Correlation Between Prolonged Mouth Opening and TMD First Onset Symptoms-Cross-Sectional Study

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Abstract

Background: *Temporomandibular Joint Disorders (TMJD) is a prevalent disorder, affecting individuals of all age. Previous evidence suggests that it is a multifactorial condition, which could be associated with occlusal and psychological factors, such as anxiety. So, we conducted a cross-sectional*

study to evaluate the association between onset of symptoms and previous prolonged mouth opening.

Methods: *Cases diagnosed according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD), the pain was assessed by visual analog scale (VAS), The prolonged mouth opening rated according to the duration in minutes spent during the dental treatment session. Data analyzed using the chi-square test for independence, correlations, and logistic regression analysis, with 95% confidence intervals (CI).*

Results: *A total of 400 participates included with a mean age (29.54 ± 4.38) of whom 352 were females (88%) and 48 males (12%). 345 cases have pain (86.3%), 55 cases with joint sounds (13.8%), and 103 cases with a decrease in range of mouth opening (25.8%). Significant association detected between prolonged mouth opening during dental treatment and pain ($\chi 2 = 0.434$; $P < 0.000$), maximum mouth opening (MMO) ($\chi 2 = -0.174$; $P < 0.000$) and absence of any relation regarding joint sounds ($\chi 2 = 9.06$; $P = 0.106$).*

Conclusion: *The study provides evidence that prolonged treatment sessions correlated with the appearance of TMJD symptoms. Informing dentists of this possible relation might aid in the prevention of considerable percentage of TMJDs.*

Keywords: Prolonged mouth opening, pain, temporomandibular disorders, cross-sectional study

Introduction

Temporomandibular joint disorders (TMJD) are common now, about five to twelve percent of the population affected, and a half to two-thirds seek treatment [1]. TMJD is a collective term affecting the TMJ and masticatory muscles and characterized by one or more symptoms in the form of limitation of masticatory function, pain, and joint sounds [2]. Numerous reported risk factors of TMJD include joint hypermobility, trauma, and infection [3]. Studies suggest autoimmune diseases, socioeconomic factors, psychological factors, are among risk factors for TMJD development, but the results have been inconsistent [4]. Better knowledge of the risk factors associated with this disorder would improve understanding of the disease etiology, and lead to earlier diagnosis with subsequent effective treatment [5, 6]. Mouth opening for an extended duration during dental treatment could constitute a risk factor in the development of TMJD through the strain of muscles of mastication with the release of inflammatory mediators [7]. Because prevention is better than treatment, this investigation conducted to study the possible association between the start of TMJD symptoms and prolonged mouth opening during dental treatment.

Methods

A cross-sectional study included a total of 400 patients selected from the outpatient clinic of the Faculty of Dentistry, Cairo University, Egypt. Ethical approval recorded by the Regional Ethical Review Board for the study design (1/13-10-2019).

The study started from September 2018 to August 2019, sample size calculation by using Steven K. Thompson equation [8] with a confidence interval of 95% and a significance level of $p< 0.05$.

Patients included in the study according to the following eligibility criteria; presented with the first onset of at least one symptom of pain, joint sounds or limited mouth opening (defined as < 36 mm), age between 19 and 43 years, dental treatment within the past few days with the duration of the dental treatment session equal to, or more than 15 minutes.

Patients excluded from the study if there is; a history of trauma to the head or neck, previous use of an intra-oral appliance, active orthodontic treatment, chronic pain condition, current daily use of analgesics, antidepressant, or muscle relaxant medications.

Each participant should pass the State-Trait Anxiety Inventory (STAI) questionnaire [9] for the exclusion of emotional stresses. STAI is a psychological questionnaire based on a four-point "Likert scale" and consists of 40 questions, patients excluded from the study if their score more than 30.

Research Question

Is there a relationship between prolonged mouth opening, during dental treatment, and the first onset symptoms of TMJD? The null hypothesis (H0) postulates that there is no correlation between the duration of dental treatment and the appearance of TMJD symptoms, while the alternative hypothesis (H1) assumes that there is a correlation.

Assessments

TMD Assessment

Cases diagnosed according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) for screening of patients [10, 11] however, cases with differential diagnoses including other conditions that may be similar to TMDs pain as odontalgia, neuropathic pain, and intra-oral lesions discarded.

Additionally, to the clinical examination that composed the Axis I, individuals classified as myofascial pain (Group Ia, Ib, Ic), and joint dysfunction (disc displacement: Group IIa, IIb, IIc;).

Individuals free from TMJ pain, or those presented any other TMJD diagnosis, not including pain (only disc displacement), or limited mouth opening included in study.

Pain Intensity

The pain evaluated by a visual analog scale (VAS), and the intensity reported for each participant represented as a numerical value from 0-10 according to the severity of pain.

Mouth Opening

The range of mouth opening (MMO) measured using the poly gauge to the nearest millimeter and recorded. Participants with less than 36 mm considered having limited mouth opening.

TMJ Sounds

Sounds identified by palpating both joints during function and findings recorded in a dichotomous manner (yes or no), representing the presence or absence of joint sounds.

Duration of the Mouth Opening

Based on the patient's statement treatment dental session duration, classified into seven intervals, each interval comprises fifteen minutes describing the length of the dental treatment sitting.

Explanatory Variables

The dependent variable is TMJD symptoms [pain, limited mouth opening, and sounds] and the independent variable [duration of dental treatment session].

Statistical Analysis

Data processed using SPSS version 23 for Windows (SPSS Inc, Chicago, IL, USA). Descriptive statistics representing mean, and the standard deviation. Assessment of the correlation between the first onset symptoms of TMJD in the form of pain, MMO, and joint sounds, according to the criteria previously mentioned, and the duration of mouth opening summarized. Chi-square test for independence and regression analysis between different duration intervals with each dependent variable applied.

Results

Sample Characterization

A total of 400 adolescents participate in the current study with a mean age of 29.54 ± 4.38 years, of whom 352 were females (88%) and 48 males (12%). Regarding the TMD symptoms, 345 cases have pain (86.3%), 55 cases with joint sounds (13.8%), and 103 cases with a decrease in range of mouth opening (25.8%). Among them, 138 Participants have bilateral symptoms (34.5%); 47 cases have pain and sounds (11.75%), 75 have pain and limited MMO (18.75%), and 16 cases have sounds and limitations in MMO (4%) respectively (Table-1).

	Mean	Std. Deviation
Pain	6.81	2.188
MMO*	36.18	2.625
Duration	32.35	6.554
Age	29.54	4.383

*MMO = Maximum mouth opening.

Table 1: Summary of descriptive statistics

Test for Independence

There is a relation between the length of dental treatment and both pain and limitation of MMO. We can reject the null hypothesis and accept the alternative hypothesis concluding that there is a significant moderate association between prolonged mouth opening during dental treatment and appearance of TMJD symptoms for the first time ($\chi 2 = 0.434$; $P < 0.000$). Furthermore, minimum decrease on MMO ($\chi 2 = -0.174$; $P < 0.000$) and absence of any relation between joint sounds and prolonged mouth opening during dental treatment ($\chi 2 = 9.06$; $P = 0.106$) (Table-2,3).

Pain		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	0.434	0.008	54.774	0.000[c]
Ordinal by Ordinal	Spearman Correlation	0.352	0.008	42.767	0.000[c]
MMO					
Interval by Interval	Pearson's R	-0.174	0.009	-20.067	0.000[c]
Ordinal by Ordinal	Spearman Correlation	-0.181	0.009	-20.907	0.000[c]

a. Not assuming the null hypothesis. b. Using the asymptotic standard error assuming the null hypothesis. c. Based on normal approximation

Table 2: Chi square test for pain and MMO Weighted by duration Symmetric measures

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.069[a]	5	0.106
Likelihood Ratio	8.960	5	0.111

a.1 cells (8.3%) have expected count less than 5. The minimum expected count is 3.58.

Table 3: Chi square test results for sounds

Relationship between symptoms and duration of the mouth opening

Application of the Pearson correlation test, the results reveal a correlation between the length of the treatment session and pain or range of MMO (p = 0.05) (Table-4).

		Pain	MMO	Sounds	Duration
Duration	Pearson Correlation	0.468**	-0.109*	-0.003	1
	Sig. (2-tailed)	0.000	0.029	0.955	
	N	400	400	400	400

** . Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4: Correlations between Duration of dental treatment and dependent variables [Pain, MMO, and sounds]

Regression Analysis

Running linear regression analysis between each symptom separately (the dependent factor) and the duration of mouth opening (independent factor), we found that the pain increased about 43-46%, and mouth opening decreased about10-17% of their measuring unite for every increase in the duration interval of the treatment session (Table-5).

Model	Unstanderdized Coefficients		Standerdized Coefficients Beta	t	Sig	95% Confidence interval for B		Correlations		
	B	Std. Error				Lower Bound	Upper Bound	Zero-Order	Partial	part
(Constant)	1.762	0.488		3.608	0.000	0.802	2.722			
Duration	0.156	0.015	0.468	10.554	0.000	0.127	0.185	0.468	0.468	0.468
a. Dependent Variable: Pain										
(Constant)	37.594	0.659		57.082		0.000	36.299	38.889		
Duration	-0.044	0.020	-0.109	-2.190	0.029	-0.083	-0.004	-0.10	-0.1099	-0.109
a. Dependent Variable: MMO										
(Constant)	0.163	0.105		1.554	0.121	-0.043	0.370			
Duration	0.000	0.003	-0.003	-0.056		0.955	-0.006	0.006	-0.003	-0.003

a.Dependent Variable: Sounds

Table 5: Regression analysis of each dependent variable against duration.Coefficient[a]

Discussion

Temporomandibular joint dysfunction (TMJD) affects more than 12% of the general population, more frequent in women between twenty to forty-five years of age, affecting their quality of life. It involves masticatory muscles and joints, or associated structures resulting in pain, tenderness, decrease mandibular range of motion and joint sounds.

The article supported the concept of preventive medicine and conducted for the evaluation of prolonged mouth opening during dental treatment on the emergence of TMJD symptoms.

Proper diagnosis through the use of research diagnostic criteria (RDC/TMD) enables us to detect other hidden risk factors related to the etiology of the condition [12].

Prolonged dental treatment is frequent nowadays because of the use of rubber dams and the introduction of the dental microscope depriving the patient of rest during the treatment session.

The association between prolonged mouth opening and pain could be suggested from muscle strain and ligament hyperlaxity, initiating the symptoms of TMJD. According to [13] who focusing the attention on the harmful effect of isometric muscle contraction, creating taut bands within the muscles of mastication, and subsequent trigger points that generating referred or localized pain and tenderness.

Joint sounds have different confounding factors not related to the mechanical effect of prolonged mouth opening, or it requires repeated sessions to present.

Prolonged mouth opening may reduce recovery and relax periods of the muscles, thus preventing regeneration of micro-injuries with pain induction. Pain and reduction of mouth opening due to prolonged mouth opening explained through the increase in the number of infiltrating macrophages in the masseter muscle and synovial membrane of the TMJ as reported by [14] in their experimental study. Macrophages are promoting the release of cytokines which, act directly on adjacent nociceptors resulting in neural hypersensitivity. [15].

Neural injury directly reduces jaw function regardless of the presence of accompanying pain, explaining why some patients reported limited jaw opening without pain.

This cross-sectional study has some limitations, as we measured the maximal mouth opening few days after the dental treatment session, pain could not develop immediately within days after a single treatment session and multiple successive visits required for the proper estimation of the association.

Conclusion

Only a possible association demonstrated but not a causal relationship; in other words, many patients that kept in a maximal open-mouth position during dental treatments don't frequently develop TMJD symptoms.

In summary, the present study demonstrated that prolonged mouth opening leads to persistent pain and jaw dysfunction, which can be prevented by relaxing intervals during dental treatments session.

Conflict of Interest

The author declares no conflicts of interest to publish this article.

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