjects and no comparison of case/control characteristics
Mohlin et al., 2004 [13]	*n* = 134; young adults; 63% female; 62 TMD	19	CE; self-created checklist evaluating muscle tenderness and function; case = symptom at 19; control = no TMD at 19 and no history of TMD	Orthodontic treatment seems to be neither a major predictive nor a significant cause of TMD	55% of baseline sample dropped out at follow-up; no effort was made to assess if dropouts at follow-up affected cases and/or controls; nor was an effort made to compare the characteristics of cases/controls; orthodontic history was "assessed," but it was unclear how this factored into the analysis or sample selection
Selaimen et al., 2007 [14]	*n* = 102; 100% female; 72 TMD	Inclusion criteria of 15–60	CE; RDC/TMD	The results confirm that some occlusal factors, such as Class II malocclusion and the absence of canine guidance on lateral excursions, can be considered risk indicators for TMD, even controlling for sociodemographic confounding variables (employment, age, cigarette, and alcohol consumption)	1 operator blinded to case/control status made all occlusal and TMD assessments; cases/controls subject to the same inclusion/exclusion criteria; history of orthodontic treatment was not assessed in this study and is a potential confounder; characteristics not accounted for in the inclusion/exclusion criteria (such as education, race, and employment) were accounted for in analysis with adjusted odds ratios (OR) although those adjusted ORs were not used in this meta-analysis and it would have been preferable if they were matched for during sample selection

Figure 2: Funnel plot for the assessment of publication bias in (a) no-canine guidance, (b) RCP-MI discrepancy, (c) mediotrusive interferences, (d) open-bite, (e) overbite, and (f) overjet



The total patients were 2147 subjects with three of the studies enrolling only female subjects. All included studies had diagnosed TMD cases with the aid of a clinical examination. Within a given study, the same trained operator(s) conducted the clinical evaluation for occlusal factors, but only two studies [13, 14] mentioned operator blinding. **Table 1**

A random-effects model meta-analysis of two studies resulted in an overall pooled odds ratio of laterotrusive interferences of 2.190 which suggested that the presence of working side interferences increased the odds of TMD diagnosis that is highly significant. Also overall pooled odds ratio for patients without canine guidance shows that the absence of canine guidance significantly increased the odds of TMD diagnosis as did retruded contact position to maximal intercuspation discrepancies ≥ 2 mm. Funnel plots for assessing the reporting were only provided for the analysis of canine guidance where the number of studies combined was at least three (Figure 2). Overall pooled odds ratios for mediotrusive interferences, open- bite, overbite and overjet did not prove to be significant. The combined analysis for mediotrusive interferences showed significant heterogeneity.

DISCUSSION

Our study found that static occlusal factors (overjet, overbite, open-bite, and crossbite) had no significant association with TMD. Of the dynamic occlusal factors assessed, only the absence of canine guidance, laterotrusive interferences, and RCP-MI discrepancies ≥ 2 mm demonstrated significant ORs when pooled across studies. Mediotrusive interferences did not show significance. These results suggest that dysfunctions of dynamic occlusion may act as risk factors for TMD.

Our results appear to support the position that the human TMJ is able to adapt to small, static occlusal discrepancies and can therefore tolerate considerable variation without showing signs of pathology.

Dynamic occlusal factors are of greater interest

because of their potential to disrupt the TMJ. Our study found that laterotrusive interferences, the absence of canine guidance, and RCP-MI discrepancies ≥ 2 mm were associated with the presence of TMD. Lateral-side shifts of the mandible displace the working-side condyle and thus introduce orthopedic instability. Laterotrusive interferences have immediate, significant effects on working-side condylar movement, reducing the rotation of the mandible about the anteroposterior and superoinferior axes [20, 21]. Loading these restricted condylar positions could contribute to TMD pathogenesis; however loading forces were not measured in the included studies.

Thus, the present findings of an association between dynamic occlusal factors and TMD may support at least in part the hypothesis that a stable occlusion is important to maintain the relationship between joint structures.

This analysis represents the first known effort to combine the quantitative results of multiple studies that used a similar TMD definition. The great variability in TMD disease definitions across the literature makes the synthesis of study findings difficult unless all studies included within an analysis share a similar definition. A limitation of our analysis was the paucity of comparable case/control studies defining TMD specifically as a dysfunction of myofascial pain.

CONCLUSIONS

Quantitative results from the current study should be interpreted with caution. Our results suggest that dysfunctions of dynamic occlusion may act as risk factors for TMD.

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