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Prevalence and Associated Risk Factors of Periodontal Disease among Adults Attending Dental Department in Rwanda Military Hospital (Rwanda): A Cross Sectional Study

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ABSTRACT

Background: Periodontal disease is one of the most widespread bacterial diseases of mankind and is estimated to affect 10-15% of the population. Data indicate that the prevalence of periodontal disease is very high particularly in several African countries affecting all age groups. The purpose of the present investigation was to study the prevalence of periodontal disease among 1282(15-65 years) old individuals attending the Department of Dentistry of the Rwanda Military Hospital (RMH) from July to December 2013. In addition, an attempt is made to identify possible risk factors of periodontal disease in this population.

Methods: The study included all patients aged 15-65 years old. This was a retrospective cross-sectional study where by we abstracted data from medical files of the patients and then completed a questionnaire designed for each patient. Periodontal status was assessed using the epidemiological part of the Community Periodontal Index of Treatment Needs (CPITN), the Community Periodontal Index (CPI) with 10 index teeth (17, 16, 11, 26, 27, 47, 46, 31, 36, 37) and 6 sextants (17-14, 13-23, 24-27, 38-34, 33-43, 44-47) per individual, four indicators of periodontal status were applied. All statistical analyses were performed using SPSS version 20.

Results: Of the 1282 patients enrolled in the study, 49.5% were detected with calculus. Shallow pockets (4-5 mm) were present in 26.1%, and 13.6% had deep pockets (>5 mm), 9.3% had bleeding, and only 1.5% were healthy. After multiple regression analysis and adjustment for potential confounders, our findings indicated that the age, a low level of education, frequency of tooth brushing, attending dental clinic only in an emergency, diabetes mellitus, HIV/AIDS, and smoking (*p*<0.01) were all statistically associated with the dependent variable "*periodontal disease*".

Conclusion: The results demonstrate that the vast majority of patients attending the Department of Dentistry at RMH in Rwanda had different degrees of periodontal infection and demonstrates for the first time high prevalence of periodontal status and associated risk factors in an adult cohort. Our findings are of major public health significance and needs urgent attention and also calls for further population-based research studies.

KEYWORDS: Prevalence; Periodontal diseases; Risk factors; Adults; Rwanda.

ABBREVIATIONS: ANUG: Acute Necrotizing Ulcerative Gingivitis; AOR: Adjusted Odd Ratio; CAL: Clinical Attachment Level; CDC: Centers for Disease Control and Prevention; CI: Confidence Interval; CPI: Community Periodontal Index; CPITN: Community Periodontal In-

dex of Treatment Needs; DHS: Demographic and Health Survey; NHANES III: National Health and Nutrition Examination Survey III; OR: Odd Ratio; RMH: Rwanda Military Hospital; SES: Socioeconomic status; WHO: World Health Organization; USA: United States of America; UR/CMHS/SPH: University of Rwanda, College of Medicine and Health Sciences, School of Public Health.

BACKGROUND

Periodontal disease is an inflammatory disease that affects the soft and hard structures that support the teeth and is a leading cause of connective tissue attachment and tooth loss in older adults.[1] They are the most common chronic diseases affecting people of all ages worldwide. However, the severe forms of the disease are more pronounced in older individuals primarily due to prolonged exposure to risk factors.[2] Several methods have been developed to study the distribution of periodontal diseases in a population. From the epidemiological and clinical data, it is clear that the severity of periodontal disease can be categorized as mild, moderate, or severe on the basis of multiple measurements of periodontal pocket depth, attachment loss, and gingival inflammation around teeth.[3] Additionally, data from large epidemiological studies indicate in some populations periodontal disease is more prevalent in males than in females and it worsens with increasing age.[4,5] One of the major risk factors of periodontal diseases is considered to be poor oral hygiene.[5] The most widely accepted methods for controlling periodontal diseases and the associated conditions are personally and professionally applied mechanical oral hygiene measures.[6,7]

Severe periodontal disease can be associated with other systemic diseases, for example, diabetes mellitus, HIV infection, adverse pregnancy outcomes, cardiovascular diseases, certain types of leukemia, neutropenias and genetic disorders. Furthermore, some systemic diseases have oral manifestations which increase the risk of oral disease, which in turn is a risk factor for a number of general health conditions.[5,8] With such a relationship between oral health and general health, there is a strong reason to prevent and control periodontal diseases, to do otherwise would be irresponsible and unethical.

To date, there is no information on the prevalence and risk factors of periodontal diseases in Rwanda. Such data are important to identify people at high risk for periodontal disease and undertake strategic planning for preventive and therapeutic programs. Against this background, the present study has been designed to study the prevalence of periodontal diseases and associated risk factors including the age, gender, frequency of tooth brushing, and smoking in an adult population seeking dental services in Rwanda Military Hospital, Kigali City, Rwanda.

METHODS

This retrospective, cross-sectional, descriptive study was undertaken to evaluate the periodontal status and their risk factors in 15-65 year old individuals attending the Department of Dentistry of the Rwanda Military Hospital (RMH) at Kicukiro District, Rwanda. A total of 1282 adults aged of 15-65 who attended the Hospital for dental services from July to December 2013 were included in the study.[9-11]

DATA COLLECTION

The required information for each patient was abstracted from their medical files and then completed using a questionnaire designed for each patient. The questionnaire was composed of 4 parts: demographic characteristics (sex, date of birth, educational level and occupation); oral health behaviours (oral hygiene aids used, use of toothpaste, frequency of tooth brushing and flossing, current smoker, frequency of smoking, preventive dental visits and other aspects of care that might influence the participant's oral health); systemic diseases and other conditions related to periodontal diseases and finally, periodontal condition. Community periodontal index (CPI) of community periodontal index of treatment need (CPITN) was used to record the periodontal status. Periodontal status was assessed using the epidemiological part of the CPITN, the CPI[12,13] with 10 index teeth (17, 16, 11, 26, 27, 47, 46, 31, 36, 37) and 6 sextants (17-14,13-23, 24-27, 38-34, 33-43, 44-47) per individual, four indicators of periodontal status were recorded.

When two indexed teeth were considered in a sextant, the tooth with the highest score was recorded. Each indexed tooth was scored on 2 sites (buccal and lingual) and each sextant was scored according to its highest CPI score. If no indexed tooth was present in a sextant, all the remaining teeth in that sextant were examined and the highest score was recorded as the score for that sextant. The overall CPI score of the participant represented the value of the highest recorded code for that individual. A patient was considered as having periodontitis when he/she was classified as having CPI ≤ to 3.
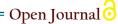
STATISTICAL METHODS

Statistical analysis was performed using statistical package for social sciences (SPSS version 20). Cross tabulation, chi square statistics, logistic regression analyses was used for statistical analysis at 5% level of significance. The variables were age, gender, education level, occupation, use of toothpaste, frequency of tooth brushing, frequency of tooth-flossing, dental office attendance, variables related to conditions known to be linked to periodontal diseases and variables related to smoking status of the patient. These variables were compared with the CPI codes.

ETHICAL CONSIDERATIONS

Permission and ethical clearance was sought from the Institutional Review Board of the University of Rwanda, College

of Medicine and Health Sciences, School of Public Health (UR/CMHS/SPH). Approval reference number was 017/UR/CMHS/SPH/2014. The UR/CMHS/SPH Institutional Review Board is operating under the Rwanda National Ethics Committee (FWA Assurance No: 00001973; IRB 00001497 of IORG 0001100). This study was based on hospital records.

RESULTS

Of the 1282 adults who participated in this study, 588(45.9%) were females and 694(54.1%) were males. 773(60.3%) were in the age group of 15-34 years and 509(39.7%) 35-65 years. 173(13.5%) were illiterate or had primary school level of education while 1109(86.5%) had secondary or university level of education; 511(39.9%) were unemployed and 771(60.1%) were employed (Table 1). All patients enrolled in the study were documented as using a toothbrush. In terms of frequency of tooth-brushing, more than half of the patients enrolled in the study (69.7%) were reported as, brushing once per day, 349(27.2%) were reported as brushing twice or more a day and 39(3%) were brushing their teeth irregularly. The vast majority of the patients numbering at 1280(99.8%) were documented using dome form odd toothpaste. Of 1256 patients 98 percent never used dental floss.

Variables	Number	%
Age		
15-34 years old	773	60.3
35-65 years old	509	39.7
Gender		
Female	588	45.9
Male	694	54.1
Education level		
Illiterate or primary school	173	13.5
Secondary school/University	1109	86.5
Occupation		
Unemployed	511	39.9
Employed	771	60.1

Table 1: Socio-demographic characteristics of the study population (N=1282).

Only 22(1.7%) reported were irregular users of dental floss, 3(0.2%) were using dental floss once per day. A single individual (0.1%) was using dental floss twice or more a day. As per dental office attendance, 1217 patients (94.9%) reported attending when there is an emergency dental situation while 65(5.1%) were attending the dental department for preventive purposes (Table 2). The prevalance of conditions that impact on the pathogenesis is of periodontal diseases are shown in Table 3. Accordingly, a small proportion of patients, 107(8.3%) were pregnant, 107(8.3%) were documented as diabetic patients, 104(8.1%) were living with HIV/AIDS and 23(1.8%) suffered from different forms of cancer. As for the smoking status of the participants,

those who never smoked comprised 108(9.5%) of the study population. The vast majority 1257(98%) were documented as not undergoing orthodontic treatment. Of the 1282 adults enrolled in the study, the majority, 49.5% were detected with calculus followed by shallow pockets (4-5 mm) 26.1%; 13.6% had deep pockets, 9.3% had bleeding, and only 1.5% were healthy as it is demonstrated in Table 4.

Variables	Number	%
Tooth-brushing		
Irregular	39	3.0
Once per day	894	69.7
Twice or more a day	349	27.2
Use of toothpaste		
Yes	1280	99.8
No	2	0.2
Tooth-flossing		
Never	1256	98.0
Irregular	22	1.7
Once per day	3	0.2
Twice or more a day	1	0.1
Dental Office Attendance		
Emergency only	1217	94.9
Preventive	65	5.1

Table 2: Oral health behaviour (N=1282).

Variables	Number	%
Orthodontic treatment		
Yes	25	2
No	1257	98
Pregnancy		
Yes	107	8.3
No	1175	91.7
Diabetes		
Yes	107	8.3
No	1175	91.7
HIV/AIDS		
Yes	104	8.1
No	1178	91.9
Cancer		
Yes	23	1.8
No	1259	98.2
Smoking Status		
Ever smoked	108	9.5
Never smoked	1174	91.5

Table 3: Distribution of clinical conditions known to be related to Periodontal Diseases (N=1282).

CPI	Variables	Number	%
0	Healthy gingival	19	1.5
1	Bleeding on gentle probing	120	9.3
2	Calculus at any supra or sub gingival site	635	49.5
3	Shallow pocket (4-5 mm)	334	26.1
4	Deep pocket (6 mm or more)	174	13.6

Table 4: Distribution of Periodontal Condition (N=1282).

In the logistic regression (full and reduced model) shown in Table 5, patient between 35-65 years old were 11.421 times more likely to develop periodontal diseases. On the other hand low level of education, irregular tooth brushing, attending dental clinic only in an emergency situation, diabetes mellitus, HIV/AIDS and smoking were also associated with periodontal diseases.

DISCUSSION

The purpose of this study was to determine the prevalence of periodontal disease among individuals aged between 15-65 years old who attend dental clinic in Rwanda Military Hospital. In our study, one of the most frequently observed condition was calculus at any supra or sub gingival site (49.5%) followed by shallow pockets of 4-5 mm (26.1%). Deep pockets

Factors	Full model Prevalence	OR	95% C.I.	P value	Reduced model AOR	95% C.I.	p value
1. Socio-demographic characteristics							
Age							
15-34 years old	15.9%	1			1		
35-65 years old	75.6%	11.440	(8.032-16.294)	**0.000****	11.421	(8.029-16.247)	**0.000****
Education level							
Illiterate or primary school	69.9%	1			1		
Secondary school and beyond	34.9%	0.360	(0.221-0.586)	**0.000****	0.358	(0.220-0.583)	**0.000****
Occupation							
Unemployed	24.7%	1			1		
Employed	49.5%	2.017	(1.374-2.962)	**0.000****	2.042	(1.392-2.997)	**0.000****
Oral health behaviour characteristics							
Toothbrushing							
Irregular user	92.3%	1			1		
Regular user	38%	0.100	(0.023-0.428)	**0.002****	0.105	(0.025-0.446)	**0.002****
Dental Office Attendance							
Emergency	40.4%	1			1		
Preventive	24.6%	0.244	(0.119-0.501)	**0.000****	0.243	(0.119-0.498)	**0.000****
2. Clinical conditions known to be related to Periodontal Diseases							
Pregnancy							
Yes	22.4%	1					
No	41.2%	1.369	(0.770-2.432)	0.285	-	-	-
Diabetes							
Yes	90.7%	1			1		
No	35%	0.327	(0.159-0.673)	**0.002****	0.317	(0.154-0.651)	**0.002****
HIV/AIDS							
Yes	93.3%	1			1		
No	34.9%	0.027	(0.011-0.064)	**0.000****	0.146	(0.011-0.063)	**0.000****
3. Smoking status							
Smoking status							
Patients with smoking history	90.7%	1			1		
Patients without smoking history	34.9%	0.150	(0.071-0.319)	**0.000****	0.146	(0.069-0.310)	**0.000****

Table 5: Predictors of periodontal diseases.

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of more than 6 mm were found in 13.6% of the subjects. Bleeding on gentle probing was found in only 9.4% of the population surveyed. Only 1.5% had healthy periodontium (Table 4). These findings are not surprising as most of the cohort were nit attending to regular oral hygiene measures.

The high prevalence of gingivitis (58.9%) and periodontitis (39.6%) found in this study is similar to that of gingivitis (98.7%) reported in a similar study done in Morocco and in West Africa (84.2%) respectively.[14-17] The latter studies of Harley and Floyd,[14] Adegbembo and El-Nadeef,[15] Kubota, et al.,[16] indicate that the major problem in this geographic region as in many other jurisdictions of the developing world is gingivitis and to a lesser extent periodontal disease. Other studies, for instance in Gambia, have also shown a much higher proportion (80%) of participants in need of complex periodontal treatment.[17] Interestingly in Uganda, 41% of the subjects in the age group below 25 years, one of the major problems reported were Acute Necrotizing Gingivitis[18] and early onset periodontitis (28.8%).

Further in Kenya, where both the child and adult populations have been studied adults studied, aged 15-65 years, only 20% of the surfaces had loss of attachment ≥4 mm.[19] In Tanzania, in 1967, it had been reported from the Usambara Mountains, particularly from Bumbuli and Mayo villages that more than 75% of the people over 20 years had different degrees of periodontal infection.[20]

The risk factors for periodontal disease in our study population were older age, low level of education, poor oral hygiene, the behaviour of attending dental clinic only when the patient is sick, diabetes, HIV/AIDS and smoking.[21-24] Therefore, some of these modifiable risk factors should be considered to improve the oral health of these populations.

The surface of calculus is always covered by a viable microbial plaque with periodontal pathogens, and therefore it is considered to be a secondary etiological factor for periodontal disease.[25] The proportion of study participants that exhibited these risk factors was 58.9% and therefore population-based preventive measures should be done as a priority.

Our findings showed a high prevalence of periodontal disease in diabetics compared with their peers without diabetes (90.7% *versus* 35%) and this difference was statistically significant ($p<0.01$). It is now known that periodontal disease is often a complication of diabetes. Indeed, a recent meta-analysis of 23 studies the authors concluded that the prevalence and severity of periodontal disease is greater in diabetics than non-diabetics. On the other hand, periodontitis contributes to poor metabolic control in people with diabetes[26-35] which can in turn place them at risk for diabetic complications. More studies are needed to explore fully the effects of periodontal diseases and their progress in diabetes patients.

CONCLUSION

This study shows that the oral hygiene status among the study population was very poor, and did not match the self-reported tooth brushing practices. The majority had plaque, calculus, gingival bleeding and a moderate periodontal probing pocket depth of 4-5 mm. In view of the potential association of periodontal disease with systemic diseases (atherosclerosis, diabetes, HIV/AIDS, Leukemia, myocardial infarction, stroke and pregnancy) as documented in different studies, this current health situation is of major public health significance and needs urgent attention. To conclude, our study for the first time has provided an insight into the periodontal status and risk factors for periodontal disease among adults aged between 15-65 years old in Rwanda. As such it provides valuable information to help plan a full national study.

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHOR'S CONTRIBUTIONS

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CONSENT

In this retrospective study, the written informed consent was waived as the required information for each patient enrolled in the study was abstracted from their medical files.

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