

## Association between periodontal diseases and cardiovascular diseases in Cameroon

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reciprocally and this can be highlighted through the interrelationship between some systemic diseases such as cardiovascular diseases (CVD) and some oral diseases especially periodontal diseases (PD).<sup>1-4</sup>

CVD are the leading cause of death worldwide, with ischemic heart diseases responsible of 7.4 million deaths worldwide in 2012 as leader; followed by stroke, responsible of 6.7 million deaths; While hypertensive diseases responsible of 1.1 million deaths, were the tenth cause of global mortality in 2012.<sup>5</sup> PD are bacterial chronic inflammatory diseases that affect supporting tissues of the teeth which can lead to destruction of these tissues and premature loss (spontaneous fall) of teeth. There are two major groups of PD, gingivitis and periodontitis. They are among the most common oral diseases. Gingivitis affects 90% of the world population and periodontitis affects 20% to 50% persons in the world.<sup>6,7</sup> CVD and PD are progressive, chronic multifactorial diseases that share some risk factors such as smoking, age, obesity, diabetes and heredity among others.<sup>1,8</sup> In addition to these common risk factors, the relationship between CVD and PD may be explained through some pathophysiological mechanisms.<sup>1,4,8-10</sup> Indeed, during the inflammatory process induced by PD, some markers of inflammation such as C-reactive protein (CRP), interleukins (IL-1, IL-6, IL-8) and tumor necrosis factor  $\alpha$  (TNF- $\alpha$ ) have been shown to be associated with atherogenesis in patients with periodontitis.<sup>1,8,10</sup> More directly, the bacteria of the oral cavity access the bloodstream through the gingival sulcus. Thus, bacteria involved in PD such as *Streptococcus sanguis* (*S. sanguis*), *Aggregatibacter actinomycetemcomitans* (*Aa*) and *Porphyromonas gingivalis* (*Pg*), invade the blood vessels, adhere to their walls; And their presence has been highlighted in atheromatous plaques.<sup>1,8,10</sup> From the epidemiological point of view, many studies suggest that the risk of developing CVD is almost doubled in patients with PD.<sup>3,11</sup> And in addition, some authors demonstrate a beneficial effect of periodontal therapy on endothelial function.<sup>12</sup> Public health actions aiming to improve oral health of patients with CVD could greatly contribute to improve their quality of life and reduce mortality and morbidity attributable to CVD. The implementation of such actions requires existence of local epidemiological data on the link between CVD and PD as a prerequisite but these are still rare in Africa and Cameroon in particular. In order to help to overcome this deficiency, this study aimed to evaluate the link between PD and CVD in patients requiring dental consultation in Cameroon.

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### Abstract

To assess the association between periodontal diseases and cardiovascular diseases in dental patients in Cameroon, a prospective observational study was carried out in 3 hospitals in Cameroon from January 2013 to December 2015. Data on general condition, age, gender and lifestyle were collected during medical history taking. The Dutch Periodontal Screening Index assessed periodontal health during oral examination. The Wilcoxon test, the Fisher test and logistic regression analysis were performed. 558 patients (53.9% women) were included in the study. The mean age was 44±13 years (30 to 85). In terms of overall health, 161 (28.9%) had cardiovascular diseases (CVD) and 73 (13.1%) had diabetes. Hypertension accounted for 87.6% of CVD. In terms of periodontal diseases (PD), 431 (77.2%) patients had PD, the break-down by PD was 347 (62.2%) gingivitis and 84 (15%) periodontitis. Statistical associations were found between CVD and gingivitis [OR=4.30 (1.85-10.00), P=0.001], and CVD and periodontitis [OR=2.87 (1.04-7.93); P=0.04].

### Introduction

Oral health affects general health and

### Materials and Methods

#### Participants

Participants were recruited from patients visiting dental services of three Cameroonian hospitals over a period of 3 years (from January 1, 2013 to December 31, 2015); The General Hospital of Douala, the Military Hospital of Region N°2 in Douala, and the Military Medical Center of Sector N° 5 in Ngaoundéré.

To be included patient must be at least 30 years, with at least 50% of teeth in the mouth and should had not received any periodontal therapy in the previous 6 months.

#### Medical history and oral examination

Information on the medical history of patient was taken through a questionnaire. Selected data for our study was gender, age, lifestyle habits related to alcohol and tobacco, the presence or absence of any CVD, the name of the CVD, the presence or absence of type 2 diabetes.

Periodontal condition was assessed using Dutch Periodontal Screening Index (DPSI), The DPSI is a validated index based on bleeding on probing, pocket probing depth, and clinical attachment loss.<sup>13</sup> Full-mouth measurements was made using

a probe and the highest DPSI score was retained as patient's DPSI score. PD was determined on the basis of the DPSI score, patients with DPSI scores of 1 and 2 were considered to have gingivitis, and those with DPSI scores of 3, 4, and 5 were considered to have periodontitis.

### Statistical analysis

Statistical analysis was performed using the Epi info7 software. Quantitative variables were described by means with standard deviations, and medians with interquartile differences. Qualitative variables were described by frequencies.

The Wilcoxon test was used to compare the quantitative variables. The chi-square test was used to compare the qualitative variables. Multivariate logistic regression analysis was performed to evaluate and quantify the association between CVD and different variables. The significance threshold was set at  $P < 0.05$ .

### Ethical consideration

The study was explained to patients prior to their inclusion and participation was self-willed. This study was carried out in accordance with the revised Helsinki Declaration of 1989. The study was also authorized by the hospital management of the three health units.

## Results

### General characteristics of the sample

The sample comprised a total of 558 subjects including 301 (53.9%) women. The mean age was  $44 \pm 13$  years [30 to 85 years]. 161 (28.9%) patients had CVD and 73 (13.1%) had diabetes. In terms of PD, 431 (77.2%) patients suffered from PD, the break-down by PD was 347 (62.2%) gingivitis and 84 (15%) periodontitis (Table 1). Hypertension accounted for 87.6% of CVD,

it was concerning 141 (25.3%) patients in the sample, while heart failure affected 18 (3.2%) patients and cerebrovascular disease 8 (1.4%) patients (Figure 1).

### Factors associated with CVD

Logistic regression analysis (Table 2) revealed a significant association between gingivitis and CVD (OR = 4.30 [1.85-10.00],  $P = 0.001$ ), and between periodontitis and CVD OR = 2.87 [1.04-7.93],  $P = 0.04$ ; and between diabetes and CVD (OR = 1.99 [1.01-3.82],  $P = 0.04$ ).

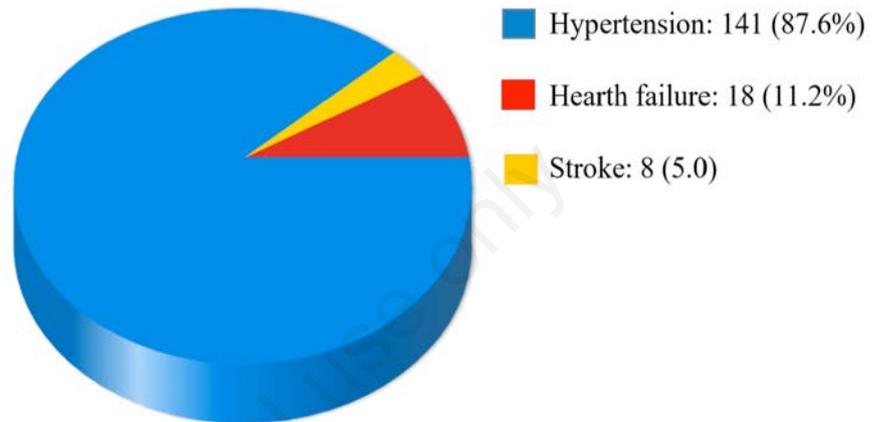


Figure 1. Distribution of cardiovascular diseases in the sample.

Table 1. General characteristics of the sample.

Characteristics	Total n=558	CVD		P
		Yes n=161 (28.9%)	No n=397 (71.1%)	
Gender frequency (%)				0.05
Women	301 (53.9)	97 (60.2)	204 (51.4)	
Men	257 (46.1)	64 (39.8)	193 (48.6)	
Age (years) median [IQR]	39 [34-53]	57 [49-65]	36 [33-42]	0.000
Smoking frequency (%)	55 (9.9)	35 (21.7)	20 (5.0)	0.000
Alcohol frequency (%)	186 (33.3)	75 (46.9)	111 (28.0)	0.0000
Diabetes frequency (%)	73 (13.1)	44 (27.3)	29 (7.3)	0.0000
Periodontal status frequency (%)				0.0000
Healthy periodontium	127 (22.8)	10 (6.1)	117 (29.5)	
Gingivitis	347 (62.2)	123 (76.4)	224 (56.4)	
Periodontitis	84 (15.0)	28 (17.4)	56 (14.1)	
DPSI median [IQR]	2 [1-2]	2 [2-2]	2 [0-2]	0.0000

CVD: Cardiovascular disease; DPSI: Dutch Periodontal Screening Index; IQR: interquartile range.

Table 2. Risk factors of cardiovascular disease in the sample.

Variables	Univariate analysis			Multivariate analysis		
	OR	95%CI	P	OR	95%CI	P
Gender (W/M)	1.43	0.99-2.08	0.05*	2.52	1.45-4.38	0.001*
Age	1.15	1.13-1.18	0.0000*	1.13	1.11-1.16	0.000*
Smoking	5.24	2.92-9.4	0.0000*	2.86	1.27-6.47	0.01*
Alcohol	2.25	1.54-3.28	0.0000*	1.60	0.93-2.77	0.09
Diabetes	4.77	2.86-7.97	0.000*	1.99	1.01-3.82	0.04*
Gingivitis	6.45	3.26-12.77	0.000*	4.30	1.85-10.00	0.001*
Periodontitis	5.85	2.66-12.88	0.000*	2.87	1.04-7.93	0.04*

OR: Odd Ratio; 95%CI: 95% confidence Interval; W: women; M: men.

**Table 3. Periodontal treatment needs of the sample.**

Categories	Total Periodontal treatment needs n (%)	n=558	CVD	
			Yes (n=161)	No (n=397)
A (DPSI=0, 1, 2)	OHI, scaling, removal of plaque retaining factors	431 (77.2)	151 (93.8)	280 (70.5)
B (DPSI= 3)	OHI + scaling and root planing	347 (62.2)	123 (76.4)	224 (56.4)
C (DPSI=4, 5)	OHI + scaling and root planing + surgical periodontal procedures	57 (10.2)	15 (9.3)	42 (10.6)
		27 (4.8)	13 (8.1)	14 (3.5)

CVD: cardiovascular disease; OHI: oral hygiene instructions.

### Periodontal treatment needs

431 (77.2%) patients of the sample needed a periodontal treatment. For those with CDV, 151 (93.8%) of them had periodontal health needs; 123 (76.4%) of these patients needed scaling, while periodontal surgery was required for 13 (8.1%) patients (Table 3).

### Discussion

This study is the first to assess the link between PD and CVD in Cameroonian subjects, and it reveals that the two main PD, gingivitis and periodontitis, are linked to CVD in the Cameroonian population.

In addition to this finding, this study provides additional information on the distribution of CVD in Cameroon, especially hypertension that was the most common CVD in our sample. In our study, the prevalence of hypertension was 25.3%, slightly lower than the prevalence of 29.7% found by Kingue *et al.* in a national study carried out in the urban areas of Cameroon during the same period as our study.<sup>14</sup> The difference between our results could be explained by the fact that in Kingue's study, the blood pressure of participant was measured while in our hypertension was self-reported by the patient whereas in Cameroon, only 14% of persons are aware of being hypertensive patients.<sup>14</sup> Nevertheless, the frequency of hypertension in our sample remains in line with the literature that highlights a constant increase of this pandemic in the developing countries.<sup>14,15</sup>

Regarding CVD risk factors, our results reveal an association between CVD and conventional risk factors such as age, gender, diabetes and smoking. Our study does not demonstrate a relationship between CVD and alcohol, which is a classic risk factor for CVD. This could be explained by the fact that a part of the study was carried out in the city of Ngaoundéré where the population is predominantly Muslim.

Our work also provides additional information on the distribution of PD in

Cameroon because studies that are devoted to the evaluation of the periodontal health of Cameroonians are rather rare. In this study, the break-down of PD was 62.2% for gingivitis and 15% for periodontitis. These frequencies are different from the frequencies found in one of our previous study in 2013 (87.8% for gingivitis and 12.2% for periodontitis).<sup>16</sup> This difference could be explained by the fact that the 2013's concerned only a very small sample of 41 diabetics.

The major result of this study is the association found between PD and CVD in the Cameroonian population. This result is in agreement with recent studies in sub-Saharan populations, in Nigeria and Senegal in particular.<sup>17-19</sup> Indeed, a Senegalese case-control study comparing the periodontal health of stroke patients with controls showed an association between periodontitis and stroke (OR = 1.58 [1.1-3.022]).<sup>17</sup> Another Senegalese study comparing the periodontal status of hypertensive with that of controls also revealed an association between periodontitis and hypertension (OR = 2.045 [1.188-2.128]).<sup>18</sup> The Nigerian study, which also compared the periodontal health of hypertensive patients with that of subjects free from hypertension, also concluded that periodontitis was significantly related to hypertension.<sup>19</sup> Our results suggest that prevention and control of oral diseases can be integrated into the global approach to reducing the risk factors of chronic non-communicable diseases (NCD) in Cameroon as increasingly advocated in the literature.<sup>20-22</sup>

The evaluation of periodontal treatment needs is also an interesting result of our study. Although the difference was not significant, in terms of proportions, patients with CVD had more need of periodontal treatment than the general population (93.8% versus 70.5%). These frequencies are high and demonstrate the need to strengthen actions to improve periodontal health in Cameroon; It is moreover, to the same conclusion that we succeeded in our previous work.<sup>16</sup> Especially since the major part of those patients needed at least scaling and the presence of calculus had been asso-

ciated with the risk of death from myocardial infarction.<sup>23</sup>

One limit of this study is its cross-sectional nature. Indeed, it allows us to establish that there is an association between PD and CVD, without the possibility of establishing a causal link. Moreover, given that the study was carried out in dental services where the first reason for consultation is pain, it was not relevant to lengthen the dental consultation by heavies and long measurements that was not pertinent for the patient's immediate benefit. Thus, some factors such as obesity were not included in our study. Similarly, some biological measurements (blood glucose, blood pressure, markers of inflammation) which would certainly have made it possible to gain more precision on the nature of the association between PD and CVD had not been realized in this study. However, this study was carried out in hospitals with skilled professionals in the realization of this type of study. To minimize investigator bias, training was organized at the beginning of the study. Therefore, in spite of the limitations mentioned above, this first work demonstrates an association between the CVD and the PD, the orientation of this association has to be clarified through future works.

### Conclusions

This study highlights a link between periodontal diseases and cardiovascular diseases. Thus, improving oral health could be integrated into cardiovascular diseases control programs and more generally, chronic non-communicable diseases, which are the leading cause of global mortality.

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