Eur. J. Prosthodont. Rest. Dent., Vol.17, No. 1, pp 35-40
Printed in Great Britain

doi:10.1922/EJPRD_737-Yannikakis06

The Prevalence of Temporomandibular Disorders Among Two Different Denture-wearing Populations

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Abstract - ***Aim***. *The aim of this clinicostatistical study was to profile the complete denture wearers of two different populations, to determine any possible relationship between the prevalence of temporomandibular disorders (TMDs) and factors involved in complete denture wearing and to compare this prevalence between the groups.* ***Materials and Methods***. *Denture wearers who attended the clinics of the Dental School and Hospital, University of Bristol, U.K. (group A) and the Dental School, University of Athens, Greece (group B), were examined. An approximately equal number of patients; 115 for group A and 136 for group B, were selected. The examination included: a) a history record with reference to sex, age, years of complete denture experience, sets of dentures used, age of the current dentures, time period of every day denture wearing, any difficulties on opening the mouth, and/or pain at the temporomandibular joint (TMJ) region and b) a craniomandibular clinical examination in relation to midline deviation, pain and sounds from the joints, pain in the related muscles and inspection of the vertical dimension of occlusion. Data collected were analyzed using the chi-square test.* ***Results***. *Denture wearers of group A were older, presented with greater experience in complete denture wearing, used more sets of dentures, most wore dentures exhibiting decreased vertical dimension of occlusion and wore their dentures only in the day time. The TMDs prevalence was not statistically significantly different between A and B groups (34.8% and 41.2% respectively). In group B the TMDs prevalence was greater in females. There was a decreasing TMDs prevalence with increasing age. Neither of the groups showed significant TMDs prevalence in relation to the denture experience, the number of dentures used, the age of the present denture nor the vertical dimension of occlusion. Group B showed a decreasing TMDs prevalence in relation to continuous denture wearing.* ***Conclusions.*** *This clinicostatistical study showed that two different population groups of complete denture wearers who presented with different profiles have similar prevalence of TMDs.*

KEY WORDS: Temporomandibular disorder, temporomandibular dysfunction, temporomandibular joint, myofascial pain dysfunction syndrome, stomatognathic system, complete dentures, denture wearing.

INTRODUCTION

Despite the progress made in the field of preventive dentistry and the dramatic reduction in caries and periodontal disease that has occurred during the last 40 years, edentulism still remains a severe clinical morbidity. The percentage of edentulous persons increases with age; from 17-19% of the whole population to 58-80% for the 75+ years age group. In many institutions for the elderly, edentulism for individuals over 70 years is the rule rather than the exception. Since the replacement of missing teeth with endosseous implants is not the first choice in every day clinical practice, a large number of edentulous people seek treatment with complete dentures.[1-5] On the other hand, wearing complete dentures may have adverse effects on the health of the stomatognathic system; e.g. supporting tissues reactions and TMDs.[6-9]

An early claim was that complete denture wearers do not suffer from TMDs.[10] Some possible reasons for this statement are:[6-8,11] a) The frequent discomfort and instability of complete dentures can mask dysfunction of temporomandibular joints and masticatory muscles. Denture wearers are usually adapted to this impaired oral function and therefore accept some TMDs without complaint. b) Most dentists do not perform a functional examination of the masticatory system for their patients with the result that many symptoms remain concealed.

The statement seems to be no longer valid since a number of studies have clearly demonstrated that denture wearers also suffer from TMDs with an incidence varying from 2 to 23% among patients with TMDs.[12-19] However, the percentage of denture wearers who suffer from TMDs varies greatly across a number of studies. Table 1 presents a number of the relevant studies where this percentage is varying from 0 to 93.3%.[7,10,20-27] This variation, according to Helkimo,[28] could be attributed to a combination of two factors:

A. Differences in criteria used by examiners to record dysfunction; the more parameters for disease examined, the higher percentage of dysfunction will be recorded.

B. The prevalence of any disorder would depend on the nature of the sample of subjects examined; e.g. institutionalized patients, selected groups (nurses, students, etc.) and whole populations.

Furthermore, the impact of the quality of dentures, the denture-wearing habits and the role of vertical and horizontal relationships of the dentures on the prevalence of signs and symptoms of TMDs, still remains controversial.[29] Some studies have found correlation[6,7,13,23,30] and others have not.[25,27,31-36]

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Aim

The aim of this joint clinicostatistical study was to profile the denture wearers of two different population groups and: a) to compare the TMDs prevalence between denture wearers of two different populations; b) to determine any possible relationship between the prevalence of TMDs and factors involved in complete denture wearing.

MATERIALS AND METHODS

The two populations consisted of patients who attended the clinics of the Dental School and Hospital, University of Bristol, UK (group A) and the Dental School, University of Athens, Greece (group B) for the construction of complete dentures.

An approximately equal number of patients; 122 for group A and 149 for group B, were initially selected. The selection addressed the following criteria:

a) the patients had been wearing complete dentures for at least one year;

b) they were free of systemic diseases that might predispose to/or imitate TMD occurrence (e.g. rheumatoid arthritis, psoriatic arthritis, neurological disorders, extrinsic trauma, etc.).[11,25,37]

The study included an interview and an examination for TMDs as follows:

a) General and complete denture history: with reference to sex, age, years of complete denture experience, number of sets of dentures used, the age of the present dentures and time period of every day denture wearing.

b) Temporomandibular anamnestic investigation: with reference to any difficulties on opening of the mouth and pain at the temporomandibular joint (TMJ) region.

c) Temporomandibular clinical examination:

   1. A clinical examination in relation to midline deviation when opening and closing the mouth using a ruler placed vertically along the midline of the face.

   2. Palpation and auscultation of the joints. The auscultation of the joints was performed using a standard stethoscope.

   3. Palpation of the muscles (temporalis, masseter, lateral pterygoid, medial pterygoid) in the manner advocated by Meyerowitz[38].

   4. Examination of the vertical dimension of occlusion (VDO). A VDO providing free way space of 2-4mm was considered to be correct. The determination of the vertical dimension of occlusion was made using the postural rest position of the mandible and the Willis method.

Complete denture wearers who presented with one or more of the following anamnestic and/or clinical signs and symptoms (findings) formed the TMDs group:

(a) Midline deviation of the mandible of more than 2mm when opening and closing the mouth.

(b) Difficulty and/ or pain on opening the mouth.

(c) Pain on palpation of the temporomandibular region (including joint and muscles).

(d) Sounds from the temporomandibular joint (clicking or crepitus).

Two examiners in each center were calibrated in their perceptibility to discriminate the existence of signs and symptoms of TMDs and determine the vertical dimension of occlusion. Where there was a disagreement between the examiners, the case was rejected. The Kappa value defined 0.87 and 0.82 for group A and group B respectively. After exemption of the rejected cases, the number of patients included in this study was 115 for group A and 136 for group B.

STATISTICAL ANALYSIS

Data collected were analyzed using the X^2 test.

RESULTS

Data collected and the statistical analyses are presented in tables 2-5.

DISCUSSION

The literature reviewed in this study revealed that the controversy as to whether TMDs in the denture wearing population is more prevalent than in the whole population still remains. Also controversial is the relationship between TMD prevalence and the factors investigated such as the profile of the denture wearers, the denture-wearing habits and the overall quality of the dentures. There is only one point of universal agreement between the investigators; that temporomandibular disorders are of multifactorial nature.

The TMD prevalence in group A was found to be 34.8% and in group B 41.2% (Table 2). These rates lie between the 0-93.3% limits described in the literature (Table 1). This was expected since the range reported in the literature includes almost all the width of the percentage scale. It was mentioned earlier that the more parameters for disease examined, the higher percentage of dysfunction will be recorded. Greene and Marbach[39] criticizing the variability on the prevalence of dysfunction and the high percentage reports (12 to 80%) of seven epidemiological studies, accurately pointed out that if three-quarters of a population have signs of a disease there is a widespread epidemic or our concept of what is normal must be re-assessed.

Table 3 shows the frequencies of signs and symptoms of TMDs for both groups. It seems that the number of patients who had had anamnestically or clinically severe findings such us pain in the TMJ and pain in the muscles is limited, compared to patients with midline deviation or sounds from the TMJ. The midline deviation and the sounds from TMJ (mainly clicking) are indicative signs for TMJ pathology including dysfunction of the lateral pterygoids and disc-condyle incoordination.[40] However, many of the patients examined in this study showed midline deviation or sounds from the TMJs without any subjective pain to the muscles or the joints and at the same time presented without any discomfort during opening and closing the mouth. Specifically, 23 individuals (20%) for group A and 36 individuals (26.5%) for group B, showed midline deviation and/or sounds from TMJ without any other finding. This

Table 1. *Prevalence of TMDs among complete denture wearers.*

Author	*TMDs%*
Loiselle (1969)[10]	0
Agerberg & Carlsson (1973)[20]	19
Makila (1979)[21]	53
Choy & Smith (1980)[22]	15
Magnusson (1980)[23]	73
Zissis, Karkazis & Polyzois (1988)[7]	19
Agerberg & Wilkund (1989)[24]	94
Mercado & Faulkner (1991)[25]	93.3
Gray RJM et al (1997)[26]	20
Dervis (2004)[27]	15.1

Table 2. *Comparison of TMDs prevalence between the two patient groups.*

	Group A (n=115) %	*Group B (n=136) %*	*Statistical significance*
Temporomandibular Disorders	34.8	41.2	x^2=1.1 df=1 P>0.05

Table 3. *Frequencies of signs and symptoms of TMDs among groups.*

TMDs Signs and symptoms	*Group A (%)*	*Group B (%)*
Pain in the TMJ	9.6	11.8
Pain in the muscles	5.2	3.7
Midline deviation	19.1	12.5
Sounds from TMJ	16.5	22.1
One finding	20.9	31.6
Two findings	12.1	7.3
Three findings	1.7	0.7
Four findings	0	0

Table 4. *Comparison of the denture wearers' profiles and denture wearing habits.*

		Group A (n=115) Frequencies %	*Group B (n=136) Frequencies %*	*Statistical significance*
Sex	Male Female	40.9 59.1	52.9 47.1	x^2=3.6 df=1 P>0.05
Age	<60 60-69 >69	17.4 39 to 88 26.1 Mean=69.54 56.5	14 47 to 85 45.6 Mean=68.21 40.4	x^2=10.3 df=2 P<0.01
Denture experience	1-9 10-19 >19	1.7 11.3 87	35.3 41.2 23.5	x^2=103.1 df=2 P<0.0001
Sets of dentures used	1 pair 2 pairs >2 pairs	6.1 18.3 75.7	64 23.5 12.5	x^2=116.5 df=2 P<0.0001
Age of present denture	1-9 10-19 >19	61.7 28.7 9.6	60.3 27.9 11.8	x^2=0.3 df=2 P>0.05
Everyday denture wearing	Day Day & night Randomly	87 9.6 3.5	41.9 44.1 14	x^2=54 df=2 P<0.0001
Verticle Demiension of occlusion	Increased Correct Decreased	6.1 23.5 70.4	2.2 39.7 58.1	x^2=8.9 df=2 P<0.05

Table 5. *Comparison between TMDs prevalence and involving factors.*

		Group A (n=115) TMD patients %		*Group B (n=136) TMD patients %*	
Sex	Male	44.7	^{2}=3.4	31.9	x^2=5.4
	Female	df=1		df=1	
		27.9	P>0.05	51.6	P<0.05
Age	<60	15	x^2=4.5	63.2	x^2=7.5
	60-69	43.3	df=2	45.2	df=2
	>69	36.9	P>0.05	29.1	P<0.05
Denture experience	1-9	0	x^2=1.2	43.8	x^2=0.3
	10-19	30.8	df=2	41.1	df=2
	>19	36	P>0.05	37.5	P>0.05
Sets of dentures used	1 pair	28.6	x^2=0.6	37.9	x^2=1.4
	2 pairs	28.6	df=2	43.8	df=2
	>2 pairs	36.8	P>0.05	52.9	P>0.05
Age of present denture	1-9	38	x^2=4.9	45.1	x^2=1.4
	10-19	21.2	df=2	34.2	df=2
	>19	54.5	P>0.05	37.5	P>0.05
Everyday denture wearing	Day	35	x^2=0.2	52.6	x^2=11.8
	Day & night	36.4	df=2	25	df=2
	Randomly	25	P>0.05	57.9	P<0.01
Verticle Demiension of occlusion	Increased	28.6	x^2=0.6	66.7	x^2=3
	Correct	29.6	df=2	48.1	df=2
	Decreased	37	P>0.05	35.4	P>0.05

corroborates with the results of Loiselle[10] who reported that 17% of the sample had noise in a TMJ, hypermobility or deviation on opening or closing, but these symptoms were not associated with limitation of function or a history of pain and he did not consider them indicative for TMD. MacEntee[11] in a literature review concerning denture related diseases stated that the presence of pain and limitation of jaw movement, in at least 15% of denture wearers, poses a considerable problem although the high prevalence of joint sounds probably is of minor importance. He concluded that the inclusion of all joint noises as a diagnostic symptom of TMDs will increase its prevalence among elderly people. If midline deviation and sounds from TMJ were excluded from the descriptive analysis used in the present study, then the TMD prevalence mentioned would be transformed to 10.4% and 14.7% for group A and group B respectively. The question raised at this point could be; who of the TMD group individuals need therapy? From a survey of TMD conducted by the greater New York Academy of prosthodontics, two thirds of the surveyed practitioners who treat TMD patients, answered that "never" treat or refer for treatment asymptomatic patients who are without pain but have a click on opening or closing the mouth.[41]

The profile of the two populations examined (groups A and B) showed some differences. (Table 4) The majority of denture wearers in group A were older (>69 years old) compared to those of group B (P<0.01). Group A had greater denture experience with 87% having a denture wearing record more than 19 years, while 76.5% of the individuals of group B had a denture experience between 1 to 19 years (P<0.0001). Moreover, individuals of group A used more sets of dentures than denture wearers of group B (P<0.0001). This can be attributed to the age and the greater denture experience of the group A individuals since there is no difference regarding the age of current dentures between the groups (P>0.05).

Comparing the TMD prevalence of group A in relation to sex there was no statistically significant difference, with males having higher incidence in the TMD group. (Table 5) This finding corroborates with previous studies reported that the dysfunction has been shown to be roughly equal between sexes.[1,7,42] For group B the TMD prevalence was greater in females than in males (P<0.05). This is in agreement with the reports of Meyerowitz[38] and Sakurai et al[34]. It seems that the influence of gender on TMD prevalence remains controversial.

A significant decrease in the TMD prevalence with increasing age was found for group B (P<0.05). The initial increasing of the TMD prevalence for the 6th decade of life followed by decreasing for the individuals over 69 years old in group A, even if not statistically significant (Table 5), is in disagreement with some previous reports[25,43] but in agreement with others[27,44]. There is a relatively general agreement that the degenerative conditions such as osteoarthritis occurred frequently in the old elderly TMJs, mostly in individuals who wear complete dentures.[25,45,46] MacEntee[11] observed that 15% of elderly patients have some kind of osteoarthritis which is correlated with TMJ pain. However, the masticatory function deteriorates with increasing age. Independently if it is due to muscle mass and density decreasing or a disease and lack of physical activity, age seems to have a smoothing effect on parafunction and TMDs, except for crepitation[47-50].

The prevalence of TMD in relation to years of complete denture experience, number of sets of dentures used and the age of the present dentures was not statistically significant (P>0.05). (Table 5) This finding corroborates with previous results,[7,27,36] but is in disagreement with the results of Sakurai et al[34] who reported that patients who used the same set of complete denture for more than 6 years had more signs and symptoms of TMD. Moreover, Faulkner

and Mercado[35] stated that denture wearers with a history of fewer sets of complete dentures had higher prevalence of TMDs. The relevance of the number of sets of dentures used and the age of the current dentures could be interpreted in different ways. Patients, who have had a history of more sets of dentures or renew their dentures earlier, might have visited the dentist more often therefore maintaining their dentures in a more favourable condition and thus show lower prevalence of TMDs. However, patients who have had fewer sets of dentures may do so because they feel comfortable and have no complaints.

Continuous denture wearing has been reported[51] that could have a protective effect relieving the stress from the joints and muscles of mastication. Other studies reported no correlation between TMDs and the removal of dentures during sleep.[27,34] In the current study, no correlation was found between time period of every day denture wearing and TMD prevalence for group A. (Table 5) In contrast, group B showed evidence of decreasing TMD prevalence ($P<0.05$) with continuous denture wearing which supports a previous finding.[51] Perhaps patients with TMDs should be prompted to use their dentures during sleep as an exception to the general rule of night-time removal?

The role of VDO in TMDs still remains controversial. No correlation could be found between VDO variations and signs and symptoms from the stomatognathic system (Table 5). This was consistent with some reports[3,13,27,52] and in disagreement with others[7,30,33,53].

Interpreting the clinical implication of this study, we can conclude that complete denture wearers may present with TMDs. Therefore, edentulous patients should be examined for TMJ dysfunction and a typical TMD questionnaire included as part of a routine examination.

Concerning the possible factors and their role on the prevalence of signs and symptoms in the incidence of TMDs, no clear pattern is presented by previous literature reports and the results from the present study. A multivariate analysis should be performed as a more appropriate statistical analysis, since all the possible factors that have an influence on TMDs are incorporated in the same test, but this demands a large number of subjects. Perhaps multicenter contribution and cooperation between investigators could reinforce the statistical significance by increasing the sample size.

It seems that the criteria for what is normal, what is indicative for future development of dysfunction and what needs immediate treatment must be confirmed, differentiated and perhaps reevaluated in a more precise and descriptive norm.

CONCLUSIONS

Within the limitations of this study, we can conclude that in both groups: a) TMDs affect more than one third of denture wearers b) denture wearers of group A were older, presented with greater experience in complete denture wearing, used more sets of dentures, in the majority used dentures exhibiting decreased vertical dimension of occlusion and wore their dentures mainly in the day time c) the prevalence of TMDs in relation to years of complete denture experience, number of sets of dentures used and the age of the present dentures was not statistically significant d) denture wearers of group B presented with day and night denture wearing showed decreased TMD prevalence.

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