Association of signs and symptoms of temporomandibular joint disorder between gender, partial edentulism, and morphological occlusion among dental patients in Chennai

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INTRODUCTION

Temporomandibular disorders (TMDs) are a collective term that includes a number of clinical complaints involving the muscles of mastication, the temporomandibular joint (TMJ), or the associated orofacial structures. It is considered a subclassification of musculoskeletal disorders characterized largely by facial pain. The etiology of TMD is still unknown; however, several studies reported relationships between TMD and bruxism, grinding or clenching of the teeth, osteoarthrosis, abnormal occlusion, tooth wear, non-working side occlusal interferences, limited mandibular movements, auditory function, menstrual cycle, partial loss of teeth, masseter muscle activity, osteoarthritis, anxiety and depression, and reduced maximum bite force. TMD prevalence among dental patients would provide information for the early diagnosis and management of TMD.

Aim

The purpose of this study was to find out the prevalence and severity of temporomandibular disorder (TMD) and its relationship between gender, partial edentulism, and malocclusion among dental patients in Chennai.

ABSTRACT

Aim: The aim of this study was to find out the prevalence and severity of temporomandibular disorder (TMD) and its relationship between gender, partial edentulism, and malocclusion among dental patients in Chennai. Materials and Methods: The study sample consisted of 244 subjects, of which 58% were female and 42% were male and belonged to the age group of 20–60 years. Research diagnostic criteria for TMD proposed by Shiffman et al. were used to assess the signs and symptoms of TMD. Intraoral examination was done to assess for the number of missing teeth and malocclusion status among study population. Data collected were analyzed using the Statistical Package for the Social Sciences (SPSS) software (version 20). Results: The prevalence of signs of TMD was found to be 33.7% and symptoms were found to be about 25% among the study population. Females showed higher prevalence for signs of TMD compared to males. There is statistically significant association between missing teeth and jaw deviation ($P = 0.000$), and missing teeth and muscle pain ($P = –0.000$). Class 1 malocclusion is significantly associated with signs of TMD ($P = 0.000$). Conclusion: A thorough knowledge of joint anatomy and function serves as a basis for understanding the effect of dysfunction on temporomandibular joint component parts. It is duty of a dentist to thoroughly examine the patient because many dental patients usually present with signs rather than symptoms.

KEYWORDS: Gender, Malocclusion, Missing teeth, Prevalence, Temporomandibular disorder
MATERIALS AND METHODS

The present cross-sectional study was conducted among 244 dental patients those who reported to private dental college and hospital, Chennai. A study participant age group ranged from 20 to 60 years. Partially edentulous patients with two or more missing posterior teeth and patients with malocclusion were included in the study. Patients <20 years of age, patients with trigeminal neuralgia, burning mouth syndrome, and cervical and neuropathic pain, and patients who underwent orthognathic surgery were excluded from the study. Before the start of the study, ethical clearance was obtained from the Institutional Ethics Committee, Saveetha University, and written informed consent was obtained from the study participant. Data collection was scheduled in June 2016. Sample size was calculated using G power 3.0.1.0 version (based on the study done by Syed Rashid Habib et al., 2014).

Survey Instrument

The first section includes demographic information of the participants such as age, name, and gender. The second section includes (DC/TMD) diagnostic criteria for TMD proposed by Schiffman et al., in 2014, to assess for signs and symptoms of TMD. This includes 14 symptom questionnaires about jaw pain, headache, jaw joint noises, and closed locking and open locking of the jaw. The signs of TMD are assessed, which include jaw deviation, masticatory, and other masticatory muscle pain during opening movements, lateral and protrusive movements, TMJ sounds during open and close movements, lateral and protrusive movements, masticatory muscle, and TMJ pain with palpation. The armamentarium used to evaluate signs of TMD are stethoscope, short scale with markings, divider or calliper, and gloves for intraoral and extraoral examination of masticatory muscle. The third section consists of intraoral examination to assess for missing teeth, occlusal interference, dental restoration, and malocclusion. Armamentarium used is headcap, mask, gloves, mouth mirror, and explorer.

Statistical Analysis

Data were entered into Microsoft Excel spreadsheet and analyzed using SPSS software (version 20). Descriptive statistics were used. Chi-square test was done to assess the association between signs and symptoms of TMD between gender, partial edentulism, and malocclusion.

RESULTS

Figure 1 depicts the distribution of study subjects based on gender. The study sample consisted of 244 subjects, of which 142 (58%) were female and 102 (42%) were male. The prevalence of symptoms of TMD disorder in females was found to be higher (17%) than that of males (8%). The most commonly reported symptoms are pain in temple/jaw/ear and headache [Figure 2]. Figure 3 depicts the prevalence of TMD signs based on gender. Female subjects show statistically significant association between signs of TMD (P = 0.000). The frequently elicited sign of TMD was clicking, crepitus joint sound, and jaw deviation, where it is more commonly found in 40–60 years of age group [Figure 4]. Compared to <5 years period of edentulousness, masticatory muscle pain is more common in >5 years period of edentulousness in the study subjects. Among the masticatory muscle, pain in masseter muscle was most commonly elicited [Table 1]. A statistically significant positive correlation was found between removable partial denture and joint sound (0.025), fixed partial denture and joint sound (0.012), jaw deviation and...
In this study, missing teeth were significantly associated with jaw deviation (*P* = 0.000). This finding was similar with the study conducted by Rajesh Shetty et al\[38\] where 62.5% of females reported signs of TMJ dysfunction when compared with males which was 56.6%. The significantly higher prevalence for the female gender was also reported in other studies \[8,9,13,20-23\].

TMD is observed to be up to four times more frequent in women, and women tend to seek treatment for their TMJ problems three times more often than males. It has been suggested that the presence of estrogen receptors in the TMJ of women modulates the metabolic functions in relation to laxity of the ligaments, and this could be relevant in TMD.\[23\] A German study reported that 20-59-year-old women were significantly more frequently aware of joint sounds than men.\[26\] Several attempts have been made to provide an explanation for this difference, authors attributed it to hormonal differences\[31\] or to reduced pain threshold in women.\[27\]

TMD pain has been reported more frequently on the side with most missing teeth and increased risk of joint disorders was found in subjects without any molar support.\[19\] In this study, missing teeth were significantly associated with jaw deviation and muscle pain (*P* = 0.000). This finding was similar with the study conducted by Yousef Al-Shumailan et al\[24\] where teeth loss was significantly associated with muscle tenderness (*P* < 0.01). Tallents et al\[29\] reported that missing posterior teeth may accelerate the development of degenerative joint disease. The absence of posterior support results in overload in the TMJ structures.\[30\] In a study done by Muthukrishnan et al\[31\] joint sounds was present in 8.2% of the study subjects, and it was maximum in the age group of >50 years. It has been assumed and experimentally proved that the absence of posterior teeth would result in mandibular overclosure and as a consequence, the condyles would deviate from their normal centric position in the TMJ, causing dislocation in the joint.\[31,32\] Joint pain and muscle pain have also been reported more frequently on the side with most missing teeth, and increased risk of joint disorders was found in subjects without any molar support.\[7\]

### DISCUSSION

TMDs are a class of degenerative musculoskeletal condition that affects up to 25% of the population. TMD is seen most commonly in people between the ages of 20 and 40 years and occurs more often in women than in men.\[9\]

Temporomandibular Disorder (TMD) is the main cause of pain of non-dental origin in the oro-facial region including head, face and related structures. It is generally accepted that the aetiology is multifactorial, involving a large number of direct and indirect causal factors. Among such factors, Occlusion is frequently cited as one of the major aetiologic factors causing TMD, whereas, in a study done by Bonjardim LR et al, morphologic malocclusion (molar class, Angle’s classification) was not associated with the presence of TMD symptoms.\[19\]

As, throughout the aging process, a functional overload in the TMJ may occur, this is caused by the following reasons: Lack of replacement of lost teeth, parafunctional habits, a deficient occlusion, or traumas which could give rise to TMD in the elderly.\[13\] Hence, in the current study, the age group of the participants was 20–60 years, and in the similar study conducted by Wang MQ et al,\[20\] the age range among the study group was 21–60 years.

In this study, female subjects showed higher prevalence for signs of TMD where pain in masseter was observed to be 8.1%, clicking was found to be 21.7%, crepitus was 16.3%, and jaw deviation was found to be 16.8% which was comparatively high, whereas in males, pain in masseter was 1.2%, clicking was present in 13%, crepitus was present in 9.8%, and jaw deviation was found to be 12.7%. Thus, female subjects show statistically significant association between signs of TMD (*P* = 0.000). This finding was similar with the study conducted by Rajesh Shetty et al\[38\] where 62.5% of females reported signs of TMJ dysfunction when compared with males which was 56.6%. The significantly higher prevalence for the female gender was also reported in other studies \[8,9,13,20-23\].

### Table 1: Association of the period of edentulousness and masticatory muscle pain

<table>
<thead>
<tr>
<th>Edentulous span</th>
<th>Masseter n (%)</th>
<th>Temporalis n (%)</th>
<th>Medial pterygoid n (%)</th>
<th>Lateral pterygoid n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5 years</td>
<td>6 (2.4)</td>
<td>4 (1.6)</td>
<td>2 (0.8)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>&gt;5 years</td>
<td>17 (6.9)</td>
<td>10 (4.0)</td>
<td>6 (2.4)</td>
<td>1 (0.4)</td>
</tr>
<tr>
<td>Significance</td>
<td>0.000*</td>
<td>0.000*</td>
<td>0.000*</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

Chi-Square test. Significant at *P* < 0.05
As the span and time of edentulousness, the number of missing teeth and the number of quadrant involved increased, the signs of TMD dysfunction become more prevalent. In the current study, among the study subjects, massetter muscle tenderness was present in 9.3%, jaw deviation was present in 17.6%, clicking was about 22.5%, and crepitus was observed in 17.6% of individuals who were edentulous for >5 years. Whereas in individuals with <5 year period of edentulousness, the massetter muscle tenderness was present in 6.9%, jaw deviation was present in 11.8%, clicking was present in 12.2%, and crepitus was found to be 8.6%. This value is lower than that reported by Shet RG et al. where massetter muscle tenderness about 64.1% was seen in individuals who were edentulous for >5 years.[11]

Although TMD symptoms decreased with age, the signs increased and it seemed that an increase of number of posterior teeth loss is associated with TMD signs rather than symptoms.[9] This significant association between TMD signs and tooth loss is in agreement with various clinical and epidemiological studies.[12,34]

In the current study, clicking sound was observed in 34.7% of the study subjects, mandibular deviation was present in 29.4% of individuals, TMJ tenderness was observed in 6.4% of the study subjects, and massetter muscle tenderness was present in 9.3% of individuals. This value was lower compared to the study conducted by Haralur et al.,[23] where clicking sound was present in 46.5% of individuals, mandibular deviation was present in 40% of individuals, TMJ tenderness was observed in 32%, and massetter was involved in 32% of individual. The previous study was done among the partially edentulous patients with the age group of 35–45 years. Missing posterior teeth have been associated with the TMJ sound-like clicking. Previous studies have also observed that TMJ sounds may originate from changes in articular surfaces, deviations in the form of articular components,[6,35] and lack of muscle coordination.

Epidemiological survey reports that 50–70% of the population have signs of TMD disorder, whereas an estimated 20–25% of the population have TMD symptoms.[4,5,28] Based on the association of symptoms of the TMD and gender, in the current study, there is no significant difference between gender and symptoms of TMD. In the different study conducted by Bora Bagis et al.,[33] TMJ pain at rest, pain in massetter muscle, and clicking were significantly more frequent among females.

Hiltunen et al.[34] confirmed the strong influence of occlusal interference on TMD. In the present study, occlusal interference is significantly associated with clicking ($P = 0.031$). In the similar study conducted by Haralur et al.,[23] a statistically significant correlation was observed between TMD and occlusal interferences ($P < 0.001$). Many literature have reported occlusal interference as predisposing factor for TMD. Seligman[35] showed a selective influence of occlusal factors and muscular pain. According to Ogle[36] deflective occlusal contacts may create complex neuromuscular reflex activity and joint symptoms. In a study done by Robert Celic et al.[37] 14% of subjects had centric interferences (RCP-ICP slide greater than 1 mm), 5% of subjects had working interferences and 16% of subjects had nonworking interferences during lateral and protrusive mandibular movements. The occlusal interference leads to excessive tooth wear and may even generate grating sounds while chewing. Occlusal interferences may overwork jaw muscles and cause muscle pain. In neurophysiologic terms

### Table 2: Association of signs of TMJ disorder between dental statuses among the study group

<table>
<thead>
<tr>
<th>Dental Status</th>
<th>Joint sound</th>
<th>Jaw deviation</th>
<th>Muscle pain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spearman correlation</td>
<td>$P$ value</td>
<td>Spearman correlation</td>
</tr>
<tr>
<td>Missing teeth</td>
<td>0.091</td>
<td>0.211</td>
<td>0.533</td>
</tr>
<tr>
<td>Occlusal interference</td>
<td>0.186</td>
<td>0.031</td>
<td>0.053</td>
</tr>
<tr>
<td>Dental filling</td>
<td>0.146</td>
<td>0.020</td>
<td>0.044</td>
</tr>
<tr>
<td>Removable partial denture</td>
<td>0.157</td>
<td>0.025</td>
<td>0.604</td>
</tr>
<tr>
<td>Fixed partial denture</td>
<td>0.170</td>
<td>0.012</td>
<td>0.667</td>
</tr>
</tbody>
</table>

Chi-Square test. Significant at $P < 0.05$

### Table 3: Association between signs of TMJ disorder and malocclusion among the study group

<table>
<thead>
<tr>
<th>Dental Status</th>
<th>Joint sound</th>
<th>Jaw deviation</th>
<th>Muscle pain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spearman correlation</td>
<td>$P$ value</td>
<td>Spearman correlation</td>
</tr>
<tr>
<td>Crowding</td>
<td>0.700</td>
<td>0.459</td>
<td>0.111</td>
</tr>
<tr>
<td>Open bite</td>
<td>0.098</td>
<td>0.300</td>
<td>0.076</td>
</tr>
<tr>
<td>Anterior crossbite</td>
<td>0.109</td>
<td>0.227</td>
<td>0.087</td>
</tr>
<tr>
<td>Posterior crossbite</td>
<td>0.006</td>
<td>0.865</td>
<td>0.251</td>
</tr>
<tr>
<td>Class 1 malocclusion</td>
<td>0.069</td>
<td>0.555</td>
<td>0.248</td>
</tr>
</tbody>
</table>

Chi-Square test. Significant at $P < 0.05$, TMJ: Temporomandibular joint
occlusal interferences cause the chewing system to accommodate to conflicting sensory signals that arise from competing tooth contacts.[38]

The prevalence of TMD signs in partially edentulous patients wearing upper and lower removable partial dentures (RPD) has not been well documented. On the contrary, much of the published work has been attributed to the completely edentulous CD-wearing and dentate patients. One study concludes that the partially edentulous patients (wearing RPD) exhibit more TMD signs when compared with the CD-wearing patients. In the current study, a statistically significant correlation was found in between removable partial denture and TMJ joint sound \( P = 0.00 \), jaw deviation and removable partial denture \( P = 0.00 \), and muscle pain and removable partial denture \( P = 0.00 \). In similar study conducted by Osma A.AI-Jabrah et al.,[13] patients wearing removable partial denture exhibited significantly \( P < 0.04 \) more signs of joint tenderness. The limitations of the current study were other etiological factors for TMD were not included in the study such as psychological factors, anxiety and depression, osteoarthritis, tooth wear, and reduced maximum bite force.[13] This study could not find the association between occlusion and TMD.

CONCLUSION

In the current study, the prevalence of symptoms of the TMD in females was found to be higher (17%) than males (8%). Missing teeth were significantly associated with jaw deviation and muscle pain \( P = 0.00 \). The prevalence of signs of the TMD in female subjects was observed to be 21.7% which is significantly higher than that of males, which was found to be 13%. Thus, female subjects show statistically significant association between signs of TMD \( P = 0.000 \).

A thorough knowledge of joint anatomy and function serves as a basis for understanding the effect of dysfunction on the joint’s component parts. Patients with symptomatic (pain) TMJ problems are meager in number compared to asymptomatic (clicking and deviation) patients. Some of the asymptomatic patients were not aware of the underlying problem in their TMJ due to the absence of pain. As dental practitioners, we seldom examine the TMJ during routine examination. Although treating the cause is important, it is also a duty of a dentist to thoroughly examine the patient, identify any underlying asymptomatic disorders, and educate and motivate the patient to take up preventive measures and early treatment to avoid further symptoms that serve as precursors to TMJ disorders.

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