

## Relationship between Periodontal Diseases and Hypertension in Tunisia

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### Abstract

High blood pressure is the most common cardiovascular disease. It affects more than one billion people, or 25 to 30% of the adult. It increases the risk of stroke coronary heart disease, heart disease, kidney disease and cognitive impairment, and was responsible for 7-8 million deaths worldwide in 2011. According to the National Institute of Health (Tunisia) in 2016, 38% of adults suffered from high blood pressure. Periodontal diseases affect 20 to 50% of the world population. Numerous epidemiological studies have shown an association between periodontitis and hypertension in different countries. Thus, the objective of this study is to investigate the relationship between periodontal status and hypertension in the Tunisian population.

**Keywords:** Periodontitis; Periodontal Health; Gingivitis; Hypertension

### Introduction

Hypertension represents a global public health problem and is a major risk factor for cardiovascular complications (stroke, myocardial infarction, renal failure, lower extremity arterial disease) in both men and women [1-4]. In 2011, hypertension was the cause of 7 to 8 million deaths worldwide [5, 6]. Overall, 28.7% of Tunisians aged 15 years and older were hypertensive.

Periodontal disease is an infectious disease resulting from the disruption of the homeostasis that exists between the bacteria of the dental biofilm and the immuno-inflammatory response induced by these micro-organisms. Inflammation is a natural phenomenon of defense against lesions or infections caused by the bacteria [7]. In periodontal disease, the response is inadequate and leads to a tissue loss that can go as far as the loss of teeth [8]. The prevalence of periodontal disease is constantly increasing affecting almost 50% of the world's population [9]. Many studies have shown a close relationship between periodontitis and hypertension [10, 11].

### Methods

This case-control study was conducted in the Meftah Saadallah military oral health center in Bardo, Tunis, between March and August 2021. Control cases were normotensive subjects with blood pressure between 120 and 139 mmHg systolic (SBP) and between 80 and 89 mmHg diastolic (DBP). Hypertensive subjects had a systolic (SAP) exceeding 140 mmHg and a diastolic (DBP) exceeding 90 mmHg [12]. The assessment of the level of oral hygiene and the level of gingival inflammation were based on the O'Leary index [13] and the Papilla Bleeding Index [14], respectively. The final diagnosis was based on the assessment of attachment loss, pocket depth, bleeding on probing and radiological alveolysis (Table 1). The diagnosis of periodontitis was only made when there was detectable clinical loss of attachment on at least 2 non-adjacent teeth.

Results were examined with IBM SPSS Statistics 25.0 for Mac using Student's t test to compare means. The difference was considered significant for a value of  $p < 0.05$  for a 95% degree of confidence.

### Results

100 subjects were included, 42 cases and 58 controls, aged between 25 and 65 years. Hypertension was more common in younger subjects with 31.2% between 25 and 34 years of age (Table 2). Periodontitis

affected more hypertensive than normotensive subjects; OR=1.22 (95% CI: 0.45-3.30).

The mean number of sites with a loss of attachment of 1 to 2 mm and 3 to 4 mm was higher in hypertensive than in normotensives:  $12.5 \pm 15.3$  and  $2.02 \pm 3.9$  versus  $5.9 \pm 9.9$  and  $0.9 \pm 3.2$  with a value of  $p < 0.05$ . The same is true for the mean value of periodontal pocket depth:  $2.47 \pm 0.63$  for hypertensive versus  $2.04 \pm 0.4$  for normotensives with a value of  $p < 0.01$ . La valeur moyenne de l'indice d'O'Leary des hypertendus est supérieure à celle des normotendus:  $83, 26 \pm 16,08$  versus  $69, 87 \pm 15, 25$  ( $p < 0, 05$ ). There was no significant relationship between mean attachment loss, bleeding on probing, mean number of sites with attachment loss  $> 4$  mm, and hypertension (Table 3).

### Discussion

In the present study, the hypertensive subjects were more affected by periodontal disease than the control cases. Thus, a linear association is established between these two diseases. Indeed, periodontitis is an inflammatory disease of bacterial origin. Periodontopathogenic bacteria by bacteremia and the release of pro-inflammatory mediators could influence the elevation of blood pressure by inducing a systemic vascular inflammation leading to endothelial dysfunction at the origin of cardiovascular pathology, in particular the elevation of blood pressure [11].

The microbiological study conducted by Desvarieux in 2010 shows a positive association between the growth of periodontopathogenic bacteria (*Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*) and the prevalence of hypertension [12]. *Aggregatibacter actinomycetemcomitans* is known to play a role in the pathogenesis of atherosclerosis, including endothelial permeability, serum lipoprotein concentration and lipoprotein binding in the arterial intima [15].

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**Table 1:** Differential diagnosis between periodontal health and gingivitis in the new classification of periodontal and peri-implant diseases and conditions.

	No history of periodontitis				With treated periodontitis	
	Intact periodontium		Reduced periodontium		Reduced periodontium	
	Periodontal health	Gingivitis	Periodontal health	Gingivitis	Periodontal health	Gingivitis
Attachment loss	No	No	Yes	Yes	Yes	Yes
Pocket depth	≤ 3mm	≤ 3mm	≤ 3mm	≤ 3mm	≤ 4mm	≤ 4mm
Bleeding on probing	< 10%	>10%	< 10%	>10%	< 10%	>10%
Radiological alveolysis	No	No	Possible	Possible	Yes	Yes

**Table 2:** Distribution of subjects according to periodontal disease and blood pressure status.

Periodontal condition	Blood pressure status		Total
	Normotensive	Hypertensive	
Periodontal health on intact periodontium	2 (3,5 %)	0	2 (2%)
Periodontal health on reduced periodontium without history of periodontitis	0	0	0
Periodontal health on reduced periodontium with a history of periodontitis	0	0	0
Gingivitis	18 (31 %)	12 (28,6 %)	30 (30 %)
Gingival inflammation on reduced periodontium	0	0	0
Periodontitis	38 (65.5 %)	30 (71,4 %)	68 (68 %)
<b>Total</b>	<b>58</b>	<b>42</b>	<b>100</b>

**Table 3:** Average values of different periodontal parameters according to blood pressure status.

Periodontal condition	Blood pressure status	
	Normotensive	Hypertensives
O'Leary Index	69,87 ± 15,25	83, 26 ± 16,08*
Bleeding on probing index	1.1 ± 0,93	1,3 ± 0.99
Attachment loss	4,96 ± 1,69	5,3 ± 1.8
Pocket depth	2,04 ± 0,4	2,47 ± 0,63**
Number of sites with 1 to 2 mm attachment loss	5,9 ± 9,9	12,5 ± 15,3*
Number of sites with 3 to 4 mm loss of attachment	0,9 ± 2,3	2,02 ± 3,9*
<u>Of Attachment &gt; 4mm</u>		
*P ≤ 0.05. **P ≤ 0.01		

## Conclusion

The absence of regular control of periodontal health in Tunisia with the existing association between periodontal disease and hypertension could explain in part the increase in the prevalence of hypertension in Tunisian. Randomized Controlled Trials should be conducted to determine the impact of periodontal treatment on blood pressure and further investigation is needed to reveal the detailed causal relationship between specific periodontopathic bacterial infection and hypertension. To combat this heart failure pandemic, improvement in the global control of heart failure risk factors and regular control of periodontal health will be required.

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