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Research Article

Evaluate Scientific Evidence Of The Association Between Temporomandibular Joint Disorders And Facial Asymmetry: A Systematic Review And Meta-Analysis

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Abstract

Background and aim: clinical investigation of temporomandibular joint (TMJ) in asymmetric patients should be considered, even in the absence of signs and symptoms of TMJ disorders. Despite the importance of this issue, there is still no scientific evidence for a link between TMJ and FA disorders. Therefore the aim of current Systematic Review and Meta-Analysis study was evaluate Scientific Evidence of the Association between Temporomandibular Joint Disorders and Facial Asymmetry.

Method: From the electronic databases, PubMed, Scopus, LILACS, Web of Science, EBSCO, LIVIVO, and Embase have been used to perform a systematic literature over the last ten years between 2011 and May 2021. For Data extraction, two reviewers blind and independently extracted data from abstract and full text of studies that included. Mean difference with 95% confidence interval (CI), fixed effect model and Inverse-variance method were calculated. Random effects were used to deal with potential heterogeneity and I^2 showed heterogeneity. I^2 values above 50% signified moderate-to-high heterogeneity. The Meta analysis have been evaluated with the statistical software Stata/MP v.16 (The fastest version of Stata).

Result: 610 studies were selected to review the abstracts, the full text of 14 studies was reviewed. Finally, four studies were selected. Mean difference of linear menton deviation (general and unilateral)) was (MD, 1.29 95% CI 0.31, 2.53. $P<0.05$) and (MD, 2.35 95% CI 1.57, 1.13; $P<0.05$), respectively; in TMJ group was greater than control group.

Conclusion: The present Systematic Review and Meta-Analysis study showed mean difference of linear menton deviation (general and unilateral)) in TMJ group was greater than control group, and mean of angular menton deviation (unilateral) in TMJ group was greater than control group.

Key words: Temporomandibular Joint Disorders, Facial Asymmetry, Temporomandibular disorders

Introduction

Temporomandibular disorders (TMD) are disorders of the jaw muscles, temporomandibular joints, and the nerves associated with chronic facial pain. Any problem that prevents the complex system of muscles, bones, and joints from working together in harmony may result in temporomandibular disorder(1, 2). TMD affects up to 15% of adults, with a peak incidence at 20 to 40 years of age. TMD is classified as intra-articular or extra-articular. Common symptoms include jaw pain or dysfunction, earache, headache, and facial pain(3). Number of clinical signs and symptoms involving the masticatory muscles, the temporomandibular joint (TMJ) and associated structures(4, 5). A study showed first-onset TMD developed in 3.9% of participants per annum, typically producing mild to moderate levels of pain and disability in cases. TMD incidence was positively associated with age, whereas females had only slightly greater incidence than males(6). Etiological factors include occlusal abnormalities, orthodontic treatment, bruxism and orthopedic instability, macrotrauma and microtrauma, joint laxity and exogenous estrogen. Psychological factors such as stress, mental tension, anxiety or depression can cause TMD(7). The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD), published in 1992, was based on international expert recommendations and available empirical data(8). As further studies improved its validity and clinical use, a new Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) was published in 2014(9, 10). All temporomandibular joint disorders divide into four broad categories having similar characteristics as follows: temporomandibular joint disorders; masticatory muscle disorders; headache, and associated structures(11, 12). Magnetic resonance imaging (MRI) is a powerful and noninvasive tool for the imaging and understanding of TMD(13). Also, computed tomography (CT) and MRI may be required for degenerative joint disease, and disc displacement, respectively(14). Imaging may change the patient's treatment plan or prognosis(15). Facial asymmetry (FA) might arise from some pathological conditions that affect TMJ, such as congenital disorders, internal derangements, rheumatoid arthritis and osteoarthritis. For this reason, the relation between TMJ disorders and craniofacial morphology has been extensively studied(16). TMJ evaluation in people with FA is a clinically relevant issue. Therefore, clinical investigation of TMJ in asymmetric patients should be considered, even in the absence of signs and symptoms of TMJ disorders. Despite the importance of this issue, there is still no scientific evidence for a link between TMJ and FA disorders. Therefore the aim of current Systematic Review and Meta-Analysis study was evaluate Scientific Evidence of the Association between Temporomandibular Joint Disorders and Facial Asymmetry.

Method

Search strategy

From the electronic databases, PubMed, Scopus, LILACS, Web of Science, EBSCO, LIVIVO, and Embase have been used to perform a systematic literature over the last ten years between 2011 and May 2021. The reason for choosing studies in the last ten years is to be able to provide sufficient evidence in this area and use newer studies. Therefore, a software program (Endnote X8) has been utilized for managing the electronic titles.

Searches were performed with mesh terms:

((((("Temporomandibular Joint Disorders"[Mesh]) AND "Temporomandibular Joint"[Mesh]) AND "Facial Asymmetry"[Mesh]) AND ("Radiography"[Mesh] OR "Diagnostic Imaging"[Mesh] OR "diagnostic imaging" [Subheading] OR "Radiography, Dental, Digital"[Mesh])) OR ("Tomography, X-Ray

Computed"[Mesh] OR "Cone-Beam Computed Tomography"[Mesh] OR "Computed Tomography Angiography"[Mesh]).

This systematic review has been conducted on the basis of the key consideration of the PRISMA Statement–Perfumed Reporting Items for the Systematic Review and Meta-analysis(17), and PECO strategy (Table1).

Selection criteria

Inclusion criteria: Randomized controlled trials studies, controlled clinical trials, and prospective and retrospective cohort studies, observational studies; in English. In vitro studies, case studies, case reports and reviews were excluded from the study.

Table1. PECO strategy

PECO strategy	Description
P	Population: Total population
E	Exposure: patients with TMJ disorders
C	Comparison: patients without TMJ disorders
O	Outcome: occurrence of Facial Asymmetry

Study selection, Data Extraction and method of analysis

The data have been extracted from the research included with regard to the study, years, and study design, number of patients, sex, age, TMJ examination and outcome.

The quality of studies included was assessed using the Fowkes and Fulton guidelines(18). Scale scores range from (+) minor problem; (++) major problem; (0) no problem; NA (not applicable). A higher score means higher quality.

For Data extraction, two reviewers blind and independently extracted data from abstract and full text of studies that included. Prior to the screening, kappa statistics was carried out in order to verify the agreement level between the reviewers. The kappa values were higher than 0.80.

Mean difference with 95% confidence interval (CI), fixed effect model and Inverse-variance method were calculated. Random effects were used to deal with potential heterogeneity and I^2 showed heterogeneity. I^2 values above 50% signified moderate-to-high heterogeneity. The Meta analysis have been evaluated with the statistical software Stata/MP v.16 (The fastest version of Stata).

Results

According to the purpose of the study, in the initial search with keywords, 610 articles were found. In the first step of selecting studies 571 studies were selected to review the abstracts. Then, studies that did not meet the inclusion criteria were excluded from the study (557 article). In the second step, the full text of 14 studies was reviewed. Finally, four studies were selected (Figure1).

Characteristics

Four studies have been included in present article. The number of patients with TMJ disorders (TMJ group) and patients without TMJ disorders (control group) was 278 and 242, respectively (total=520). The mean of age in TMJ group and control group was 25.9 and 25.2 years. The number of male and female participants was 234 and 286, respectively. TMJ examination was made in two studies with Magnetic resonance imaging (MRI), one study with RDC/TMD Axis I and one study with clinical examination (Table2).

Bias assessment

According to Fowkes and Fulton guidelines (18), three studies omitted the sampling method, one study reported sample size with no problem. Matching/Randomization, Distortion reduced by analysis, in all studies were with minor problem and in all studies nor reported compliance. Table 3 reports all the information.

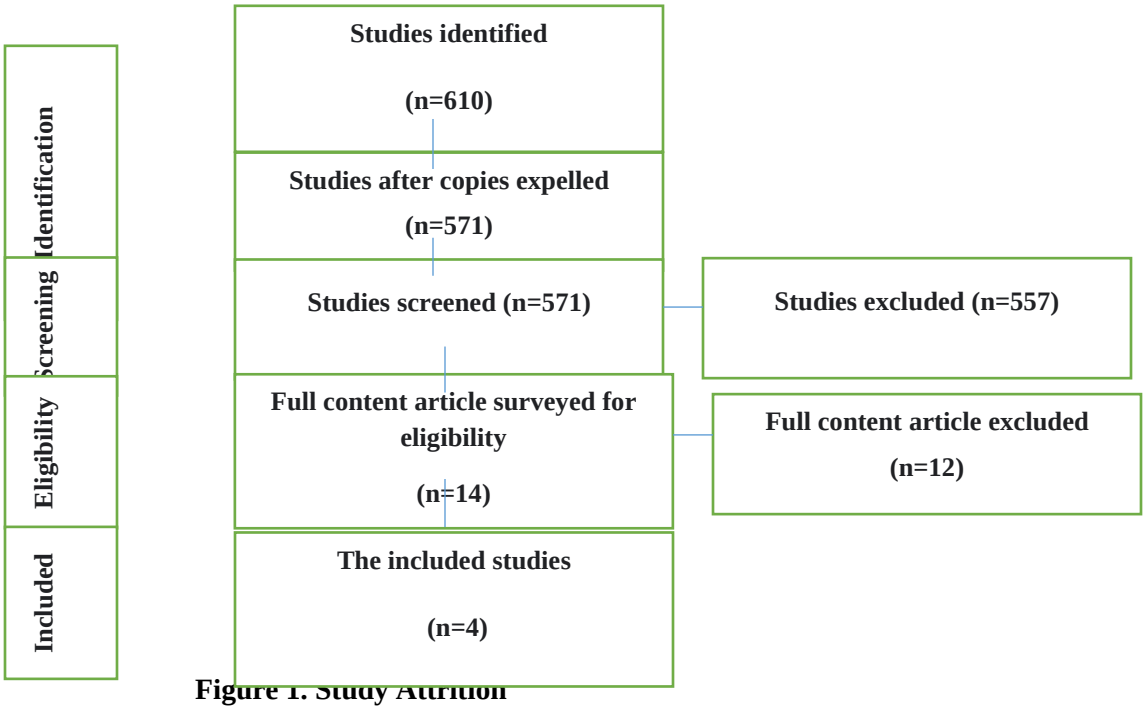

Figure 1. Study Attrition

Table2. Studies selected for systematic review and meta-analysis.

Study. Years	Sample size		mean of age		sex		TMJ examination	Linear relationship (mm)		Angular relationship (°)	
	TMJ	control	TMJ	control	female	male		TMJ	control	TMJ	control
Xie et al, 2015 (19)	165	156	16.7	16.2	161	160	Magnetic resonance imaging	5.62	4.19	NR	NR
Yáñez-Vico et al, 2013 (20)	20	21	36.70	37.14	18	23	clinical examination	2.25	1.34	NR	NR
Almăşan et al, 2013 (21)	35	26	24.87	25.7	47	14	RDC/TMD Axis I	NR	NR	3.45	1.21

Choi et al., 2011 (22)	58	39	22.1	22.1	60	37	closed mouth and open mouth, Magnetic resonance imaging	8.3	3.5	NR	NR

Table3. Risk of bias assessment

Study. Years	Study design	study sample representative				Control group acceptable				Quality of measurements and outcomes		Completeness	Distorting influences		Summary
		Source of sample	Sampling method	Sample size	Entry criteria/exclusions	Definition of controls	Source of controls	Matching/Randomization	Comparable characteristics	Validity	Blindness	Compliance	Confounding factors	Distortion reduced by analysis	
Xie et al	-	-	++	-	-	-	-	++	+	-	++	NR	++	++	No
Yáñez-Vico	-	-	-	++	+	+	-	++	++	+	-	NR	+	++	No
Almăşan et al	-	-	++	++	+	+	-	++	++	-	-	NR	+	++	No
Choi et al	-	-	++	++	-	+	-	++	+	-	++	NR	++	++	No

No problem: (-); major problem: (++); minor problem: (+); not reported (NR)

Subgroup Meta-analyses

The mean of linear menton deviation (general) was 1.29 (MD, 1.29 95% CI 0.31, 2.53. P<0.05) among two studies and heterogeneity found (I^2=100), this result showed the mean of linear menton deviation in TMJ group was greater than control group (Figure2).

The mean of linear menton deviation (bilateral) was 0.81 (MD, 0.81 95% CI -0.92, 2.54. P>0.05) among one study,this result showed the mean of linear menton deviation in TMJ group was similar to the control group (Figure2).

The mean of linear menton deviation (unilateral) was 2.35 (MD, 2.35 95% CI 1.57, 1.13; P<0.05) among two studies and heterogeneity found (I^2=91.64), this result showed the mean of linear menton deviation in TMJ group was greater than control group (Figure2).

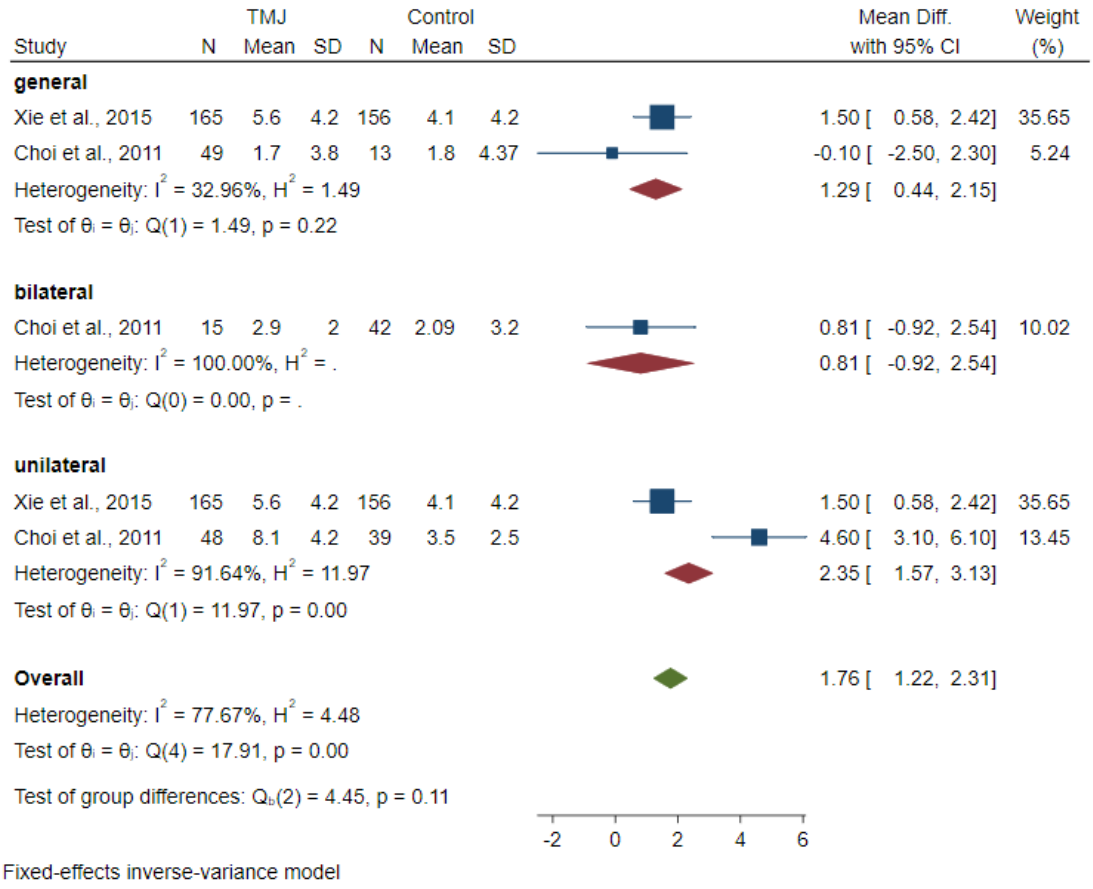

Figure2: mean of linear menton deviation in TMJ group was greater than control group

The mean of angular menton deviation (general) was 0.39 (MD, 0.39 95% CI -0.39, 1.17. P<0.05) among one study and heterogeneity found (I^2=100), this result showed the mean of angular menton deviation in TMJ group was similar to the control group (Figure3).

The mean of angular menton deviation (bilateral) was 0.20 (MD, 0.20 95% CI -0.57, 0.97. P<0.05) among one study, this result showed the mean of angular menton deviation in TMJ group was similar to the control group (Figure3).

The mean of angular menton deviation (unilateral) was 2.20 (MD, 2.20 95% CI 0.47, 3.93. P<0.05) among one study, this result showed the mean of angular menton deviation in TMJ group eas greater than control group (Figure3).

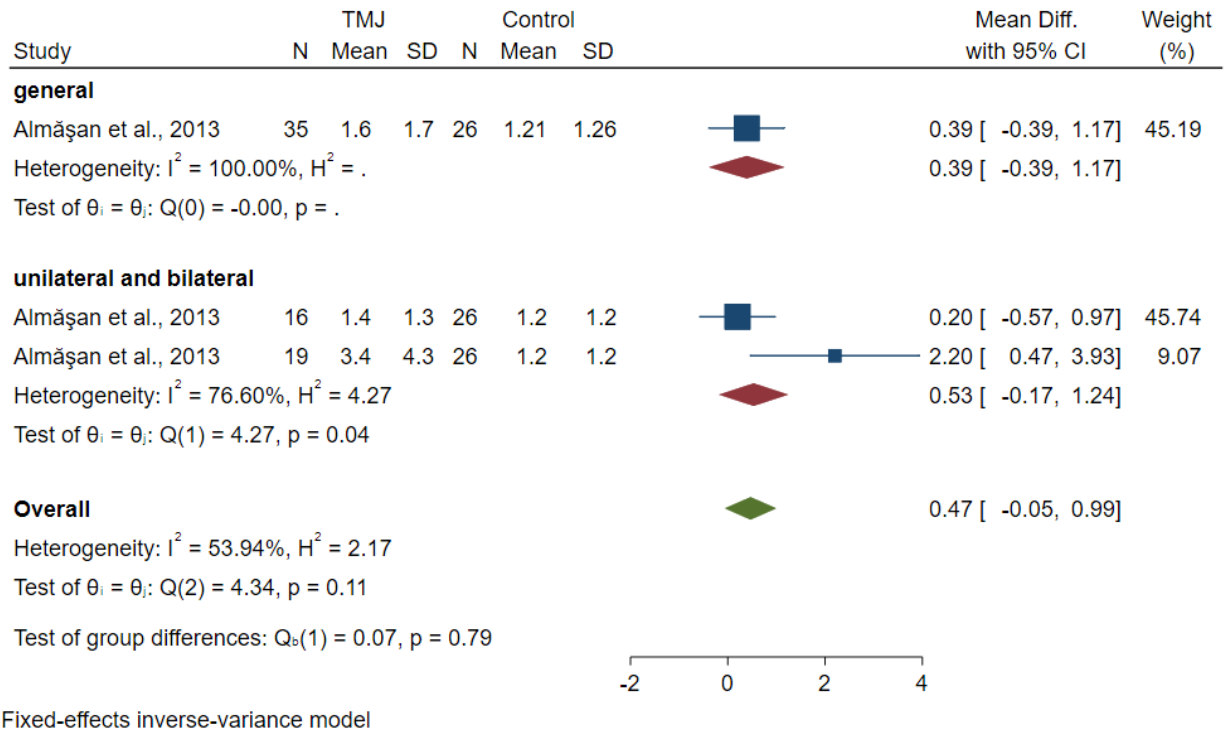

Figure3: mean of angular menton deviation in TMJ group eas greater than control group

Discussion

The aim of current Systematic Review and Meta-Analysis was evaluate scientific evidence of the association between Temporomandibular Joint Disorders and Facial Asymmetry. The present meta-analysis showed the mean difference of linear menton deviation (general and unilateral)) in TMJ group was greater than control group, however the mean of linear menton deviation (bilateral) in TMJ group was similar to the control group. Mean difference of angular menton deviation (general and bilateral) in TMJ group was similar to the control group, also mean of angular menton deviation (unilateral) in TMJ group was greater than control group. However, the high heterogeneity in the studies and the low incidence of studies in this field, the studies that were included in the meta-analysis do not show strong evidence for these results and few studies have attempted to link TMJ and FA disorders.

TMJ may be affected by FA. Differences in bilateral TMJ morphology indicate anatomical abnormalities that predispose these patients to TMJ problems(23). Changes in the mandibular condyles, specially decreased condylar height, may induce shortening of the disc displacement side, leading to facial asymmetry. Therefore, it is difficult to describe a clear cause end effect relation between FA and TMDs (16, 24, 25). Xie et al.,2015 (19) showed mandibular asymmetry is much more common and severe in young unilateral anterior disc displacement patients. The severity of mandibular asymmetry is correlated with the height of condyle and the status of the disc. Yáñez-Vico et al., 2013 reported Asymmetries in the maxillary

and mandibular structures were statistically significant ($P < 0.05$) for subjects with unilateral TMJ sounds and for controls, except in the case of maxillary rotation and mandibular ramus height ($P > 0.05$). The highest deviations found were frontal and lateral ramal inclination, goniac angle and canting of occlusal plane(20). Almăşan et al., 2013 showed Unilateral TMDs are associated with changes in posteroanterior cephalometric measurements. The assessment of posteroanterior cephalometric variables could be used as a key factor for evaluating the presence of TMDs(21). Choi et al., 2011 investigate the relationship between temporomandibular joint disk displacement and facial asymmetry in skeletal Class III patients, the result showed when the TMJ DD was more advanced on one side than on the other, the chin point usually deviated to the advanced side. When the TMJ DD status was equal or bilaterally normal, the amount of mandibular deviation was not significant(22). The present study has limitations such as, heterogeneity between studies was high, and sample size was small. Also, cross-sectional studies were reviewed only. Further studies with high sample size, follow-up period, clinical trial and cohort studies are required. Further research is needed to establish a long-term link between TMJ and FA disorders.

Conclusion

The present Systematic Review and Meta-Analysis study showed mean difference of linear menton deviation (general and unilateral)) in TMJ group was greater than control group, and mean of angular menton deviation (unilateral) in TMJ group was greater than control group. Longitudinal studies are needed for further research.

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