Original Research Article

Correlation between posterior edentulousness and temporomandibular disorder in adult population: A case control study

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Abstract

Back ground: Posterior tooth loss significantly reduces chewing efficiency, causes loss of posterior support, movement of remaining teeth and changes in occlusal contacts, in turn, increasing risk of temporomandibular disorders (TMD).

Materials and methods: A case control study was conducted to assess correlation between posterior tooth loss and temporomandibular disorders.70 patients with unrestored posterior edentulous areas and 70 partially edentulous patients using removable partial denture prostheses to replace all missing teeth were assessed using Helkimo Index and compared.

Results: Linear regression analysis of Pearson used to analyse Helkimo Anamnestic index scores (OR =1.28 CI 0.46 to 2.106) and clinical dysfunction index scores (OR =1.12 CI 0.125 to 2.11) at 95% confidence level for posterior tooth loss without replacement and removable partial denture wearers. No statistically significant difference was found between the two groups. (p=0.110 and p=0.265).

Conclusion: A case control study was conducted to assess the role of posterior tooth loss in development of TMD with removable partial dentures wearers as controls. Outcome measures including patient verified TMD symptoms and clinically verified TMD signs were scored using the Helkimo Index. Statistically insignificant difference was seen between posterior tooth loss group and denture wearing group in their association with signs and symptoms of TMD.

Key words

Dysfunction, Edentulous, Removable partial denture, Shortened dental arch, TMJ, Tooth loss.

Introduction

Posterior tooth loss in one or both the jaws is of concern, both to the patient and the health care provider, as it significantly reduces chewing efficiency, posterior support and more often than not, creates a restorative challenge. Implant supported restorations, removable partial denture prostheses, and the shortened dental arch concept provide reasonable solutions to this challenge. Majority of patients with posterior tooth loss remain untreated or treated with less than satisfactory Removable partial denture prostheses. Long term support loss can cause movement in the remaining teeth and change in occlusal contacts 1] which in turn increases the risk of temporomandibular disorders (TMD) [2].

Loss of posterior support was also thought to significantly increase the risk of osteoarthrosis [3-5] and precipitate TMD [6-9].

However, shortened dental arch studies revealed that retaining premolar occlusion in shortened dental arch concept is not a major risk factor for TMD pain when compared to molar replacement with RPDs [10, 11]. Creugers NHJ, et al. 2010 [12] stated that occlusal contacts of the denture teeth decrease considerably from second premolars to second molars and distal extension removable partial dentures in moderate shortened dental arches had no effects on occlusion and temporomandibular function. Loss of teeth in more quadrants, though fewer in number was also found to be a significant is a risk factor for TMD [13].

Only few studies assessed the correlation between posterior tooth loss and temporomandibular disorder. The present study was conducted to correlate posterior edentulousness with signs and symptoms of TMD with hypotheses that states that Signs and symptoms of temporomandibular disorder are more in partially edentulous patients without replacement of missing teeth when compared to removable partial denture wearers.

Materials and methods

A case control study was undertaken to assess the correlation between loss of posterior teeth and presence of temporomandibular Disorder in adults. Prevalence of signs and symptoms of temporomandibular Disorder in partially edentulous subjects without replacement of missing teeth, in removable partial denture wearers and in subjects with a full complement of teeth was studied.

Participants in the study were recruited from the outpatient department of the Department of Prosthodontics, Army College of Dental Sciences. Of the 1880 patients screened over a period of two months, 140 patients who meet the inclusion and exclusion criteria were selected, a written consent obtained and allotted to three groups as shown below:

Group I: Partially edentulous subjects with posterior tooth loss in at least one arch.

Group II: Partially edentulous subjects with a removable partial denture replacing all the missing teeth

The eligibility criteria are as follows:

Inclusion criteria

- Subjects should have more than two posterior teeth lost in at least one quadrant.
- One edentulous span in at least one of the arches should be distal to the teeth present.
- Subjects wearing removable partial denture prostheses should have been wearing it for a period of 6 months or more.
- Male and female subjects should be in the age group of 30 to 60 years.

Exclusion criteria

- Subjects who had a history of maxillofacial trauma or developmental abnormalities.
- Subjects with complete denture in on arch.
- Subjects not willing for clinical examination of the Temporomandibularjoint.

Evaluation and scoring of subjects

The signs and symptoms of temporomandibular disorder/ dysfunction in the subjects were scored using the using the Helkimo Index.

The TMD symptoms were scored based on a questionnaire administered to each subject before clinical examination (**Table – 1**). The subject is scored as 0, I and II on the Helkimo Anamnestic index - Ai., where 0 indicates no symptoms, I indicates mild symptoms and II indicates severe/ acute symptoms.

The 5 Signs of TMD, namely, impaired mandibular movement, impaired or altered TMJ movement, muscle pain, joint pain and pain in mandibular movements were elicited using observation, measurement using a calliper and ruler and manual palpation. Helkimo Clinical Dysfunction index was used to score these clinically visible signs. Mandibular movements were assessed for maximal mouth opening, maximal movement to right, left and forward on a score card of 0, 1 and 5, based on severity. The movements of TMJ were perceived and noises of the joint noted. Deviation of mandible on opening and closure was evaluated as altered TMJ movements by measuring the deviation from midline. Bilateral palpation of deep and superficial heads of masseter muscle was carried out as the subject was asked to clench teeth and pain elicited. The anterior and posterior portion of temporalis muscle and its insertion at the coronoid process were palpated, one side of the head at a time. Medial pterygoid was palpated intraorally. Signs of lateral pterygoid muscle tenderness were elicited by functional palpation. TMJ pain was elicited by palpation of lateral and posterior aspects of the joint on closure, opening and closing and open position of the jaw. Intra auricular palpation was also done. Pain on mandibular movement was recorded. The signs so elicited were scored on Clinical Dysfunction Index as 0, 1 and 5 based on severity. Scores of all the 5 clinical outcome measures were added to arrive at the Clinical dysfunction index – Di code for each subject in Group I and Group II (**Table – 2**).

Table - 1: Questionnaire for assessment of subjective symptoms.

Name: Age: Sex: M/F Occupation:			
1.	Do you have sound in the joint?	Yes	No
2.	Do you have stiff jaw when you wake up in the morning?	Yes	No
3.	Do you have difficulty opening your jaw?	Yes	No
4.	Did you ever have a lock jaw?	Yes	No
5.	Do you have pain in the joint?	Yes	No
6.	Do you have pain in the lower jaw when you move it?	Yes	No
7.	Does your jaw come out of the joint when you open your mouth?	Yes	No

To measure the association between unrestored posterior tooth loss and temporomandibular disorders in Group I and to compare it to risk of TMD in subjects with removable partial denture prostheses Odds Ratio at a 95% Confidence Interval was calculated. Linear regression analysis was used for correlation.

Results

The scores of Helkimo Anamnestic Index Ai and Clinical Dysfunction index Di of Partially edentulous patients without restoration of the missing teeth were tabulated under Group I and those of partially edentulous patients wearing removable partial denture to replace all the missing teeth were tabulated under Group II.

Table - 2: Helkimo Clinical dysfunction index Di for the 5 signs of TMD.

Symptoms		**Score**
A. Mandibular mobility:		
Vertical	Horizontal	
≥40mm – normal range	≥7mm – Normal range	0
30-39mm –slightly impaired	4-6mm – slightly impaired	1
≤29mm – severely impaired	≤3mm – severely impaired	5
B. TMJ Dysfunction or altered function:		
Smooth movements, no noise, no deviation		0
Clicking/Friction, Deviation of jaw on lateral movement ≥ 2mm		1
Luxation/ locking of jaw		5
C. Pain in mandibular movement:		
Painless		0
Pain with one movement		1
Pain in 2 or more movements		5
D. Muscle pain:		
No tenderness on palpation		0
Tenderness in 1-3 places		1
Tenderness in 4 or more places		5
E. Pain in TMJ :		
No tenderness on palpation		0
Tenderness to lateral pressure		1
Tenderness to posterior pressure		5

Sum of A, B, C, D, E = Points
Clinical Dysfunction index Di:
0Points = Dysfunction group 0 =absence of symptoms = Di 0
1-4 Points = Dysfunction group 0 =absence of symptoms = Di I
5-9 Points = Dysfunction group 0 =absence of symptoms = Di II
10-13 Points = Dysfunction group 0 =absence of symptoms = Di III
15-17 Points = Dysfunction group 0 =absence of symptoms = Di III
20-25 Points = Dysfunction group 0 =absence of symptoms = Di III

Table - 3 shows scores for subjective symptoms of the patients in Group I and II. 12.86% of patients in group one felt clicking or popping sounds in their joints compared to 8.5% in Group II. Also, there was a difference in the frequency of luxation of joint see in Group I (4.28%) as opposed to Group II (1.43%).

Table - 4 displays frequency of subjects, by group, within each Helkimo Anamnestic Index Score. Though a small difference, the frequency of subjects who reported symptoms of mild and severe dysfunction was comparatively higher in Group I (10% and 4.3%) than Group II (8.6% and 2.9%).

Table - 5 shows frequency of TMD signs, by group; according to Clinical Dysfunction index Score. Five outcome measures show comparable frequencies between Group I and Group II except

in restriction of mandibular movement and clinically verified pain during mandibular movements. 15.7% of subjects had mild restriction of mandibular movements when compared to 10% in Group I. Also 7.2% of Group II had mild pain during jaw movements compared to none in group I. However, muscle pain on palpation and clicking and deviation of jaw were seen in 4.3% and 20% of Group I subjects respectively.

Table - 3: Frequency of symptoms in relation to groups according to Helkimo Anamnestic index - Ai.

	Group I		**Group II**	
	N	**%**	**N**	**%**
Do you have sound in the joint?	9	12.86	6	8.5
Do you have stiff jaw when you wake up in the morning?	1	1.43	0	0
Do you have difficulty opening your jaw?	3	4.28	2	2.86
Did you ever have a lock jaw?	0	0	1	1.43
Do you have pain in the joint?	1	1.48	0	0
Do you have pain in the lower jaw when you move it?	0	0	0	0
Does your jaw come out of the joint when you open your mouth?	3	4.28	1	1.43

Table - 4: Frequency of subjects in each Helkimo Anamnestic index - Ai score.

Helkimo Anamnestic index - Ai	**Ai Score**	**Group I**		**Group II**	
		N	**%**	**N**	**%**
	0 (Normal)	60	85.7	62	88.5
	I (mild dysfunction)	7	10	6	8.6
	II (severe/acute dysfunction)	3	4.3	2	2.9
Total Subjects		70	100	70	100

Table - 5: Frequency of signs in relation to groups in Helkimo Clinical Dysfunctional Index Di.

TMD Signs	**Points**	**Group I**		**Group II**	
		N	**%**	**N**	**%**
A. Mandibular mobility	0	62	88.6	58	82.8
	1	7	10	11	15.7
	5	1	1.4	1	1.4
B. TMJ dysfunction	0	55	78.6	56	80
	1	14	20	12	17.1
	5	1	1.4	2	2.9
C. Pain in mandibular movement	0	69	98.6	64	91.4
	1	0	0	5	7.2
	5	1	1.4	1	1.4
D. Muscle pain	0	66	94.3	68	97.1
	1	3	4.3	1	1.4
	5	1	1.4	1	1.4
E. Pain in TMJ	0	69	98.6	69	98.6
	1	0	0	0	0
	5	1	1.4	1	1.4

Table - 6: Frequency of subjects for each Helkimo Clinical Dysfunction index Di score.

Helkimo Clinical Dysfunction index - Di	**Di score**	**Group I**		**Group II**	
		N	**%**	**N**	**%**
	0 (normal)	59	84.3	60	85.7
	I (mild dysfunction)	8	11.4	7	10
	II (moderate dysfunction)	2	2.9	2	2.9
	III (Severe dysfunction)	1	1.4	1	1.4
Total Subjects		70	100	70	100

Table - 7: Linear regression analysis of pearson with Ai and Di scores in 70 partially edentulous patients and 70 removable partial denture wearers.

Variable	**P value**	**OR**	**95% CI for OR**
Helkimo Anamnestic index score Ai	0.110	1.28	0.46 to 2.106
Helkimo Clinical Dysfunction score Di	0.265	1.12	0.125 to 2.11

Table - 6 shows frequency of subjects, by group, with in each Helkimo Clinical Dysfunction index Di score. Group I and II show comparable scores.

Comparison of **Table - 4** and **Table - 6** shows that patient verified mild and severe TMJ dysfunction was higher when compared to clinically verified TMJ dysfunction in Group I subjects. This was obvious when a similar comparison done with Group II.

Table - 7 gives the Odds ratio of Group I and II using Helkimo Anamnestic index scores (OR =1.28 CI 0.46 to 2.106) and clinical dysfunction index scores (OR =1.12 CI 0.125 to 2.11) at 95% confidence level. Both the values were not statistically significant (p=0.110 and p=0.265).

Discussion

The case control study was undertaken with the rationale of a low cost, short duration study that could give reasonable level of evidence to substantiate the much debated topic of posterior tooth loss being a risk factor for TMJ disorders. The participants of the control group were matched for sex and age to improve comparability between the two groups and reduce confounding. Previous incidence of TMJ disorders was not considered as exclusion criteria for both the groups, so as to facilitate selection of both cases and controls independent of exposure of interest.

Outcome measures for TMD can be scored either using the revised Research Diagnostic Criteria for Temporomandibular Disorders given by Schiffman E, et al, 2014 or the Helkimo Index. Helkimo index was chosen for this study because of its simplicity in scoring clinically visible signs.

Helkimo Anamnestic index using the patient verified or self-reported scores showed that more number of subjects with posterior edentulousness without restoration of missing teeth, reported noises in the joint, difficulty in jaw opening and previous episodes of luxation when compared to number of subjects with removable partial denture wearers. This group also reported more and increased severity of symptoms compared with Group II. This indicates that loss of posterior teeth can have a significant relationship with occurrence of jaw pain, sinus pain and headaches as reported in studies by Pullinger, et al. 1993 [7], Abdel Fattah 1996 [14] and Tallents RH 2002 [9], Dulcic N, et al. 2003 [15]. However Clinical Dysfunction index formulated using clinically verified scores shows comparable number of subjects showing similar index scores. This outcome is comparable to that in studies by Witter DJ, et al. 1994 [16], Dervis, et al. 2004 [17], Witter DJ, et al. 2007 [18],

Creugers NHJ, et al. 2010 [12]. All the studies were prospective observational studies, that compared shortened dental arches i.e. arches with posterior edentulousness and premolar occlusion, with either partial edentulous arches with RPD or Complete arches. They concluded that there is no significant difference between the groups in incidence or prevalence of TMJ disorders.

In the present study, correlation of posterior edentulousness with signs and symptoms of TMD and its comparison with posterior edentulous patients wearing removable partial dentures showed no statistically significant correlation (OR =1.28 CI 0.46 to 2.106 p=0.110 and OR =1.12 CI 0.125 to 2.11 p=0.265) at 95% confidence level. Hence the study hypotheses was rejected.This is in agreement with a multicentre randomised control trial by Reissman DR, et al. 2014 [10] to assess the impact of missing posterior support and replacement on the risk for temporomandibular disorder (TMD) pain. Logistic and linear random-intercept models were used to analyse self-reported TMD pain and clinically verified TMD pain. Results showed OR: 1.1; CI: 0.4 to 3.4 in RPD group with self-reported pain and OR: 0.7; CI: 0.1 to 4.3 in RPD group with clinically verified pain. Mean pain intensity was identical in RPD and SDA (Coeff: 0.01; CI: -0.30 to 0.32).

However comparison between the groups for individual outcome measures of clinical dysfunction index showed variation in association between the groups. Non denture wearers showed increased muscle pain on palpation and clicking and deviation of the jaw, whereas, denture wearers showed mild restriction of mandibular movements and mild pain during jaw movements. Witter J, et al. 2007 concluded that restricted mobility was significantly related with chewing side preference and bruxism habits (both: p=0.01).

Dulcic N, et al. 2003 [15], Katyayan PA, et al. 2016 [19] concluded that edentulousness, and poor condition of the dentures associate with greater incidence and intensity of TMD associated signs and symptoms whereas Gleissner, et al. 2003 [20]. Maintained that adequate tooth support might help to prevent progressive TMJ impairment in the course of disease.

Statistically insignificant results in the present study might be because of the low sample size and study design. Randomised control trials are very few and need to be conducted to yield high level of evidence.

Conclusion

A case control study was conducted to assess the role of posterior tooth loss in development of TMJ disorders. Patients with removable partial dentures to restore lost teeth were used as controls. Outcome measures including patient verified TMD symptoms and clinically verified TMD signs were scored using the Helkimo Index. Results show statistically insignificant difference between posterior tooth loss group and denture wearing group in their association with signs and symptoms of TMD.

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