



Original Article



Association of Partial Edentulism with Signs and Symptoms of Temporomandibular Disorders

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ABSTRACT

Temporomandibular Joint (TMJ) is a complex joint and occlusal disharmony affects the joint health and result into temporomandibular joint dysfunction syndrome. **Objective:** To assess the signs and symptoms of temporomandibular joint disorders in partially edentulous patients and find out the association between TMD's and edentulous span, tooth loss quadrant and occlusal support. **Methods:** The cross-sectional observational study was carried out. 200 partially edentulous patients selected by non-probability purposive sampling and TMJ were examined for maximum mouth opening, joint deviation, tenderness of muscles of mastication and joint pain with clicking. The sample was grouped into 3 characteristics i.e.; number of partially lost teeth, number of dental quadrants with posterior teeth loss and the numbers of Occlusal Support Zones (OSZ) based on Eichner Classification system. **Results:** TMJ muscle pain existed in 8.0% and joint pain was 23.0%. Many patients had missing teeth in 2 quadrants 30.0% and had 5-8 numbers of missing teeth 42.5%. A3 support zone was frequently found 29.5%. Significant association of gender was found for TMJ pain, and maximum mouth opening. The tooth loss quadrant, number of partially lost teeth and occlusal support zones had significant association with muscle pain, TMJ pain with clicking and maximum mouth opening. **Conclusions:** It can be concluded that the partially edentulous patients frequently develop one or more signs and symptoms of TMJ disorders and number of teeth lost, number of quadrants with missing teeth and loss of occlusal support disturb the joint function and associated stomatognathic system.

INTRODUCTION

The Temporomandibular Joint (TMJ) is a synovial joint that has rotating and gliding movements in the joint cavity assisted by ligaments [1]. There is harmony in the joint and the associated stomatognathic system. The joint has a complex anatomy of 3-point articulating surfaces where condyle fossa being 2 points of contact and the occluding teeth surfaces are the third point. If any of the components of these points altered; the effect will disturb the whole joint structure [2]. The term Temporomandibular Joint Disorder (TMDs) depicts such problems that affect TMJ and associated muscles. There are contrasting results

documented in the dental literature regarding the association of tooth loss, their numbers and support mechanism with the development of TMJ disorders and the matter remained controversial [3]. Other studies documented that temporomandibular joint disorders are greatly associated with the occlusion [4, 5]. A change in the normal occlusion due to loss of a single tooth results in occlusal interferences and risk of developing TMJ problems. Many patients manage to adjust the occlusion and position of their condyle in a not so ideal position and adaptive mechanism helps but if the adaptive capacity



exceeds the patients started to develop symptoms of degenerative joint disease [6]. Loss of posterior teeth results in overloading of joint and associated muscles more than the loss of anterior teeth because of transferring heavy occlusal forces of chewing and mastication over the remaining occlusal table [7]. The TMJ problems most commonly present as pain related diseases of muscle and joint pain, structural disorders mainly articular disc displacements and degenerative changes [6, 7]. In The development of TMJ disorders in partially edentulous patients with lost posterior teeth support results joint and muscles pain, crepitus, limited or reduced mouth opening and mandible jaw movement deviation. This will lead to pain in masticatory muscles, myofascial pain disorders, joint derangements and locking [8]. The difficulty in chewing and mastication, limited mouth opening, joint sounds and deviation of mandibular movements will further affect the life quality and wellbeing of the individual [7, 8]. The disorder is progressive and problems become complex if not timely diagnosed and treated. Early diagnosis and management can efficiently reverse the harmful effects and cure the disease [9, 10]. In this region especially the poor patients seek prosthodontic help very late due to financial constraints until irreversible damage has occurred. The percentage of patients seeing the subjective manifestations of the TMD is high as compare to the ones who look for the treatment. Furthermore, many patients with tooth loss can have one or more signs of the joint problems that go unnoticed until later that transformed into recognizable dysfunction [11]. To this knowledge the studies on investigating TMJ problems in partially edentulous patients is scars in region. The results of the study will help in knowing the frequency of partially edentulous patients with undergoing TMJ problems so that strategies could be made in teaching hospital for timely diagnosis and treatment of developing disorders.

Previous studies have reported inconsistent findings regarding the association between partial edentulism and temporomandibular disorders (TMDs), particularly concerning the role of tooth loss pattern, occlusal support, and affected dental quadrants. Limited regional evidence is available from Pakistan assessing these factors together in partially edentulous patients. Moreover, many studies focused mainly on pain symptoms while ignoring functional signs such as mouth opening restriction and mandibular deviation. The objective of the current study was to assess the signs and symptoms of temporomandibular joint disorders in partially edentulous patients and find out the association between TMD's and edentulous span, tooth loss quadrant and occlusal support.

METHODS

The cross-sectional observational study was carried out in the Out Patient Department of Prosthodontic, Lahore

Medical and Dental College, Lahore. The study was conducted in a span of 3 months i.e.; October 1st 2024 till January 1st 2025. A total of 200 partially edentulous patients presenting to the department for the provision of partial dentures were recruited for the study. Patients of both genders within the age ranged from 30 to 70 years were selected. Non probability purposive sampling technique was used to select the sample. The sample size was estimated via computer aided software RAO Soft Epi Calculator against 11.6% prevalence of TMD in adults with in age ranged from 31 to 65 years of age; keeping margin of error 5% at 95% confidence interval [12]. Inclusion criteria was set to include all the healthy patients with partial tooth loss for at least 6 months and patients with a history of trauma, previous surgeries, genetic and developmental defects were excluded. Verbal informed consent from each patient was taken. The ethical clearance was obtained from the Ethical Review Board of the Dental College, Ref No. FD/5309/24. Patients after comfortably seated in the dental chair were assessed by two experienced prosthodontists. Temporomandibular Joints (TMJ) of every patient were clinically examined using TMD diagnostic criteria. Maximum mouth opening distance was measured in mm by asking patients to widely open their mouth and distance from the maxillary incisal edges to mandibular incisors edges was measured with graduated scale; mouth opening >40mm was considered normal and <35mm was considered as restricted, presence or absence of joint deviation (right or left) upon mouth opening was assessed by asking patients to open their mouth and any deviation from midline and its direction was checked, presence or absence of tenderness in muscles of mastication (temporalis, masseter, lateral and medial pterygoids) was checked by bimanual palpation method. Pain was assessed as being present or absent and severity of pain was not checked. The joint pain with clicking during mandibular movements was assessed in preauricular area via digital palpation as present or absent; and clicking and popping sounds were checked during mandibular movements via stethoscope as present or absent [9, 11]. The sample was grouped into 3 characteristics i.e.; number of partially lost teeth (1-4, 5-8, >8), number of dental quadrants with loss of posterior teeth (1, 2, 3, 4) and the numbers of Occlusal Support Zones (OSZ) based on Eichner Classification system [13]. The index classifies teeth into 3 categories A = OSZ are 4, B where OSZ are 3 and C = zero support zone. Category A (A2 = has 4 OSZ with missing teeth in one arch only), (A3 = has 4 OSZ and missing teeth in both arches). Category B (B1 = 3 OSZ), (B2 = 2 OSZ), (B3 = 1 OSZ), (B4 = zero OSZ with no opposing molar contact). Category C (C1 = zero OSZ; teeth in both arches but not in contact), (C2 = zero OSZ teeth in only one arch). Data were entered and analyzed by computer software SPSS Version 26.0. Frequency distribution (n, %) was found for the qualitative variables like gender, number of partially lost teeth, tooth loss quadrant and number of occlusal support zones. Descriptive statistics for quantitative variables like age

(mean and SD) was calculated. Association of TMD with edentulous span, tooth loss quadrant and occlusal support was found using Chi square. Statistical significance $p < 0.05$ was set.

RESULTS

The current study was carried out on 200 partially edentulous patients and their TMJs were examined to find out the signs and symptoms of the disorders of the joints. Both genders i.e.; males 82(41.0%) and females 118 (59.0%) were included in the study. The age ranged from 30 to 70 years with the mean age 56.15 ± 9.937 . Patients with maximum mouth opening i.e.; >40 mm were 171 (85.5%), frequency of mandibular deviation was 53 (26.5%), TMJ muscle pain was present in 16(8.0%) and frequency of joint pain with clicking was 46(23.0%), Table 1.

Table 1: Frequency distribution of TMJ signs and symptoms (n=200)

Variables	Frequency (%)
Maximum Mouth Opening	
>40 mm	171(85.5%)
35-39mm	19(9.5%)
<35 mm	10(5.5%)
Mandibular Deviation	
Yes	53(26.5%)
No	147(73.5%)
Muscle Pain	
Yes	16(8.0%)
No	184(92.0%)
Joint Pain with Clicking	
Yes	46(23.0%)
No	154(77.0%)

Maximum patients had missing teeth in 2 quadrants 60 (30.0%), maximum patients presented with in range of 5-8 numbers of missing teeth 85 (42.5%) and A3 i.e.; support zone 4 with missing teeth in both arches was frequently reported 59(29.5%), Table 2.

mouth opening was significant; p -value < 0.001 . Deviation of jaw up on mouth opening had insignificant association with gender; p -value 0.37 and number of tooth loss; p -value 0.10, (Table 3).

Table 3: Association of Gender and Number of Partial Tooth Loss with Signs and Symptoms of TMJ (n=200)

Variables	TMJ Pain with Clicking Frequency (%)		Muscle Pain Frequency (%)		Deviation of Jaw Frequency (%)		Maximum Mouth Opening Frequency (%)		
Gender	Yes	No	Yes	No	Yes	No	>40mm	35-40mm	<35mm
Male	27(32.9%)	55(67.1%)	7(8.5%)	75(91.5%)	19(23.2%)	63(76.8%)	64(78.0%)	13(15.9%)	5(6.1%)
Female	19(16.1%)	99(83.9%)	9(7.6%)	109(92.4%)	34(28.8%)	84(71.2%)	107(90.7%)	6(5.1%)	5(4.2%)
p-Value	0.05		0.81		0.37		0.02		
Number of Tooth Loss									
1-4	0(0.00%)	39(100.0%)	2(5.1%)	37(94.9%)	12(30.8%)	27(69.2%)	38(97.4%)	1(2.6%)	0(0.00%)
5-8	3(3.5%)	82(96.5%)	13(15.3%)	72(84.7%)	16(18.8%)	69(81.2%)	81(95.3%)	3(3.5%)	1(1.2%)
>8	13(17.1%)	31(40.0%)	31(40.8%)	45(59.2%)	25(32.9%)	51(67.1%)	52(68.4%)	15(19.7%)	9(11.8%)
p-Value	<0.001		<0.001		0.10		<0.001		

Significance value; $p < 0.05$

Table 2: Frequency distribution of number of partially missing teeth, tooth loss quadrant and number of occlusal support zone; n=200

Variables	Frequency (%)
Number of Partially Missing Teeth	
1-4	39(19.5%)
5-8	85(42.5%)
>8	76(38.0%)
Tooth Loss Quadrant	
1	23(11.5%)
2	87(43.5%)
3	60(30.0%)
4	30(15.0%)
Number of Occlusal Support Zone	
A1	0(0.00%)
A2	27(13.5%)
A3	59(29.5%)
B1	44(22.0%)
B2	31(15.5%)
B3	10(5.0%)
B4	6(3.0%)
C1	5(2.5%)
C2	18(9.0%)

The TMJ pain with clicking in males was 32.9% and in females it was 16.1%. Muscle pain was 8.5% and 7.6% in males and females respectively. Deviation of mouth opening existed in males 23.2% and females 28.8%. Restricted mouth opening i.e.; was present in 6.1% males and 4.2% females. The association of gender with signs and symptoms of TMJ was significantly found for TMJ pain; $p < 0.05$, and measurement of maximum mouth opening; p -value 0.02. Tooth loss number >8 had TMJ pain 17.1%, muscle pain 40.8%, deviation of jaw 32.9% and 11.8% restricted mouth opening i.e.; <35 mm. The Chi Square test significance of number of partially lost teeth with muscle pain; p -value < 0.001 , TMJ pain; $p < 0.001$ and maximum

The TMJ pain with clicking was 4.3% in quadrant 1, 2.3 % in tooth loss quadrant 2, 10.0% in quadrant 3 and 23.3% in quadrant 4. The muscle pain was 21.7%, 14.9%, 23.3% and 46.7% in quadrants 1, 2, 3 and 4 respectively. Deviation of mouth opening was 26.1%, 28.7%, 20.0% and 33.3% in quadrants 1, 2, 3 and tooth loss quadrant 4. Restricted mouth opening i.e.; <35 mm was found in quadrants 1, 2, 3, and 4 as 0.00% 1.1%, 6.7% and 16.7% respectively. The association of tooth loss quadrant with muscle pain, TMJ pain with clicking and maximum mouth opening was significant however insignificant association with deviation of jaw was found p 0.52. The maximum TMJ pain with clicking, muscle pain and deviation of jaw were found in C2 occlusal support zone; 72.2%, 55.6%, 50.0% however maximum rescripted mouth opening was found in C1.40.0%. Significant association of number of occlusal support zones with all signs and symptoms of TMJ was found, (Table 4).

Table 4: Association of tooth loss quadrant and number of occlusal support zone with signs and symptoms of TMJ (n=200)

Variables	TMJ Pain with Clicking Frequency (%)		Muscle Pain Frequency (%)		Deviation of Jaw Frequency (%)		Maximum Mouth Opening Frequency (%)		
Tooth Loss Quadrant	Yes	No	Yes	No	Yes	No	>40mm	35-40mm	<35mm
1	1(4.3%)	22(95.7%)	5(21.7%)	18(78.3%)	6(26.1%)	17(73.9%)	21(91.3%)	2(8.7%)	0(0.00%)
2	2(2.3%)	85(97.7%)	13(14.9%)	74(85.1%)	25(28.7%)	62(71.3%)	80(92.0%)	6(6.9%)	1(1.1%)
3	6(10.0%)	54(90.0%)	14(23.3%)	46(76.7%)	12(20.0%)	48(80.0%)	49(81.7%)	7(11.7%)	4(6.7%)
4	7(23.3%)	23(76.7%)	14(46.7%)	16(53.3%)	10(33.3%)	20(66.7%)	21(70.0%)	4(13.3%)	5(16.7%)
p-Value	0.03		<0.001		0.52		0.02		
Number of Occlusal Support Zone									
A2	0(0.00%)	27(100.0%)	0(0.00%)	27(100.0%)	6(22.2%)	21(77.8%)	26(96.3%)	1(3.7%)	0(0.00%)
A3	13(22.2%)	46(78.0%)	1(1.7%)	46(78.8%)	16(27.1%)	43(72.9%)	58(98.3%)	1(1.7%)	0(0.00%)
B1	6(13.6%)	38(86.4%)	2(4.5%)	38(86.4%)	9(20.5%)	35(79.5%)	42(95.5%)	2(4.5%)	0(0.00%)
B2	7(22.6%)	24(77.4%)	1(3.2%)	24(77.4%)	4(12.9%)	27(87.1%)	31(100.0%)	0(0.00%)	0(0.00%)
B3	1(10.0%)	9(90.0%)	1(10.0%)	9(90.0%)	2(20.0%)	8(80.0%)	6(60.0%)	3(30.0%)	1(10.0%)
B4	3(50.0%)	3(50.0%)	0(0.0%)	3(50.0%)	3(50.0%)	3(50.0%)	3(50.0%)	3(50.0%)	0(0.00%)
C1	3(60.0%)	3(40.0%)	1(20.0%)	3(40.0%)	4(80.0%)	1(20.0%)	1(20.0%)	2(40.0%)	2(40.0%)
C2	13(72.2%)	5(27.8%)	10(55.6%)	5(27.8%)	9(50.0%)	10(55.6%)	4(22.2%)	7(38.9%)	7(38.9%)
p-Value	<0.001		0.01		<0.001		<0.001		

Significance value; p<0.05

DISCUSSION

The current study was conducted on 200 partially edentulous patients reporting to the prosthodontics department for tooth replacements. Patients' TMJs were clinically assessed for the signs and symptoms of TMJ disorders. The signs and symptoms were found in partially edentulous patients where 23.0% TMJ joint pain, 8.0% muscle pain, 26.5% mandibular deviation and 5.5% with restricted mouth opening was seen. Lekaviciute and Kriauciunas, demonstrated low prevalence of joint disorder in partially edentulous patients. p=0.06 [14]. In contrast, Zielinski et al., and Rawat et al., in their respective studies reported the development of at least one or more joint disorders symptoms in partially and completely edentulous patients [15, 16]. In contrast Zakir and coworkers found no correlation of developing TMJ

problems in their patients with edentulism [11]. TMJ pain and clicking results from overloading of joint articular surfaces due to tooth loss and masticatory load. The mandibular movements cease or reduced due to pain and over period become very limited [10]. Maximum number of females were reported with tooth loss 59.0% however the signs and symptoms of TMJ dysfunction were significantly more in males 32.9% than in females 16.1%. In the present study the male patients 6.1% had restricted mouth opening i.e.; <35mm whereas only 4.2% females had reduced opening. Muscle pain was more in females 7.6% as compare to males but the finding was insignificant. In accordance with the results of current study more male patients were reported in the studies carried out by Mundt et al., stating the fact that women did not show a significant relationship

with tooth loss and developing TMJ problems [17]. In contrast to the results of current study more female patients with TMJ problems were reported in the studies done by Shet *et al.*, and Zakir and coworkers [18, 19]. Likewise, Amin and coworkers found more female patients with signs and symptoms of joint disorders [20]. Quin and coworkers however found no difference in pain intensity with in gender [21]. Similarly, Zakir and coworkers reported no correlation of developing TMJ disorder with respect to gender [11]. The variation in the results could be explained on the fact that social and cultural differences in different parts of the world could make impact and the reason of diversity in the results [21]. Tooth loss in a partially edentulous patient may affect the occlusal integrity and condylar posture of the joint. Shifting of the remaining opposite or adjacent teeth to fill in the gap results in premature contacts disturbing to the joint anatomy [16]. In the current study association of number of tooth loss and signs and symptoms of TMJ disorders was significantly found. Frequently missing number of teeth was from 5- 8 teeth i.e.; 42.5%. Signs of TMJ dysfunction were more prevalent in patient with >8 teeth loss. 17.1% TMJ pain and clicking, 40.8% muscle pain, 32.9% mandibular deviation and 11.8% restricted mouth opening i.e.; <35mm was reported in patient with more than 8 teeth lost. Rawat *et al.*, and Lekaviciute and Kriauciunas, in their respective study concluded that the chances of developing TMJ disorder is directly related to the number of missing teeth [14, 16]. Increase. In contrast Chairunnisa and Sihombing, reported no association of number of missing teeth and joint problems [22]. In the present study frequently found tooth loss was seen in 2 quadrants 43.5%, and association of tooth loss in number of quadrants was significant with signs and symptoms of TMJ disorders. Muscle pain and restricted mouth opening was frequently found in teeth missing in all 4 quadrants i.e.; 46.7% and 16.7% and the association was significant whereas deviation of mouth opening was seen in tooth loss in 2nd quadrant 71.3% but the insignificant association was found. Similarly, Wang and fellows reported that loss of tooth support in different quadrants is more detrimental to the joint health than loss of tooth support in one [23]. Likewise, Chairunnisa and Sihombing, found significant association of missing posterior teeth quadrants with signs of developing TMDs [22]. Similarly, a study concluded that the loss of posterior teeth and resultant loss of support greatly affects the health of the joint even more than the loss of anterior teeth [15]. A3 occlusal support zone 29.5% was frequently existed in the patients. Significant association of number of occlusal support zones and signs and symptoms of TMJ dysfunction was found $p < 0.05$. C2 and C3 zones had maximum TMJ symptoms i.e.; 72.2% TMJ pain and clicking, 38.9% restricted mouth opening and 55.6% muscle pain. In

contrast Chairunnisa and Sihombing, and Hiltunen found no correlation between occlusal support and joint problems claiming that number of teeth cannot describe the masticatory system functionality [22, 24]. Bertram and coworkers documented that bilateral loss of posterior teeth has more pronounced effect on the joint health as it results in condyle displacement and erosion [25]. Amin and coworkers in their study stated the multifactorial etiology of TMJ disorder in partially and completely edentulous patients and stressed that not only occlusal support loss damages the stomatognathic system but occlusal disharmony, masticatory pattern and parafunction influences the joint health [20]. Ammann and coworkers claimed it is still debatable that loss of posterior support and position of the condyle that very little is about the negative impact on the condylar position of the joint and the missing anterior teeth [26]. There is always an undergoing damage to TMJ due to loss of teeth that may go unnoticed as the detrimental effects not always end up in pain so recording other symptoms like restricted mouth opening, deviated mandibular movements and clicking in partially edentulous patients should also be recorded for accurate diagnosis.

The limitation of the study was its small sample size and the cross-section study design. The study lacks the follow up and studies recommended on larger group and long term follow ups for more precise outcomes. This will help in early identifying of TMJ problems and timely cure would be beneficial to the society. Future studies should include multicenter populations with larger sample sizes and longitudinal follow-up to better establish causal relationships. Further research incorporating radiographic assessment, severity grading of TMD symptoms, and evaluation of additional contributing factors is recommended for more comprehensive understanding and management of TMJ disorders.

CONCLUSIONS

It can be concluded that the partially edentulous patients frequently develop one or more signs and symptoms of TMJ disorders and number of teeth lost, number of quadrants with missing teeth and loss of occlusal support disturb the joint function and associated stomatognathic system.

Authors' Contribution

Conceptualization: MIAM

Methodology: S, SN, KQ

Formal analysis: MIAM

Writing and Drafting: MM, MHR, KY, TH

Review and Editing: MM, MHR, KY, TH

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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