ORIGINAL RESEARCH

Stomatognathic Risk Factors and Clinical Manifestations of Temporomandibular Disorders in Indian Population: A Case-control Study

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Abstract

Aim: This study was aimed to compare the risk factors and associated clinical manifestations of patients with temporomandibular disorders (TMDs) in the Indian population.

Materials and methods: A total of 52 patients were explored according to the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) and compared with 48 controls. The mean age of the study group was 30.96 ± 11.60 years, 41% were males and 59% were females. The mean age in the control group was 31.5 ± 9.9 years (37.5% males), measuring differences in TMD risk factors (self-perceived stress, parafunctions, occlusal interferences, history of orthodontic treatment, and/or extraction).

Results: The most common sign observed in the selected subjects was the joint sound (clicking) (42%), followed by mandibular deviation 39% as the second most common sign. Myofascial pain (MFP) (single or multiple diagnoses) was the most frequent diagnosis ($n = 40$, 76%), followed by disc displacement with reduction (DDWR) (32.1%), arthralgia (30%), and disc displacement without reduction (DDWoR) (7.6%). More than one DC/TMD diagnosis was established in 63.2% of the patients. The risk factors like presence of clenching, stress perception, parafunctions, tooth wear, and occlusal interferences were significantly more frequent in all the cases than in the respective controls.

Conclusions: In the studied population, the presence of TMD was found to be positively related to factors namely female gender, parafunction, occlusal interferences, psychological stress, and tooth wear. Myofascial pain is the commonest diagnosis (either single or in combination). It is followed by DDWR (either single or in combination with others). Double diagnosis is also common.

Clinical significance: Temporomandibular disorders showed a female predilection and were found to be positively related to factors, viz., parafunction, occlusal interferences, stress, and tooth wear. Clinicians should also be aware of common clinical manifestations of TMDs and their related stomatognathic risk factors to provide comprehensive oral care and to identify such factors for disease prevention.

Keywords: Disc displacement, Myofascial pain, Temporomandibular disorder, Temporomandibular joint disorder.

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Introduction

Temporomandibular disorders are the conditions producing abnormal, incomplete, or impaired function of the temporomandibular joint(s) and/or the muscles of mastication.[1] As per the recent systematic review by Valesan et al.,[2] the overall prevalence of TMJD was approximately 31% for adults/elderly and 11% for children/adolescents, and the most prevalent TMJD was DDWR. Numerous etiological factors have been suggested such as occlusion, trauma, deep pain input, emotional stress, and parafunction. Various other factors of the host such as genetic, biological, and hormonal levels modulate the response, and an individual might remain asymptomatic even in the presence of all these etiological factors. However, when the adaptability of the host is surpassed, the symptoms begin to manifest in the form of TMDs.[3] A diagnostic model was proposed in 1992, known as the Research Diagnostic Criteria for Temporomandibular Disorders.[4] It has been widely used in epidemiological, clinical, and experimental studies. It has a series of protocolized clinical procedures and strict diagnostic criteria applied to the most common types of TMD.

Diagnostic Axes for TMDs

There are two proposed diagnostic axes: (1) axis I establishes a diagnosis based on clinical variables, while (2) axis II establishes a diagnosis based on psychological variables.[5] Three major diagnostic categories are contemplated in axis I (myofascial pain, disc alterations, and arthralgia–arthritis–arthrosis), each with several subcategories. Researchers have investigated the relationship between etiological factors and the presence and severity of TMDs in various populations, and the results are diverse according to the regions. Diagnosing TMDs has been controversial too, and methods vary greatly.

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Table 1: Characteristics of participants

Characteristics	*Category*	*Subcategory*	*Participants details*
Average age	–	Case group	30.96 ± 11.60 years
		Control group	31.5 ± 9.9 years
Sex	Male	Case group	21 (41%)
		Control group	18 (37.5%)
	Female	Case group	31 (59%)
		Control group	30 (62.5%)
Type of diagnosis of case-group patients	Single diagnosis	MFP	16
	Double diagnosis	DDwR + MFP	22
		DDwoR + Arthralgia	11
	Triple diagnosis	–	2

Need for this Study

To the authors' best knowledge, research is lacking in the Indian population regarding the stomatognathic risk factors and clinical manifestations of TMDs. Therefore, the present pilot study was carried out to evaluate the risk factors and clinical manifestations of TMDs diagnosed according to the DC/TMD Axis I criteria in the Indian population.

Materials and Methods

Study Design and Period

This prospective case-control study was conducted between June 2019 and February 2020. Institutional Ethical Committee Approval was obtained (IEC/VSPMDCRC/46/2019). All patients signed a written informed consent before entering the study.

Study Participants and Sample-size Estimation

Referring to a study by Poveda-Roda et al.,[5] the authors compared the risk factors and the clinical manifestations in patients with TMDs and compared with normal individuals. Some of the prominent risk factors were: stress perception [OR: 1.98, $p = 0.12$], psychoactive medications [OR: 2.21, $p = 0.08$], and parafunctions [OR: 1.9; $p = 0.008$]. Further, joint sounds [OR: 4.3, $p < 0.0001$], clicks [OR: 3.2, $p < 0.0001$], coarse crepitus [OR: 2.5, $p < 0.0001$], and tender muscle/joint palpations were the most prominent clinical manifestations. The proposed study also aims at determining the risk factors and clinical manifestations in patients with TMD in the central Indian population. The odds ratio for the above risk factors from the above study was referred for estimating the sample size for case and control groups. Specifically, the data for parafunctions were considered, which showed 66% occurrence in the TMD group, while 50% in the control group, with OR of 1.9. These data resulted in a sample of 151 individuals in each group (~150 per group), thus resulting into a total sample of 300 individuals, that can provide the difference with 95% confidence and 80% power of test. The parameters with higher OR needed a smaller sample size than that for parafunction.

The formulation used for the estimation of sample size is:

Let pA and pB be the proportion of outcome in two groups, then the hypotheses to be tested are:

$$H_o: \text{OR} = 1 \text{ vs } H_1: \text{OR} \neq 1$$

where

$$\text{OR} = p\text{A}(1 - p\text{B})/p\text{B}(1 - p\text{A})$$

and the formula for sample size is:

$$n\text{A} = n\text{B} = \left(\frac{1}{p\text{A}(1-p\text{A})} + \frac{1}{p\text{B}(1-p\text{B})}\right)\left(\frac{Z_{1-\alpha/2} + Z_{1-\beta}}{\log(\text{OR})}\right)^2$$

where $Z_{1-\alpha/2}$ and $Z_{1-\beta}$ are the standard normal variate values for 5% type I error and 20% type II error, and nA and nB are the sample sizes for groups A and B, respectively.

For this pilot study, a total of 52 TMD patients were recruited in the Department of the Prosthodontics in the authors' institution. Patients consulting for the first time in the department (with no history of treatment for TMD) were included in this study.

Inclusion Criteria

Patients were included in the case group when they presented myofascial pain, with or without limited opening, and/or disk displacement with or without reduction. Inclusion criteria were as follows: men and women over 18 years, absence of any previous or ongoing treatment for TMD, absence of any other pain than orofacial and cervical pain, and absence of rheumatologic disorders. A total of 48 control patients consisted of subjects age- and gender-matched to the study group and were selected from among the patients referred to the same department. The control patients were recruited if they satisfied the inclusion criteria and had no signs, symptoms, or history of TMD. The study participants characteristics are shown in Table 1.

Exclusion Criteria

Exclusion criteria in the control group were subjects who were unwilling to participate and those with a history of malignant disease or major surgery in the orofacial region, minor surgery in the previous 3 months, cervicofacial chemo- or radiotherapy, and recovery from facial injuries.

Clinical Examination, Grouping, and Data Collection

Clinical examination for signs and symptoms of TMD was adapted from the DC/TMD Axis I. Information was collected in relation to the risk factors for TMDs, namely history of previous orthodontic treatment, trauma to teeth/or head and neck area, traumatic dental extractions, stress perception, and parafunctional habits. For all patients, cases and controls, occlusal variables were recorded during a clinical examination: Angle's occlusal relationship, the occlusion (canine guidance/group function), and interferences (protrusive interferences, right and left mediotrusive interferences, and right and left laterotrusive interferences). Tooth wear was

Table 2: Difference in risk factors and clinical variables between the groups

Risk factors and clinical variables	*Case (TMD) n = 52 (%)*	*Control n = 48 (%)*	*Chi-square test value*	*Significance *p < 0.05*
Parafunctional habits	36 (72%)	17 (34%)	$\chi = 24.22$	0.007*
Self-perceived stress	23.6	19.30	$t = 3.021$	0.003*
Occlusal interferences	17 (34%)	9 (18%)	3.326	0.048*
Tooth wear	20 (40%)	1 (2%)	21.820	<0.001*
Type of occlusion				
Class I	48 (96%)	49 (98%)	1.01	0.603
Class II	1 (2%)	1 (2%)		
Class III	1 (2%)	0 (0%)		
H/o orthodontic treatment	12 (24%)	9 (18)	0.542	0.461
H/o trauma	5 (10%)	2 (4%)	1.382	0.240
H/o extraction	11 (22%)	4 (8%)	30,843	0.069

evaluated using Smith and Knight's tooth wear index,[6] and self-perceived stress was evaluated using Cohens' questionnaire.[7] Identification of parafunctional habits was carried out by self-reports. Patients answered few questions about the frequency and duration of their oral behaviors: betel nut chewing, intake of acidic beverages, gum chewing, nail biting, biting foreign objects (like pencils), continuously leaning on the palm (leaning the head or chin on the palm of the hand), awareness of daytime teeth clenching, awareness of night-time bruxing, tongue, cheek, or lip biting, chewing food on one side, and sleeping on one side. Besides, the clinicians paid attention to these habits during the clinical examination to detect some parafunctions of which the patient would not be aware. All the anamnesis and clinical examinations were performed by the same two trained operators with expertise in TMD clinical assessment.

Statistical Analysis

The data on continuous parameters are expressed in terms of mean, standard deviation, median, and range, while the categorical parameters are expressed in terms of frequencies and percentages. The continuous parameters are compared between two groups using a *t*-test for independent samples/Mann–Whitney *U* test, while categorical parameters are compared using Pearson's Chi-square test. All the analyses were performed using SPSS ver 26.0 (IBM Corp., USA), and the statistical significance will be evaluated at 5% level.

Results

The mean age of the study group was 30.96 (11.60) years, 41% were males and 59% were females. The mean age in the control group was 31.5 ± 9.9 years (37% males). Table 1 describes the diagnoses of the patients in the study group. The most common sign observed in the selected subjects in this study was joint sound (clicking) that is 42%, followed by mandibular deviation at 39% as the second most common sign. Myofascial pain (MFP) (single or multiple diagnoses) was the most frequent diagnosis ($n = 40$, 76%), followed by disc displacement with reduction (DDWR) (32.1%), arthralgia (30%), and disc displacement without reduction (DDWoR) (7.6%). More than one RDC/TMD diagnosis was established in 63.2% of the patients. In the analysis of risk factors according to diagnostic categories (Table 2), presence of clenching, stress perception, parafunctions, tooth wear, and occlusal interferences was significantly more frequent in all the cases than in the respective controls.

Discussion

The TMDs have been investigated very widely with respect to etiology, clinical manifestations, risk factors, and treatment modalities over the past few decades. However, owing to the complex nature of the disease and the many variables involved, drawing definitive conclusions is very challenging. The factors that make generalization of findings rather impossible are, namely, individual variations among the population, differences in data collection methods and the study designs, and so on. Therefore, this study was planned and executed to evaluate the clinical manifestations and risk factors of TMDs in the Indian population using a case-control design. The advantage of case-control cannot be overemphasized. It allows the researcher to eliminate the confounding factors and thus reduce the bias.

Since its publication in 1992, DC/TMDs have been the most widely employed diagnostic protocol for TMD research. Using such a validated and widely accepted tool facilitates easy recording and classification, and communication of the disorder in the patient. Additionally, it helps to compare the data with previous studies using the same tool. Rather than using a sample from the general population, in our study, a control group was selected from among the patients seeking dental care, so as to avoid potential bias associated with the variable "active seeking of treatment".

Schiffman et al.[8] proposed an evidence-based new DC/TMD protocol appropriate for use in both clinical and research settings. More comprehensive instruments augment short and simple screening instruments for Axis I and Axis II. These validated instruments allow for identification of patients with a range of simple-to-complex TMD presentations. The TMDs are no longer considered a solely local disorder but rather are the outcome of multiple risk determinants. The presence of parafunctional habits, self-perceived stress, and occlusal interferences has shown to have a direct positive relationship with TMDs in the present population. The relationship between pathological tooth wear and TMDs has been a matter of conflict as there are studies that show no association, and yet there are studies that do. In our population, tooth wear was directly and positively related to the presence of TMDs.

Bonjardim et al.[9] evaluated the association between symptoms of TMDs and gender, morphological occlusion, and psychological factors in a group of university students and concluded that only anxiety had a statistically significant association with TMD. Poveda-Roda et al.,[5] in their retrospective study of a series of 850 patients

with temporomandibular dysfunction, reported a high prevalence of signs and symptoms of TMDs in Spanish population. The analyzed risk factors (sleep disturbances, stress perception, regular consumption of psychoactive medication, parafunctional habits, and ligament hyperlaxity, except loss of posterior support) show a statistically significant OR for the diagnosis of TMD. Ferreira et al.[10] investigated the correlation between TMDs, occlusal factors, and oral parafunction in the young population and found that tooth clenching was significantly associated with TMD. In the occlusal factors, overjet showed statistically significant correlation only with myofascial pain. No association between functional alteration and TMD was found. Mélou et al.[11] investigated the relationship between occlusal factors, oral parafunctions, and TMDs using case-control design in French population. They found a positive correlation between parafunctional activities, occlusal interferences, and overbite >4 mm and TMDs. They emphasized on a behavioral re-education to reduce parafunctional activities that could be the first phase of care. Mickeviciute et al.[12] found a positive correlation between tooth wear and TMDs. The positive relationship of tooth wear and TMDs found in this study can be attributed to loss of tooth substance due to parafunction activity such as bruxism. Lee et al.[13] used artificial intelligence to determine major risk factors for TMDs in the Korean population and highlighted the importance of obesity, general health, stress, socioeconomic status, and working conditions in the management of TMDs. Meloto et al.[14] concluded in their investigation that TMD onset appears to represent the cumulative effect of multiple system dysregulation and assessment of patients, including attention to multiple risk determinants. They emphasized the need for both condition-specific and more person-centered interventions. The etiology of TMDs is multifactorial and still being investigated, but several biological and psychosocial risk factors for TMD have been identified, which vary in different populations.[15] In this study, TMDs showed a female predilection and found to be positively related to factors, namely, parafunction, occlusal interferences, stress, and tooth wear. Therefore, it is imperative to educate the patients regarding the deleterious effects of the parafunctional habits, stress, the role of proper dental occlusion, and the presence of tooth wear and seek care as and when such factors exist to prevent disease progression.

There are a few limitations of this pilot study, namely, a small sample size limited to one setting and lack of long-term follow-up. This study is being continued in the author's institution with a larger sample size, and the results will be reported in due course of time.

Conclusions

Within the limitations of this case-control study, the following conclusions can be drawn. In the studied population, the presence of TMD was found to be positively related to factors, namely, female gender, parafunction, occlusal interferences, psychological stress, and tooth wear. Myofascial pain is the commonest diagnosis (either single or in combination). It is followed by DDWR (either single or in combination with others). Double diagnosis is also common.

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