ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 2, Issue – 1, January - February - 2019, Page No. : 91 - 97

Is There Any Association Between Increased Over Jet And TMD…?? A Systematic Review

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Type of Publication: Systematic Review

Conflicts of Interest: Nil

Abstract

Aim: The aim of this systematic review is to evaluate whether there is any association between increased overjet and temporomandibular joint dysfunction.

Data Sources: The search strategy was performed according to standard Cochrane systematic review methodology. The MEDLINE database, Cochrane Library, Ovid, EMBASE databases were searched. The inclusion and exclusion criteria were then applied for the studies to be included. The authors were contacted for further data.

Results: Total 162 articles were retrieved. After reading the title and abstract of these articles, full text of 35 articles were retrieved for thorough evaluation. After reading the full text only 22 articles met the inclusion criteria and for final study only those articles were considered. Out of 22 articles included, in only 14 studies significant association between increased overjet and TMD was found and rest of the studies failed to identify significant and clinically important associations. 15 studies were of moderate (B) quality and 6 studies were of low (C) quality and one of the studies was a high (A) quality study. Individual variations in signs and symptoms of TMD over the time according to some studies further emphasized the difficulty in establishing increased maxillary overjet as a significant risk factor for TMD.

Conclusions: Grade 3 evidence is found for this systematic review evaluating association between increased overjet and TMD. As strong evidence is not found, so there is still need for more standardised long term study.

Keywords: Overjet, Temporomandibular joint disorder.

Introduction : The association between dental occlusion and temporomandibular dysfunction (TMD) is still a debatable issue in the world of dentistry. Temporomandibular dysfunction (TMD) is a generic term having a number of clinical signs and symptoms involving the masticatory muscles, the temporomandibular joints (TMJs), and associated structures.

It is considered that the etiology of TMD is multifactorial. Various factors like, untreated malocclusions, non

occlusion, stress and other psychologic factors, and trauma have been suggested as likely etiologic factors. The impact of occlusion on the occurrence of TMD has varied from none to considerable. The incidence of excessive overjet increased with age. With excessive overjet, people develop a habit of positioning the mandible forward. This tends to cause a dual bite which could over time, aggravate the muscles of mastication and muscle tension and load the temporomandibular joint.[1]

The idea of temporomandibular disorders commonly includes a wide variety of signs and symptoms. Subjective symptoms like temporomandibular sounds, pain or discomfort in the jaws, headaches, earaches, and bruxism. Clinical signs of temporomandibular dysfunction such as limited range of mandibular movement, mandibular locking or luxation, pain on movement of the mandible, joint sounds (clicking), and temporomandibular and muscle.[2] Signs and symptoms of temporomandibular disorders (TMD) are present in children and adolescents. However, the frequency of severe disorders accompanied by headache and facial pain, and regarded as by urgent need of treatment is 1 to 2% in children and about 5% in adolescents. According to a study by Thailander, prevalence of temporomandibular dysfunction is high in developing stage. Girls had more prevalence than boys.[3] Many authors seems to find out association between different features of malocclusion and temporomandibular disorders. According to some authors, there is significant association between different signs of TMD and increased maxillary overjet.[2-5] But number of studies[6-11] have shown that there is no relationship between the overjet and TMD. There are still controversies concerning increased maxillary overjet and occurrence of temporomandibular disorders. The aim of this systematic literature review was to answer the following question: Is there any association between increased maxillary overjet and temporomandibular disorders?

Material and Methods

Search design: The data were searched from the MEDLINE database, Cochrane Library, Ovid, Embase database. Following keywords and their combinations were used: temporomandibular joint disorder, overjet, TMD, temporomandibular dysfunction, increased maxillary overjet. For this study, national and internationally published articles, relevant cited articles were included. The reference lists and abstracts of the papers were examined. The full text of a paper was obtained if at least one of the reviewers thought that the paper addressed the issue in question. If obviously relevant literature was missing from the reference lists, further database searches were carried out using key words from known papers. All selected papers were read independently by the authors.

Inclusion criteria: The articles on temporomandibular disorder, significant association between overjet and TMD, data only from human subjects, language in English, randomized controlled studies (RCTs), control group included, prevalence studies, case control studies, cohort studies, were selected for inclusion criteria.

Exclusion criteria: Articles on animal studies, case reports, review articles, opinions, and columns in publications, pilot studies, articles in a language other than English, temporomandibular disorder in syndromes or any muscular dystrophy subjects were in exclusion criteria in this study.

Literature Flow (Figure 1)

We got 162 articles when data was searched on different search engines and 35 articles were selected when we screened them by their title and abstract. After that only the relevant articles were included. Only 22 articles were selected for data extraction after reading full text of these.

Both authors performs a first-stage screening of titles and abstracts based on the research question and its study design, population, intervention, and outcome to be studied. Based on the initial screening, selected full-text articles are obtained for the second-stage screening. The studies selected are then submitted for data extraction.

Figure 1: Showing the flowchart of search strategy

Evaluation for conclusion [12]

Evaluation based on the grade of evidence is presented in Table I.

Table I. Evaluation for conclusion

Grade of Evidence	Criteria
Grade 1 Evidence	Two studies with strong evidence
Grade 2 Evidence	One study with strong evidence and two studies with moderate evidence
Grade 3 Evidence	Two studies with moderate evidence
Insufficient Scientific support	Lack of studies with evidence

Conclusion based on at least two studies with strong evidence considered strong scientific or grade 1 evidence.

Conclusion based on one study with strong evidence and two with moderate-strong evidence were considered moderately strong scientific support for grade 2 evidence. Studies with opposite conclusions lower the grade of evidence.

Conclusions based on two studies with moderately strong evidence were considered moderately scientific support or grade 3 evidence. If opposite conclusion studies existed, the scientific evidence was considered as insufficient and contradicting.

Insufficient scientific support means lack of studies with evidence criteria.

Contradicting scientific support means contradictory results exist between similar evidence studies. The scientific result was considered contradictory because no conclusions could be drawn.

Results

Total 162 articles were retrieved and after reading title and abstract of these articles, full text of 35 articles were retrieved for thorough evaluation. After applying the inclusion and exclusion criteria, only 22 articles were relevant to this study and studied by the authors. The flowchart of the search strategy was shown in figure 1.

Finalized articles were thoroughly evaluated for their quality and potential risk for bias based on an evaluation adapted from Cericato et al [11] (Table II)

Q.1The abstract clearly presents the study objective, methodology, results and conclusion

Q2.The study exposes objective clear and precisely.

Q.3The ethical aspects of the research are cited in the text.

Q.4The research design is described.

Q.5The sample size calculation is reported.

Q.6The eligibility (1 point) and exclusion (1 point) criteria are described.

Q.7Control groups are used.

Q.8 The research design is adequate (randomization and blinding).

Q.9The statistical tests are described.

Q.10The p values are cited.

Q.11The study exposes the results clear and precisely.

Q.12The study limitations are discussed.

Table II: Quality assessment of included studies

Author and year	Q.1 (1 pt)	Q.2 (1 pt)	Q.3 (1 pt)	Q.4 (1 pt)	Q.5 (2 pts)	Q.6 (2 pts)	Q.7 (1 pt)	Q.8 (2 pts)	Q.9 (1 pt)	Q.10 (1 pt)	Q.11 (1 pt)	Q.12 (1 pt)	Overall score	Quality
Riolo[2] (1987)	1	1	1	1	0	2	0	0	1	1	1	1	10	Moderate (B)
Motegi[14] (1992)	1	1	0	1	0	0	0	0	0	0	0	0	3	Low(C)
Pullinger[15] (1993)	1	1	0	1	0	2	1	0	1	1	1	0	9	Moderate(B)
Keeling[16] 1994	1	1	0	1	0	2	0	0	1	1	1	1	9	Moderate(B)
VANDERAS[17] (1994)	1	1	0	1	0	0	0	0	1	0	0	0	4	Low(C)
TSOLKA[18] (1995)	1	1	0	1	0	2	1	0	1	1	1	0	9	Moderate(B)
Henrikson[19] (1997).	1	1	0	1	0	2	1	1	1	1	1	0	10	Moderate(B)
Sonnesen[20] (1998)	1	1	1	1	0	2	0	0	1	1	1	0	9	Moderate(B)
Kahn[21] (1998)	1	1	0	1	0	2	1	0	1	1	1	0	9	Moderate(B)
Seligman DA[22] (2000)	1	1	0	1	0	1	1	2	1	0	0	1	9	Moderate(B)
Ćelić[23] (2002)	1	1	0	1	0	2	1	0	1	1	1	0	9	Moderate(B)
Pahkala RH[5] (2002).	1	1	0	1	0	0	1	0	1	1	0	0	6	Low(C)

Thilander B [3] (2002),	1	1	0	1	0	2	0	0	1	0	0	0	6	Low(C)
Gidarakou[24] (2003)	1	1	1	1	0	2	1	0	1	1	1	0	10	Moderate(B)
Abdullah[25] (2005)	1	1	0	1	0	2		1	0	1	1	1	9	Moderate(B)
Selaimen[10] (2007)	1	1	1	1	2	2	1	1	1	1	1	1	14	High(A)
Turasi[26] (2007)	1	1	1	1	0	2	1	0	1	1	0	0	10	Moderate(B)
Schmitter[27] (2007)	1	1	1	1	0	2	0	2	1	1	0	0	10	Moderate(B)
Manfredini[8] (2010)	1	1	0	0	0	2	0	0	1	1	0	0	7	Low(C)
Manfredini[6] (2013)	1	1	1	0	0	2	1	0	1	0	0	0	7	Low(C)
Manfredini[9] (2014)	1	1	0	1	0	2	1	0	1	1	0	1	9	Moderate(B)
Haralur[4] (2014)	1	1	1	1	0	2	0	0	1	1	1	0	9	Moderate(B)

Based on this evaluation each article were classified as low (C) quality (0-8 points), moderate (B) quality (9-11 points) or high (A) quality (12-15 points). 1 study was of high (A) quality, 15 were of medium (B) quality and 6 were of low (C) quality based on risk bias.

(Table III) Out of 22 articles included, in only 14 articles significant association between increased overjet and TMD was found, while rest of them fail to identify any association. From these 14 articles, 11 were of B quality and 3 of C quality.

Table III: Summary of included studies

S. NO.	AUTHOR/ year	STUDY Design	AGE GP	POPULATION (mean overjet)	STAT	RESULT/P VALUE	EVIDENCE

1.	Riolo[2] (1987)	Cross sectional	6-17 years	1342 subjects (>7mm)	chi-square	Rate of clicking was not statistically associated with overjet except when greater than 7mm (p=0.05). excessive overjet positively associated with TMJ pain.	M (B)
2	Motegi [14] (1992)	Cross sectional	6-18 years	7337 children, 3219 boys and 4118 girls (>5 mm)	Statistical analysis not clearly defined	Significant. Prevalence of TMD in cases of excessive overjet is high (20.1%) and it increases with age. But p value not given.	L(C)
3	Pullinger[15] (1993)	Cross-sectional		Asymptomatic controls (n = 147) , symptomatic Experimental(n = 413i.e. divided into five groups) (>6mm)	multiple logistic regression	Significant overjets > 6-7 mm (p < 0.05 to p <0.01). Smallest mean overjet occured in asymptomatic control (2.2mm) and largest mean overjet in primary osteoarthrosis group (3.3mm). Significant increase in risk occured with overjet >6-7mm	M(B)
4	Keeling[16] 1994	Prevalence	mean age = 9.0 years	4393428 3(>3.54mm)	logistic regression	P=0.874 NSAs overjet was in range between -4 to 12mm and mean value was 3.54mm, overjet not statistically associated with increased risk of having TMJ sound.	M(B)
5	VANDERAS[17] (1994)	Epidemiological study	aged 6 to 10 years	386 children (>4mm)	chi-square	No statistically significant difference. Each clinical sign and overjet was found in both groups	L(C)
6	TSOLKA[18] (1995)	Case control	TMD-mean 29.2, normal 27.1	64 tmd,28 control (>3.5mm)	Chi-square analysis,analysis of variance	No statistically significant difference in horizontal overlap relationship found between calm and not calm group.	M(B)
7	Henrikson [19] (1997).	Prospective	11-15 years	total of 183 girls,normal occlusion (n = 60) and class II malocclusion group (n = 123) (>6mm)	multiple regression analysis	Significant p less than 0.05. overjet >6mm increased the odds for reported frequent headaches and pain on mandibular movement	M(B)
8	Sonnesen [20] (1998)	Cross sectional study	7-13years	104 children (56 F, 48 M) (>6mm)	logistic regression	Significant (p < 0.05) Signs and symptoms of TMD were significantly associated with extreme maxillary (>6mm)	M(B)
9	Kahn [21] (1998)	Case control	Age group not mention	263case, 82 control (>4mm)	Chi-square	SS (p= 0.05) Horizontal overlap equal to or greater than 4mm was greater in symptomatic patients with intraarticular temporomandibular joint disorders	M(B)
10	Seligman DA[22] (2000) (RCT)	Case control	Experimental group(13-72 years) Control (21-74 years)	124 female patients with intracapsular TMD were compared with 47 symptomatic female controls (>5.25mm)	multiple stepwise logistic regression, and univariate analyses	Not significant. Occlusal and attrition factors were only moderately useful in differentiating normal from TMD patients. Occlusal factor in identifying normal individuals were absence of open bite, smaller overjet (<5.25mm).	M(B)
11	Ćelić[23] (2002)	Prevalence study	19 and 28 years	230 men (>5mm)	Pearson's chi square test.	SS(P = 0.001) Horizontal overlap = or >5mm was significantly more prevalent in symptomatic patients.	M(B)
12	Pahkala RH[5] (2002).	longitudinal study	mean age during the first examination = 7.6 years, second examination 10.6 years, and third one 15.4 years	Experimental group n = 94,(41 girls and 53 boys) control n = 93(50 girls and 43 boys) Amount of overjet not mention includes both positive and negative overjet groups	Multiple logistic regression	Overjet was positively related to hypermobile but negatively to hypomobile jaw movements. Excessive overjet in 10 years old group seemed to be related to large mandibular movements in adolescence.	L(C)
13	Thilander B [3] (2002),	Prospective study	5-17 years old	4724 children (2353 girls and 2371 boys) (>6 mm)	The t-test and chi-square test	Significant association is found between different signs of TMD and malocclusion. Prevalence of TMD is	L(C)

						mild (30.4%), moderate (3.4%) and severe (0.6%) in increased overjet (>6mm)	
14	Gidarakou[24] (2003)	Case control	Normal-28.366.7,symptomatic-30.368.5 years	29 symptomatic female patients and 46 asymptomatic normal female volunteers (4.69+/_2.75)	Analysis of variance	SS. Increased overjet (4.69+/- 2.75) was found in Bilateral degenerative joint disorder group	M(B)
15	Abdullah[25] (2005)	prevalence	10 year or older	716 individuals (355 male and 361 female) (>6mm)	chi-square	SS. Masseter muscle tenderness is higher (P < .05) in excessive overjet cases and also in female subjects.	L(C)
16	Selaimen[10] (2007) CONTROL GP	Case control	15-60 year	60 TMD patients (2.9+/_ 1.6)30 control (2.4+/_ 1.6)	Logistic regression	NS. Overjet variable did not show statistically significant difference between TMD patients (2.9+/_ 1.6) and non pain subjects(2.4+/_ 1.6).	H(A)
17	Turasi[26] (2007)	Case control	18 and 29 years	Two groups n=33 each. overjet group(mean 7.8mm) includedsubjects 19women, 14 men; Control group (1.3 mm,Mean) subjects (17 women, 16 men)(> mm).	Student's t-test	SS. Patients with increased overjet (6mm) shows some differences in condylar position when compared with normal overjet group even in non patients. Greater vertical and transverse CO-MI slide in overjet group was found to be significant (p=0.030 and p= 0.008 respectively)	M(B)
18	Schmitter[27] (2007)	prevalence	18-65 years	171 women (>4mm).	Multiple logistic regression	NS. Non occlusion and open bite increased the risk of myofascial pain, but did not confirm result with regard to overjet.	M(B)
19	Manfredini[8] (2010) No control gp	Prevalence study	25-45 years	276 consecutive TMD patients193females; 83 males(>5mm)	logistic regression	NS. Parameter of overjet >5mm (OR 2.83) combined with clinically diagnosed bruxium were with highest odds for TMD even though non of those was significant with respect to confidence interval.	L(C)
20	Manfredini[6] (2013) CONTROL GP	Clinical trial study.	25-44 years	442TMD patients (72% female; 32.2 ±5.7 years, divided into a TMJ clicking and a no-TMJ clicking group (>5mm)	logistic regression	NS. Difference between TMJ clicking and TMJ non clicking group as for the prevalence of various occlusal features one of them overjet was not statistically significant.	L(C)
21	Manfredini[9] (2014) CONTROL GP	Case control	Group A-mean age: 38.1 +/- 15.9 years Group B-mean age: 34.6 +/- 13.8 years	Group A-receiving a jaw clenching diagnosis and having large overjet or anterior open bite,N=45, 75.5% females, (Group B- normal occlusion N=69, 71% females) (>5mm)	Chi-square test	SS. Percentage of patients reporting pain with joint palpation was significantly higher in increased overjet or anterior open bite group (p= 0.026)	M(B)
22	Haralur[4] (2014)	Cross Sectional study	15-35 years.	250 Patients (38.8% of individuals had overjet >2mm)	Pearson's correlation and logistic regression	On the basis of odd ratio strong association between TMD and overjet was found. Significant (p=.016).	M(B)

Discussion

Purpose of this systematic review was to evaluate the association between excessive overjet and temporomandibular disorders. After thorough evaluation and reading of all studies only 22 studies met the inclusion criteria. Finalized articles were thoroughly evaluated for their quality and potential risk for bias based on an evaluation adapted from Cericato et al [12] (Table II) On quality assessment, 1 study was of high quality grade, 15 studies were found to have moderate quality grade and 6 studies were under low quality grade.

Out of 22 studies included for the final analysis only in 14 studies significant association between excessive overjet and temporomandibular disorder was found.

In only three studies[19,22,25], research design was found adequate (blinding). Three studies[5,14,17] did not explain their eligibility and exclusion criteria. Few studies explained the sample selection for their study. None of the studies reported about sample size calculation.

The symptoms included in all the studies to evaluate the temporomandibular disorders were myofacial pain, jaw ache or stiffness, feeling of an uncomfortable bite, ringing in the ears, bruxism, pain in lateral pterygoid and medial pterygoid, etc.

Table III showing the results of the included studies. Out of 22 studies included for the final analysis only in 14 studies[2-5,9,14,15,19-21,23-26] significant association between temporomandibular disorder and excessive overjet was found. In one study[25] masseter muscle tenderness was found higher in excessive overjet cases and also in female patients in the age group from 10-19 years. Motegi[14] revealed about high prevalence of TMD in excessive overjet cases which increased with age. Sex difference was not significant in this study. Frequent headaches and pain on mandibular movements were found more in the excessive overjet groups compared to the control groups.[19] Some studies showed significant differences between the genders in relation to temporomandibular disorder, more in female subjects.[25]

In six studies no statistical difference was observed between the overjet and temporomandibular disorder.[6,8,16-18,22] In one of the study[16] the overjet of sample ranged from -4mm to 12mm. the authors did not mention how many subjects had increased overjet. In another study[18], overjet of the sample was than 3.5mm.

In a study by Riolo[2], the percent frequency of clicking associated with overjet was only significant above 6mm. In one study, patients with increased overjet (6mm) showed some differences in condylar position when compared with normal overjet group even in non-patients. Greater vertical and transverse CO-MI slide in overjet group was found to be significant (p=0.030 and p= 0.008 respectively).[26] The study on females subjects did not confirm that increase or decrease in overjet increases the risk of myofacial pain was kept in excluded group. Horizontal overlap equal to or greater than 4mm was greater in symptomatic patients with intraarticular temporomandibular joint disorders[21.]

In one study, parameter of overjet >5mm (OR 2.83) combined with clinically diagnosed bruxium were with highest odds for TMD even though non of those was significant with respect to confidence interval.[8] Difference between TMJ clicking and TMJ non clicking group as for the prevalence of various occlusal features one of them overjet was found non- significant.[6]

Percentage of patients reporting pain with joint palpation was significantly higher in increased overjet or anterior open bite group (p= 0.026)[9] In other study, smallest mean overjet occured in asymptomatic control (2.2mm) and largest mean overjet in primary osteoarthrosis group (3.3mm). Significant increase in risk occured with overjet >6-7mm[15.]

Various limitations were observed in the included studies. Except two studies by Sonnesen L and Abdullah[20,25], the other studies did not investigate the influence of the gender in occurrence of the temporomandibular disorder. Hence, dilemma still exists on regarding the influence of this parameter on temporomandibular disorder in increased overjet subjects.

In study by Pullinger et al, [15] direct observation was not carried out between the overjet and Temporomandibular disorder, instead the study observed the relationship between the overjet and temporomandibular disorder in all

five TMD groups who were divided according to various characteristics of TMD symptoms. Hence the result of the study might have been altered.

Kahn et al (1998)[21] in their study did not described age group regarding the association between increased horizontal overlap and temporomandibular disorder.

Study by Selaimen[10] had high quality grade as this study had proper research design, ethical clearance, clear objectives, methodology and results, sample size calculation mentioned, follow proper inclusion and exclusion criteria, blinding and study also mentioned limitations of study. It was not a prospective study. In this study, overjet variable did not show statistically significant difference between TMD patients (2.9+/_ 1.6) and non-pain subjects (2.4+/_ 1.6) but Class II malocclusion and absence of canine guidance on lateral excursion were considered as risk indicators for TMD.

Schmitter[27] in his study on non-patient population, through logistic regression analysis showed that non occlusion and open bite increased the risk of myofascial pain, but did not confirm result with regard to overjet.

Conclusions

As out of 22 articles included, in only 14 articles significant association between increased overjet and TMD was found, while rest of them fail to identify any association. From these 14 articles, 11 were of moderate quality and 3 of low quality. 8 articles in which no significant was found, one was of high quality, 4 were of moderate quality and 3 were of low quality. After negating contradicting studies, there still remains few studies of B quality which show association between overjet and TMD. Hence, we found Grade 3 evidence for this systematic review evaluating association between overjet and TMD. There is still need for more standardised long term study to draw concrete results.

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