Prevalence of Functional Dentition in a Group of Mexican Adult Males

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Objective: To determine the prevalence of functional dentition and associated periodontal variables in a sample of Mexican adult males.

Methods: A cross-sectional study of 161 policemen in Campeche, Mexico, was carried out. A clinical examination using an electronic probe was used to collect variables (dental plaque, periodontal pockets, gingival recession, suppuration, and bleeding on probing) on 6 periodontal sites (a maximum of 168 sites, excluding third molars). Sociodemographic, socioeconomic, and behavioral variables were collected through a self-administered survey. Functional dentition was defined as having 21 or more natural teeth. Data were analyzed with STATA 11.0, using logistic regression models.

Results: Mean age was 38.3 (±10.9) years. The prevalence of having a functional dentition was 83.8% in the sample. The odds of having a functional dentition declined with age (odds ratio [OR] = 0.93), having diabetes (OR = 0.27) and with having a high percentage of sites with plaque (OR = 0.77), with bleeding on probing (OR = 0.97), and with gingival recession (OR = 0.82).

Conclusion: While a large proportion of subjects had a functional dentition in this community-dwelling sample of adult Mexican males, the likelihood of their having a functional dentition decreased with age, with their having been diagnosed with diabetes, and with assorted negative indicators of periodontal/gingival status. [*P R Health Sci J 2017;36:146-151*]

Key words: Oral health, Tooth loss, Functional dentition, Adults, Mexico

Tooth mortality statistics are a component in the evaluation of oral health status and dental services available to a population. Dental extractions, although often considered the last treatment of choice in the dental armamentarium, remain a common procedure in dental practices in less-developed countries, and in underprivileged settings in general. Dental extractions are a reflection of the cumulative effects of sustained dental disease together with clinical decisions and available dental services (1). Many reasons contribute to permanent teeth being extracted or lost; dental caries and periodontal disease are the 2 diseases implicated in most dental extractions among Mexican adults (2) and among individuals in other countries around the world (1,3).

Tooth loss has been proposed as a negative indicator of oral health and is related to substantial public health challenges. Various international agencies have established global oral health goals to be achieved by the year 2020 (4). These goals include (but are not limited to) the following: I) reducing by X% the number of teeth lost by individuals at age 18 or from 35 to 44 and 65 to 74 years, paying particular attention to the various roles of smoking, poor oral hygiene, stress, and systemic disease in the process of doing so; II) reducing by X% the number of edentulous persons, especially those who are 18 years old and those who belong to the 35- to 44-year, and the 65- to 74-year age groups; III) increasing by X% the number of natural teeth remaining, especially to those who are 18 years old and those who belong to the 35- to 44-year, and the 65- to 74-year age groups; IV) increasing by X% the number of individuals with functional dentitions (21 or more natural teeth), especially those who are 18 years old and those who belong to the 35- to 44-year, and the 65- to 74-year age groups.

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The number of teeth both remaining in the mouth and in functional condition is recognized as a key determinant of oral fitness. Briefly, an individual's oral health and function become better or worse depending on the number of teeth he or she retains. The presence of 21 or more natural teeth is generally accepted as a marker of a functional dentition. Although this figure may be viewed as arbitrary, evidence indicates that having at least 21 teeth is required if an individual is to be able to eat, speak, and socialize without discomfort or embarrassment; possessing at least this number of teeth also reduces an individual's risk of active disease and precludes the need for prosthetic replacement (4,5). Although alternative perspectives have been proposed to consider shortened dental arches as functionally acceptable, aesthetically pleasing, and clinically feasible, no definitive descriptions of the dental attributes or their impacts on various aspects of life are universally accepted (6). In light of such an evolving scenario, we adhere to the notion of functional dentition, often postulated as the presence of 20 teeth or more in the mouth (7) or of 21 teeth or more (4,5,8–10). Studies on the prevalence of functional dentition in adults found that for those aged 20 years old (living in the USA), more than 71.7% had 21 or more natural teeth, compared with 42.4% of those aged 50 years old and older (10). In a study of Brazilian adults, investigators found the prevalence of functional dentition to be 80.6% in their sample population (7). In another Brazilian study, the prevalence was 50 to 91% among 35- to 44-years-olds (11). The variables associated with having a functional dentition (in Brazil) were gender, skin color, income, and schooling (11). In Bulgaria, the percentage of subjects aged 20 years and over having a functional dentition was 81% (12). Income, education, type of dental service most often used, lifestyle, risk behaviors, and demographic conditions are distal, intermediate, and proximal variables associated with functional dentition in adults (7). In that regard, education, family poverty, citizenship status, and language used were cited in the USA (13).

The current literature is unclear regarding not only how changes in having a functional dentition are associated with periodontal variables in less-developed countries but also the prevalence of such changes, which lacks are part of what inspired the study described herein. Emergent economies are unevenly acquiring dental care services in their rapidly urbanizing populations. It is unclear what the resulting profiles of functional-dentition prevalence may be in such transitional stages, between the very limited availability of dental care services and low experience of oral disease (e.g., in the least developed countries in sub-Saharan Africa) and the rather industrialized economies such as that of Mexico. In the latter example, the prevalence of having a functional dentition is likely conflated through high levels of disease partially met with heterogeneous access to care, noxious health behaviors (high soda intake and tobacco use), and fragmented dental care services. In Mexico, few studies have delineated the role of oral health (specifically in terms of having a functional dentition) when describing the oral epidemiological profile of the population (14). The aim of the present study was to determine the prevalence of having a functional dentition, as well as the periodontal variables associated with it, in a sample of community-dwelling Mexican adult men

Material and Methods

Design, population, and sample study

Campeche is a state in Mexico in the Yucatan Peninsula on the eastern coast of the Gulf of Mexico. The study was undertaken in the capital city, also called Campeche. This cross-sectional study included a sample of police officers 20 to 78 years of age, thus forming a very homogeneous sample in terms of variables such as income, sex, and access to third-party payment insurance. A detailed description of the survey, the planning for the study, and the methods utilized have been published elsewhere (15). After our having obtained informed consent, the final study sample consisted of 161 individuals (100% of whom agreed to be included in the study).

Data collection

Demographic, socioeconomic, and health behavior data were collected through personal interviews using a structured and validated questionnaire, which was pilot tested before being used in the study. Exposure variables at the individual level were demographic (age: 20 to 78 years; marital status: single/divorced/widowed or living with spouse/partner), socioeconomic (maximum level of education: 3 to 17 years), oral hygiene habits (frequency of tooth brushing: less than once/day or at least once/day), basic access to dental services (visit to the dentist in the previous 12 months [for any reason]: no or yes), and others risk factors (bruxism: no or yes; type 2 diabetes [diagnosed by a physician]: no or yes; and tobacco and alcohol intake: never, former or current). As has been done in other studies (16), 3 categories were used for tobacco and alcohol intake: I) subjects who had never smoked and subjects who had never consumed any type of alcoholic beverage were considered non-smokers and non-drinkers, respectively; II) ex-drinkers and ex-smokers were, respectively, those subjects who had abstained from any type of drinking and those who had abstained from smoking for at least 6 months prior to their filling out the questionnaire; and III) current drinkers and smokers were, respectively, those subjects who had consumed any type of alcoholic beverage and those who had smoked at least 20 cigarettes in any one week in the 6 months previous to their filling out the questionnaire.

All examinations were performed with the subjects sitting in a dental chair and using a dental mirror with a dental light, by a single dentist (periodontist) (MMS trained to provide a standardized diagnosis of clinical attachment loss (kappa>0.60). In addition to the kappa agreement, the measurements showed a 90% agreement (±1 mm). Periodontal data collection was performed using an electronic periodontal probe (Florida Probe®, Florida Probe, Gainesville, FL, USA) with a tip having

a diameter of 0.45 mm. The level of precision of the probe is 0.2 mm, with a regulated pressure of 15 g (17). A manual was used to ensure a standardized approach in terms of applying the clinical criteria.

The dependent variable was the prevalence of having a functional dentition, which was scored with a 0 indicating subjects with fewer than 21 teeth present in the mouth and a 1 indicating subjects with 21 or more teeth. Prostheses were excluded (4). In each subject, 6 sites were evaluated on each tooth present (distobuccal, midbuccal, mesiobuccal, distolingual, midlingual, and mesiolingual). Third molars were excluded (i.e., 168 sites per person was the maximum). We also collected data for sites with plaque, sites with bleeding on probing, sites with suppuration, sites with pockets that were 4 mm or greater, and sites with gingival recession. Dental plaque was scored using the modified Silness and Löe index, which also conveyed information on bleeding on probing; suppuration was ascertained by finger pressure on each one of the sites and direct observation of the presence or absence of this material. All those variables were further quantified by establishing their extent using the following formula:

$$\frac{(\text{number of affected sites})}{(\text{number of sites examined})} \text{ x } 100.$$

Data analysis

In the univariate analysis, we calculated frequencies and percentages for categorical variables and mean (± standard deviation) for continuous variables. In the bivariate analysis, we used logistic regression to estimate the strength of association between having a functional dentition and the independent variables, expressed as ORs with 95% confidence intervals; p values were considered statistically significant if lower than 0.05.

The data were analyzed using the Stata version 11.0 software program.

Ethical considerations

The protocol was approved by the Internal Review Board of the School of Dentistry at the Autonomous University of Campeche. It complied with international stipulations for the protection of human subjects and with existing ethical regulations. The research was conducted in accordance with the Declaration of Helsinki. Written consent was obtained from all the participants, and data were analyzed anonymously.

Results

The results of the univariate analysis are described in Table 1. The mean age of the participants was 38.3 (±10.9) years. The prevalence of having a functional dentition (21 or more teeth) was 83.8%; the average number of teeth possessed by the members of the group having a functional dentition was 26.2 (±1.8), in contrast with the average of 15.3 (±4.2) possessed by the members of the group not having a functional dentition (p<0.0001). Table 2 shows the results of the bivariate analysis between having a functional dentition and the independent variables. It was observed that as age increased, the odds of having a functional dentition decreased (OR = 0.93; 95% CI = 0.90–0.97). The odds of having a functional dentition decreased for subjects with diabetes (OR = 0.27; 95% CI = 0.11–0.66) compared with those who did not have diabetes. Similarly, people with a higher percentage of sites with plaque (OR = 0.97), of sites with bleeding (OR = 0.97), or of sites with gingival recession (OR = 0.82) had lower odds of having a functional dentition (p<0.05).

Table 1. Descriptive characteristics of variables included in the study.

Variable	n	Mean±sd
Age	161	38.36±10.99
Years of schooling	161	10.05±2.26
% of sites with plaque	161	23.51±21.72
% of sites with bleeding on probing	161	15.60±15.22
% of sites with suppuration	161	0.72±1.68
% of sites with pockets ≥ 4 mm	161	5.94±8.08
% of sites with gingival recession	161	5.09±4.98
	n	**%**
Marital status		
Single	25	15.5
Living with spouse/partner	136	84.5
Received dental care in previous 12 months		
No	13	8.1
Yes	148	91.9
Tooth brushing frequency		
<1/day	10	6.2
At least 1/day	151	93.8
Tobacco use		
Never	52	32.3
Former	45	27.9
Current	64	39.8
Alcohol intake		
Never	23	14.3
Former	64	39.7
Current	74	46.0
Bruxism		
No	97	60.3
Yes	64	39.7
Diabetes		
No	98	60.9
Yes	63	39.1

Discussion

In addition to key periodontal variables, age and having been diagnosed with diabetes were found to be inversely associated with the presence of 21 teeth or more in this homogeneous group of adult Mexican males. At the global level, little emphasis has been given to the study of having a functional dentition. Tooth loss is already known to be an indicator of health, and preventing such loss is the goal of a number of international health organizations. This study, the first of its kind in Mexico, adds to the epidemiological understanding of tooth loss, and its findings can be used in the development of dental services

Table 2. Bivariate logistic regression analysis incorporating functional dentition and independent variables.

Variable	OR (95% CI)	p value
Age	0.94 (0.90 – 0.97)	0.001
Schooling	1.06 (0.87 – 1.28)	0.550
% of sites with plaque	0.97 (0.96 – 0.99)	0.007
% of sites with bleeding on probing	0.97 (0.95 – 0.99)	0.039
% of sites with suppuration	0.99 (0.78 – 1.28)	0.973
% of sites with pocket ≥ 4 mm	0.99 (0.94 – 1.04)	0.741
% of sites with gingival recession	0.82 (0.75 – 0.90)	0.000
Marital status		
Single	1*	
Living with spouse/partner	0.99 (0.31 – 3.16)	0.982
Received dental care in previous 12 months		
No	1*	
Yes	1.63 (0.42 – 6.38)	0.483
Tooth brushing frequency		
< 1/day	1*	
At least 1/day	0.75 (0.26 – 2.15)	0.590
Tobacco use		
Never	1*	
Former	0.65 (0.24 – 1.74)	0.388
Current	2.03 (0.67 – 6.11)	0.212
Alcohol intake		
Never	1*	
Former	0.65 (0.17 – 2.56)	0.542
Current	1.37 (0.33 – 5.72)	0.662
Bruxism		
No	1*	
Yes	1.07 (0.45 – 2.52)	0.883
Diabetes		
No	1*	
Yes	0.27 (0.11 – 0.66)	0.004

*reference category

and related health policies, as well is in improving both the training of the current workforce and the relevant curricula in dental schools. Such potential adjustments are important, insofar as the dental health care system in Mexico is a mixed and fragmented health system composed of public services supplied by and social security efforts made by public institutions, third-party payment systems, and private carriers. Most services are delivered under a fee-for-item, out-of-pocket scheme; although the public health sector is responsible for a largely fluid set of services often restricted to the urban settings, dental extractions are usually included in those services (18).

This study found that more than 80% of subjects had a functional dentition. Similar results were observed in Brazil (7) and Bulgaria (12), which corresponding studies found functional-dentition prevalences of 80.6% and 81.0%, respectively. Other studies have reported greater variability; for example, in the United States, the prevalences have ranged from 42.4 to 71.7% (10), whereas these values have been reported to be from 50% to 91% in Brazil (11). In our study, the average number of teeth in the group having a functional dentition was 26.2—15.3 in the group without a functional dentition; similar results were found in Taiwan (19), which corresponding study observed an average of 26.1 and 15.5 in the two groups, respectively. Although somewhat arbitrary, a threshold of 21 teeth does in fact reflect the presence of an important grouping of teeth across population groups. Tooth loss results from an intricate medley of factors having to do with an individual's specific history of dental disease and treatment (9). Tooth loss reflects not only dental disease but also the attitudes of both the individual patient and his or her dentist, the dentist–patient relationship, the availability and accessibility of dental services, and the prevailing philosophies of dental care. This complex web of interactions was emphasized in the negative relationship between age and tooth loss that was observed. Despite the fact that tooth loss is the result of a complex interaction of biological, cultural, economic, and social factors, it may summarize the life courses of those who experience it; may represent the cumulative effect of clinical conditions affecting the teeth, as in the cases of dental caries and periodontal diseases (1). The identified relationship between age and tooth loss is in line with what has been found in previous studies in India (8), in the United States (13), and in Thailand (20). However, it is important to note that age alone may not account for the deterioration in oral health status (8).

There are several reports that show that people with diabetes also tend to have poor oral hygiene and worse oral health indicators, including a reduced likelihood of having a functional dentition. Both Jung et al. (21) in Korea and Sensorn et al. (20) in Thailand found that diabetic patients had higher numbers of missing teeth than did non-diabetic patients ($p<0.05$). Similarly, another study, this one from Mohamed et al. (22) and looking at Sudanese adults, observed that subjects with diabetes, besides having poorer oral health indicators, also had lower prevalences of functional dentition (21 teeth or more) than did subjects without diabetes; this trend was more apparent among those who had been diabetic for longer periods of time. Members of the general population lose teeth mainly because of dental caries (children and adults under 35 years) and, to a lesser extent, periodontal disease (adults over 35) (1,3). Patients with diabetes are not markedly different (23): various contributing factors appear implicated in the increased susceptibility of adult diabetics to periodontal diseases and potential tooth loss (24). These factors include compromised polymorphonuclear leukocyte function resulting from impaired neutrophil adherence, chemotaxis, and phagocytosis; abnormalities of collagen metabolism, impaired proliferation of osteoblasts, and weakened mechanical properties of newly formed bone in hyperglycemic patients; high levels of glucose in the gingival crevicular fluid that diminish the wound-healing capacity of fibroblasts in the periodontium; and the formation of advanced glycation end-products–modified arterial collagen that immobilizes low-density lipoprotein, leading to atheroma formation. The latter promotes greater basement membrane thickness of the microvasculature, hampering normal homeostatic transport and leading to the higher production of vascular endothelial growth factor, interleukin-1, and tumor necrosis factor-α, which in turn enhances vulnerability to tissue destruction (22,24).

In the present study, several indicators of periodontal disease (percentage of sites with plaque, percentage of sites with bleeding on probing, and percentage of sites with gingival recession) were associated with the prevalence of having a functional dentition. This is consistent with previous findings of periodontal conditions and tooth loss (20), periodontal conditions with multiple missing teeth (25), and periodontal parameters and having a functional dentition (26).

Tooth loss is commonly associated with aesthetic, functional, psychological, and social impacts on the lives of the people who suffer it. Both visible and non-apparent disfigurements are recognized as having profound effects on individuals. Retaining teeth is also important because tooth loss compromises nutrition and quality of life and may have a negative effect on body systems. For example, tooth loss has been associated with poor renal function, angina pectoris, atherosclerosis, increased blood pressure, metabolic syndrome, diabetes, cognitive function, and hospitalizations related to chronic obstructive pulmonary disease exacerbations, as well as with various causes of death (27–29).

This study has some limitations that ought to be considered when interpreting the results. The cross-sectional design is limited by the fact that cause and effect are measured at the same time; it is not possible to establish causal relationships but only statistical associations. Direct comparison across studies is difficult due to different diagnostic threshold criteria for determining the presence of a functional dentition. Our study group was highly homogeneous but was not representative of any larger population beyond that 1 set of characteristics. The sampling approach aimed to ensure similar income, access to clinical care, and socio-demographic and socioeconomic features; results cannot be generalized to any other population in Mexico, except those with similar features.

Conclusions

Based on the results from a community sample of adult Mexican males, we conclude that this homogeneous population group had a high proportion of subjects endowed with a functional dentition. Age, the presence of diabetes, and some key indicators of poor periodontal conditions were associated with a decreased likelihood of having a functional dentition.

Resumen

Objetivo: Determinar la prevalencia de dentición funcional así como las variables asociadas en una muestra de adultos. Material y Métodos: Se realizó un estudio transversal en 161 policías de Campeche, México. Se realizaron exámenes clínicos para recoger variables periodontales: placa dentobacteriana, bolsas periodontales, retracción gingival, supuración y sangrado. Se examinaron seis sitios periodontales en cada diente, con un máximo de 168 sitios (excluyendo terceros molares). Además se aplicaron cuestionarios para determinar las variables sociodemográficas, socioeconómicas y conductuales. La dentición funcional fue definida como la presencia de 21 dientes naturales o más. Los análisis se realizaron en el paquete estadístico STATA 9.0 donde se calcularon razones de probabilidad. Resultados: La media de edad fue de 38.3±10.9. La prevalencia de dentición funcional fue 83.8%. Conforme aumentaba la edad (RM=0.93) y en quienes presentaban diabetes (RM=0.27) se observó que disminuían los momios de tener dentición funcional. Igualmente, en las personas con mayor porcentaje de sitios con placa dentobacteriana (RM=0.77), sitios con sangrado (RM=0.97), y sitios con recesión gingival (RM=0.82), los momios de tener dentición funcional fueron menores. Conclusión: Se observó un porcentaje alto de sujetos con dentición funcional. Con el aumento de la edad, la presencia de diabetes y algunas variables periodontales negativas, disminuyó la probabilidad de tener dentición funcional en esta muestra comunitaria de adultos mexicanos.

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