Influence of missing teeth on temporomandibular joint dysfunctions in adults

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Abstract

Background: Temporomandibular disorders (TMDs) are dysfunctions of the masticatory muscles and temporomandibular joints. TMDs are considered the most commonly reported conditions by patients in the dental office, right after tooth decay and periodontal disease. Previous research suggested that there is a correlation between the lack of first molar replacement occurring due to malocclusion and the incidence of TMDs.

Aims: The aim of this research was to establish whether there is a correlation between the incidence of missing teeth and TMDs.

Material and methods: A group of 420 people took part in an online questionnaire conducted through the ankieteo.pl website. Taking into consideration the exclusion criteria, such as single missing teeth, eighth molar deficits, and ages under 24 and over 55 years, 277 individuals were eligible to participate in the study. The experimental group consisted of 145 respondents, 65% of whom were women (n=94) and 35% men (n=51). Statistical analyses were performed using SPSS software and a significance level of $p \leq 0.05$ was assumed.

Results: According to the survey, 65.3% of those with missing teeth also had tinnitus. In contrast, 15.9% of individuals in this group reported the presence of crepitation. In the experimental group, missing teeth were associated with teeth grinding (16.2%), headaches after waking up (19.1%), and sensitivity when eating hot or cold food (26.4%).

Conclusion: An association between the incidence of missing teeth and TMDs has been demonstrated. A positive correlation was found between tinnitus, teeth sensitivity when eating hot or cold food and missing teeth. However, no significant relationship was observed in relation to the presence of parafunctions.

Key words

missing teeth, temporomandibular joint dysfunctions, parafunctions, tinnitus, crepitations.

Introduction

Temporomandibular disorders (TMDs) are dysfunctions of the masticatory muscles and temporomandibular joints. Schiffman et al. [1,2], reported that they can affect between 5% and 12% of the population. Several studies indicate a higher prevalence, ranging from 33% to 40% in the general population [3,4]. TMDs are considered the most commonly reported conditions by patients in the dental office, right after tooth decay and periodontal disease [5].

The etiology of TMDs is complex, although it is most often attributed to excessive parafunctional activity and abnormal overloading of the stomatognathic system [6-8]. Symptoms are considerably more common in women [9]. Multifactorial etiology is associated with diagnostic problems that make it difficult to establish causal therapeutic management [10]. The incidence of missing teeth can cause various pathologies of the stomatognathic system, such as the displacement of an articular disk, malocclusion, and the development of systemic diseases that are associated with irregular chewing and grinding of food.

Failure to properly distribute the occlusal forces can lead to teeth overload, increased teeth mobility, and, ultimately, teeth loss. Furthermore, abnormal work of the masseter muscles can also be caused by lack of symmetry in occlusion [11]. Relations within the stomatognathic system are characterized by interdependence and mutual influence on one another. Emotional factors, chronic stress, and parafunctional habits, i.e., bruxism, are cited among the most common causes of TMDs. Comorbidities such as thyroid disorders, headaches, cervical spine pain, multi-joint flaccidity, and rheumatoid arthritis (RA) were also observed [12-15]. Anormal posture and sleep disturbances have been shown to also contribute to the occurrence of TMDs [16-19].

Previous research suggested that there is a correlation between the lack of first molar replacement occurring due to malocclusion and the incidence of TMDs [20]. It has been found that patients with even single dental deficit and damaged clinical teeth crowns experience significant changes in the distribution of occlusal contacts, as compared to patients with full dental arches [10]. A study to assess the impact of missing teeth on the incidence of TMDs in the adult population was conducted based on the literature review.

Aims

The aim of the study was to determine whether there is a relationship between the incidence of missing teeth and TMDs.

Materials and methods

420 people took part in an online questionnaire conducted through the ankieteo.pl website. Taking into consideration the exclusion criteria, such as single missing teeth, eighth molar deficits, and ages under 24 and over 55 years, 277 individuals were eligible to participate in the study (**Figure 1**).

Eligible subjects were divided into an experimental group (n=145 subjects) and a control group (n=132 subjects). The experimental group included people who had missing teeth, while the control group included people who did not have missing teeth. The experimental group consisted of 35.17% of men and 64.83% of women, while the control group included 34.85% of men and 65.15% of women. The age distribution of the participants in both groups was presented in **Table 1**.

In the experimental group, 35.17% of subjects had two missing teeth (**Figure 2**). Most respondents (46.9%) reported that the time since the loss of 2 or more teeth was 5 years prior or longer (**Figure 3**).

The research employed: an online indirect diagnostic survey method, elements of descriptive statistics, analysis, and comparison. The research tool was a proprietary questionnaire with 37 questions, which included single-choice, multiple-choice, and open-ended questions. It included questions

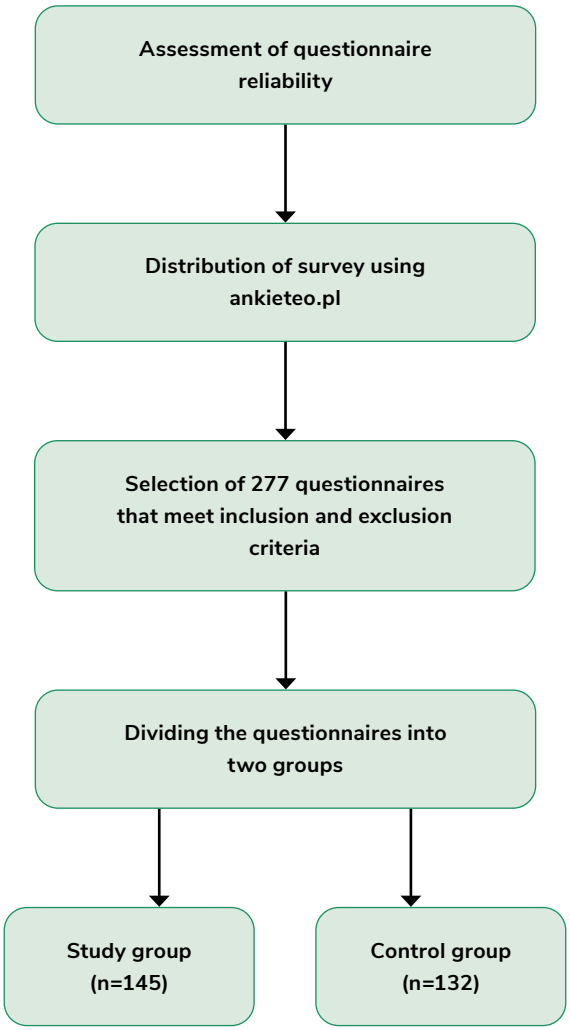

Figure 1. Flow chart of the study stages.

Table 1. Mean age in the study and control groups according to sex.

Mean age [years]	Study group		Control group	
	Females	Males	Females	Males
	38	42	36	39

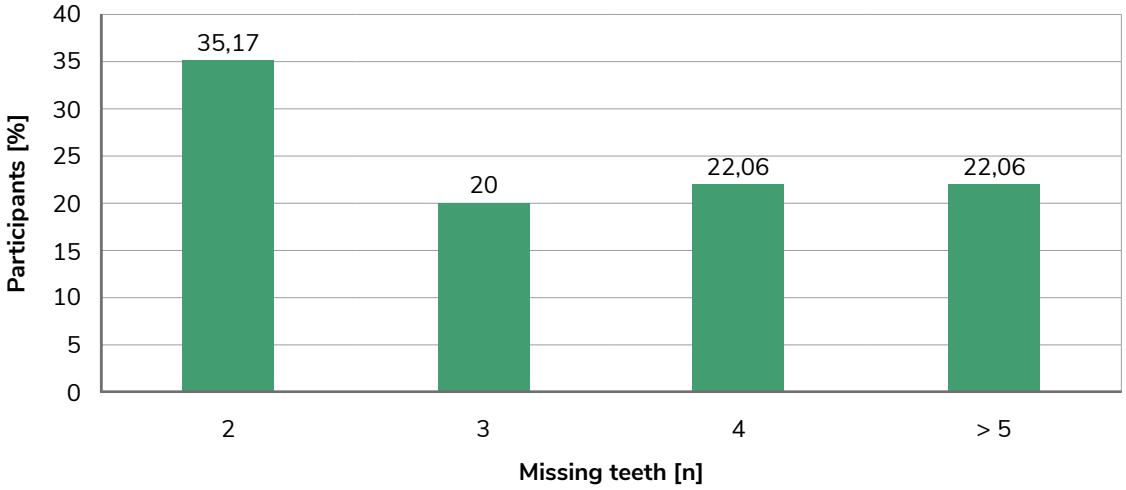

Figure 2. The number of missing teeth in the study group.

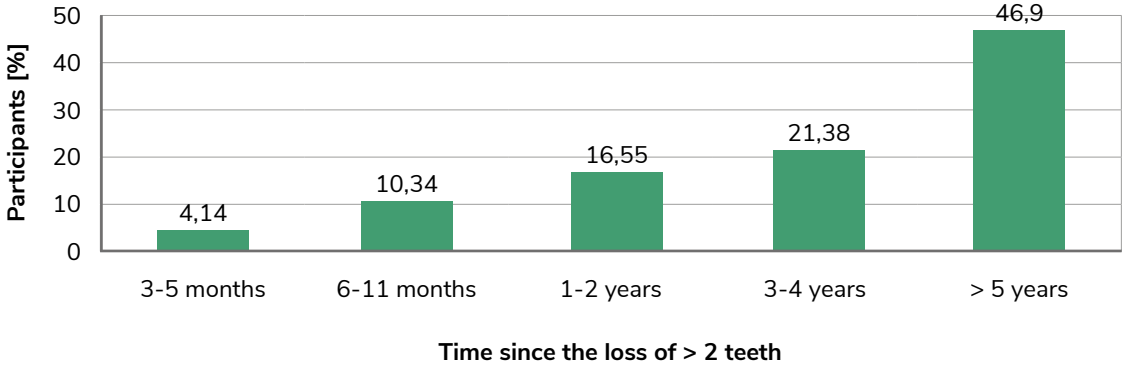

Figure 3. Time period since the loss of 2 or more teeth in the study group.

regarding gender, age, and the nature of work. The rest of the questions focused on the incidence and the number of missing teeth as well as their location in the mouth. The last part of the questionnaire included questions relating to the presence of headaches, parafunctions, tinnitus, temporomandibular joint pain, and increased tension in the facial muscles after waking up.

The following inclusion criteria were determined: Individuals between the ages of 24 and 55 years were eligible to participate in the study. Respondents in the experimental group had to have at least two missing teeth, excluding the eighth molars. Exclusion criteria were single missing teeth, missing eighth molars, age under 24 and over 55 years, neurological diseases, and mental health problems.

Statistical analysis was performed using the Chi-square test. The tests assumed a significance level of $p \leq 0.05$. Descriptive statistics for qualitative characteristics were included in the analyses.

Results

The reliability of the questionnaire was assessed before the actual research was conducted (two samples in a month). There were no significant differences between the results obtained in the two trials ($p<0.05$). Those who qualified for the research were divided into two groups. Eligibility was based on an analysis of responses in terms of inclusion criteria. The experimental group - those with missing teeth and the control group - those without missing teeth. The incidence of missing teeth has been found to be associated with the presence of tinnitus. In the experimental group, 65.3% of the participants had both characteristics (**Table 2**). It was revealed that 26.4% of those with missing teeth experienced teeth sensitivity when eating hot or cold food (**Table 4**). After conducting statistical analysis using the Chi-square test, a relationship between the above variables was found ($p<0.05$) (**Table 3 and 5**). It was determined that there is no significant correlation between the incidence of missing teeth and the occurrence of parafunctions, as illustrated by the data in **Tables 6 and 7**.

Table 2. Relationship between the occurrence of missing teeth and tinnitus.

Occurrence of missing teeth	Presence of tinnitus [n/%]		
	Yes	No	Total
Yes	47	98	145
	65.3%	48%	52.3%
No	26	106	132
	34.7%	52%	47.7%
Total	73	204	277
	26.4%	73.6%	100%

Table 3. Pearson's Chi-square test for the correlation between the occurrence of missing teeth and tinnitus.

Pearson's Chi-square	Df	Asymptotic significance
	2	.024

Table 4. Relationship between the occurrence of missing teeth and tooth sensitivity when eating hot or cold foods.

Occurrence of missing teeth	Occurrence of tooth sensitivity when eating hot or cold foods [n/%]		
	Yes	No	Total
Yes	73	72	145
	26.4%	26.0%	52.3%
No	43	89	132
	15.5%	32.1%	47.7%
Total	116	161	277
	41.9%	58.1%	100%

Table 5. Pearson's Chi-square test for the correlation between having missing teeth and the occurrence of hypersensitivity when eating hot or cold foods.

Pearson's Chi-square	Df	Asymptotic significance
	1	.003

Table 6. The relationship between the occurrence of missing teeth and the occurrence of parafunctions, such as teeth grinding, gum chewing, nail biting, lip biting, and pencil biting.

Occurrence of missing teeth	Occurrence of parafunctions [n/%]		
	Yes	No	Total
Yes	57	88	145
	55.3%	50.6%	52.3%
No	46	86	132
	44.7%	49.4%	47.7%
Total	103	174	277
	37.2%	62.8%	100%

Table 7. Pearson's Chi-square test for the correlation between having missing teeth and the presence of parafunctions.

	Df	Asymptotic significance
Pearson's Chi-square	1	.443

Discussion

The loss of posterior teeth in the maxilla or mandible is a problem for both a patient and a specialist, as it significantly reduces posterior support and, thus, efficiency and chewing ability. Prolonged loss of support can cause the remaining teeth to move and alter occlusal contacts, which in turn increases the risk of TMDs. It is also believed that loss of posterior support can significantly increase the risk of developing osteoarthrosis [21]. Malheiros et al. [22], found that teeth loss is directly related to TMDs symptoms since their study reported significantly higher symptom severity in edentulous patients. The current analysis did not address the group of people who had complete edentulousness due to the lack of a detailed classification in the questionnaire, distinguishing between those with five or more missing teeth and those with complete edentulousness.

Research conducted by Prithi et al. [23], found that the number of women reporting symptoms was higher than that of men. However, mainly among men, the loss of posterior teeth was associated with TMDs symptoms. The association between posterior teeth loss in men and TMDs symptoms was not addressed in the current study. Data analysis could provide a greater indication of the location of missing teeth, which are of a different nature in the male and female groups. The causes of TMDs are complex and multifactorial [24]. Several authors, such as Al-Ani et al. [25], believed that occlusion is a predisposing factor for the aforementioned disorders, while Manfredini et al. [26], claimed that occlusion does not have a significant role. The study conducted by Kozak et al. [27], highlighted the occurrence of tinnitus when smaller or more advanced TMDs are present. A change in the position of the mandibular head or heads at the temporomandibular joints, either due to an increase in masseter muscle tension or an abnormal spatial relationship of the tooth-to-tooth system, can cause disorders in the bicuspid area. Following an analysis of our own results, it was observed that the occurrence of tinnitus was significantly higher in those with missing teeth, accounting for 63.5%, which could be due to abnormal occlusion or excessive tension in the masseter muscles.

According to a study conducted by Michalak et al. [28], the prevalence of parafunctions among patients with missing teeth and full dentition is at the same level. Thus, it can be assumed that a smaller number of teeth does not have a major impact on the prevalence of parafunctions. However, a study conducted by Kawakami et al. [29], suggested that extensive teeth loss may be associated with diurnal parafunctions of the masticatory muscles, while it is not related to parafunctions occurring during sleep. The results of the current study showed no statistically significant correlation between missing teeth and the occurrence of parafunctions. It would be reasonable to expand the research using objective tools in a clinical trial.

According to Maciejewska-Szaniec et al. [30], pathological dental abrasion occurs due to the overloading of anterior teeth caused by missing teeth in the support zones. Sierpinska et al. [31], on the other hand, observed that among the etiological factors responsible for dental abrasion is teeth loss, especially in the support zones with

a concomitant lack of prosthetic provision. Despite a significant number of published articles on TMDs and occlusion, this topic remains controversial [32,33]. TMDs are now believed to have both somatic and psychological components. In particular, psychopathological conditions such as anxiety and depression seem to play an important role in their etiology [34–36]. The results of the study conducted by Korobkeev et al. [37], showed that distal occlusion with large cavities, compared to distal occlusion with small cavities, is accompanied by very pronounced changes in structural elements and temporomandibular joints. Henrikson et al. [38], observed that, on a group basis, the type of occlusion may play a role as a contributing factor to the development of TMDs. Jussila et al. [39], adopted a similar view, demonstrating that unstable occlusion has a statistically significant association with TMDs.

Conclusions

The investigation has shown that there is a correlation between the incidence of missing teeth and TMDs. Analysis of the results led to the following conclusions: there is a relationship between missing teeth and the occurrence of tinnitus. There is a relationship between missing teeth and teeth sensitivity when eating hot or cold food. There is no significant association between missing teeth and the presence of parafunctions, such as teeth grinding, gum chewing, nail biting, lip biting, or pencil biting.

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