Original articles

Periodontal risk assessment in patients with periodontal disease at medical center in Phu Vang District, Thua Thien Hue Province

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Abstract

Objective: This study aims to assess the periodontal risk profiles of patients with periodontal disease visiting the Health Center in Phu Vang District, Thua Thien Hue Province, Vietnam.

Methods: A cross-sectional descriptive study was conducted on 200 patients diagnosed with gingivitis or periodontitis from May 2023 to July 2024. Periodontal risk was evaluated using the "Periodontal Risk Assessment" (PRA) tool by Lang and Tonetti (2003). The model analyzed six functional parameters: percentage of bleeding on probing, number of sites with probing pocket depth ≥ 5 mm, number of missing teeth, bone loss/age ratio, presence of diabetes mellitus, and smoking habits.

Results: The distribution of periodontal risk levels among the participants was: low risk (37%), moderate risk (47%), and high risk (16%). Risk levels showed a significant correlation with demographic factors, including male gender, age over 40, marital status, and agricultural labor ($p < 0.05$). Furthermore, clinical parameters such as the stage and grade of periodontitis were strongly associated with risk levels, with 100% of Grade C patients being classified as high risk.

Conclusion: The study population predominantly exhibited a moderate level of periodontal risk. The PRA tool effectively identifies and analyzes risk factors, facilitating timely clinical interventions and personalized treatment planning for patients with periodontal disease.

Keywords: *Periodontal risk assessment; periodontal disease*; *Lang and Tonetti model.*

1. INTRODUCTION

Periodontal disease is an inflammatory condition that destroys the supporting tissues of the teeth, including the gingiva, cementum, alveolar bone, and periodontal ligament, which can lead to tooth loss and significantly impact overall health [1]. While bacterial plaque is the initiating factor, the host's immune response and environmental factors also play a critical role. In Vietnam, the prevalence of this disease is remarkably high, with 32.2% of the population affected by periodontitis [2].

Assessing the risk of periodontal disease helps predict its progression and facilitates the development of effective treatment plans. Regular periodontal risk assessment and adjustments to the intervals of supportive periodontal therapy are essential for maintaining long-term periodontal health [4]. Currently, several periodontal risk assessment models exist, with the two most prominent being the "Periodontal Risk Calculator" by Page et al. (2002) and the "Periodontal Risk Assessment" (PRA) model by Lang and Tonetti (2003) [4, 5].

The "Periodontal Risk Calculator" by Page et al. (2002) is based on 11 factors and categorizes a patient's risk level on a scale from 1 (lowest risk) to 5 (highest risk) [4]. On the other hand, the PRA model by Lang and Tonetti (2003) comprises six factors based on the progression of periodontitis: bleeding on probing percentage (%BOP), the number of sites with probing pocket depth (PPD), the number of missing teeth, the bone loss/age ratio, the presence of diabetes mellitus (DM), and smoking habits [5]. This model provides personalized results categorized into three levels: low, moderate, and high.

This study was conducted to evaluate the periodontal risk among patients with periodontal disease visiting the Medical Center in Phu Vang District, Thua Thien Hue Province, utilizing the Lang and Tonetti (2003) assessment tool.

2. MATERIALS AND METHODS

Study Design and Setting

A cross-sectional descriptive study was conducted on patients diagnosed with periodontal disease. The study took place at the Department of Odonto-Stomatology, Ophthalmology, and Otolaryngology,

Phu Vang District Medical Center, Thua Thien Hue Province, Vietnam, from May 2023 to July 2024. The study protocol was reviewed and approved by the Ethics Committee in Biomedical Research of Hue University of Medicine and Pharmacy (Approval No. H2023/139).

Participant Selection

A total of 200 patients were recruited using a convenient random sampling method. Participants were eligible for inclusion if they were aged 18 years or older, diagnosed with gingivitis or periodontitis according to the 2017 AAP/EFP classification, possessed at least 20 functional teeth (excluding third molars), and provided written informed consent prior to enrollment. Patients were excluded if they had malignant diseases, were pregnant or lactating, had undergone periodontal surgery within the past year, or had used medications affecting bone metabolism or antibiotics within the preceding three months.

Clinical and Radiographic Assessment

Comprehensive clinical and radiographic assessments were conducted to evaluate the participants' periodontal status and related parameters. Periodontal measurements included probing pocket depth (PPD), clinical attachment loss (CAL), and bleeding on probing (BOP). Tooth loss was recorded as the number of missing teeth, excluding third molars, irrespective of cause. Radiographic bone loss (RBL) was assessed using bitewing radiographs, with RBL defined as a distance greater than 1 mm from the cemento-enamel junction (CEJ) to the alveolar crest, corresponding to 10% bone loss. The bone loss-to-age ratio was further determined by dividing the maximum percentage of bone loss by the patient's age [5].

Risk Factor Assessment

Risk factor assessment included evaluation of diabetes mellitus and smoking habits. Fasting blood glucose testing was performed, and diabetes was diagnosed when fasting glucose levels were ≥ 126 mg/dL (7.0 mmol/L) [6].

Smoking status was categorized into five groups based on self-reported history: non-smokers, former smokers (quit ≥ 5 years ago), light smokers (< 10 cigarettes/day), moderate smokers (10 - 19 cigarettes/day), and heavy smokers (≥ 20 cigarettes/day) [5].

Periodontal Risk Assessment (PRA) Model

Individual periodontal risk was evaluated using the Periodontal Risk Assessment (PRA) model proposed by Lang and Tonetti (2003), which integrates six parameters: percentage of bleeding on probing (%BOP), number of sites with probing pocket depth (PPD) ≥ 5 mm, number of missing teeth, radiographic bone loss-to-age (RBL/age) ratio, presence of diabetes mellitus, and smoking history. Each parameter was scored on a scale from 1 to 5, and patients were classified as low risk when all six parameters were in the low-score zone or only one in the moderate zone, moderate risk when at least two parameters were in the moderate zone but no more than one in the high zone, and high risk when at least two parameters fell within the high-score zone [5].

Table 1. Scoring Parameters for Periodontal Risk Assessment (PRA) (4).

Score	%BOP	PPD ≥ 5 mm	Number of Missing Teeth	Diabetes Mellitus	Smoking Habit	Bone Loss/ Age Ratio
1	4%	2	2	No	Non-smoker	0.25
2	9%	4	4		Former smoker	0.5
3	16%	6	6		< 10 cigarettes/day	0.75
4	25%	8	8		10 - 19 cigarettes/day	1.0
5	36%	10	10	Yes	≥ 20 cigarettes/day	1.25

Statistical Analysis

Data were processed and analyzed using Microsoft Excel 2013 and SPSS version 22.0. Quantitative variables were expressed as mean ± standard deviation, while qualitative variables were presented as percentages. The Chi-square test was employed to compare proportions between groups. Statistical significance was set at 0.05 level.

3. RESULTS

From May 2023 to July 2024, 200 patients with periodontal disease were clinical examined. The demographic distribution revealed that 46% of participants were ≤ 40 years old, with a female-to-male ratio of 1.2:1. Based on the 2017 AAP/EFP classification, 42.5% of the subjects were diagnosed with gingivitis, while 57.5% were diagnosed with periodontitis.

According to the Lang and Tonetti (2003) PRA model, the majority of the study population was classified as moderate risk (47%), followed by low risk (37%) and high risk (16%) (Figure 1).

Table 2 demonstrates that the distribution of periodontal risk levels differed significantly across all examined demographic variables ($p < 0.05$). In particular, high-risk profiles were more frequently observed among male participants, individuals aged over 40 years, married patients, and those engaged in farming occupations.

The distribution of PRA by periodontal classification was presented in Table 3. The risk level was strongly associated with the clinical diagnosis ($p < 0.001$). In the gingivitis group, 60% of patients were at low risk, whereas in the periodontitis group, moderate and high risk accounted for 53% and 27%, respectively.

Further analysis of periodontitis cases revealed that risk levels increased significantly with both stage and grade ($p < 0.001$): High risk reached 40% in Stage IV cases, while no low-risk patients were observed at this advanced stage (Figure 1). A striking correlation was found with the rate of progression; 100% of patients classified as Grade C (rapid progression) were identified as high risk by the PRA tool (Figure 2).

Table 2. Distribution of periodontal risk levels according to general characteristics

Characteristics	Low Risk n (%)	Moderate Risk n (%)	High Risk n (%)	p-value*
Gender				**0.003**
Male	27 (29.3)	42 (45.7)	23 (25.0)	
Female	47 (43.5)	52 (48.1)	9 (8.3)	
Age Group				< 0.001
≤ 40 years old	47 (51.1)	40 (43.5)	5 (5.4)	
> 40 years old	27 (25.0)	54 (50.0)	27 (25.0)	
Marital Status				0.011
Single	21 (52.5)	18 (45.0)	1 (2.5)	
Married	53 (33.1)	76 (47.5)	31 (19.4)	
Occupation				< 0.001
Intellectual labor	32 (62.7)	17 (33.3)	2 (3.9)	
Worker	27 (37.5)	36 (50.0)	9 (12.5)	
Farmer	3 (7.9)	18 (47.4)	17 (44.7)	
Others/Retired	12 (30.8)	23 (59.0)	4 (10.3)	

** Chi square test*

Table 3. Periodontal risk distribution by clinical diagnosis

Diagnosis	Low Risk n (%)	Moderate Risk n (%)	High Risk n (%)	p-value*
Gingivitis (n = 85)	51 (60.0)	33 (38.8)	1 (1.2)	< 0.001
Periodontitis (n = 115)	23 (20.0)	61 (53.0)	31 (27.0)	

** Chi square test*

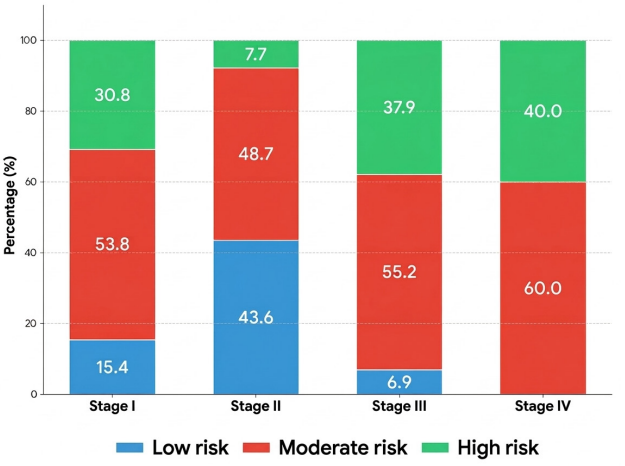

Figure 1. Distribution of periodontal risk levels according to periodontitis stages

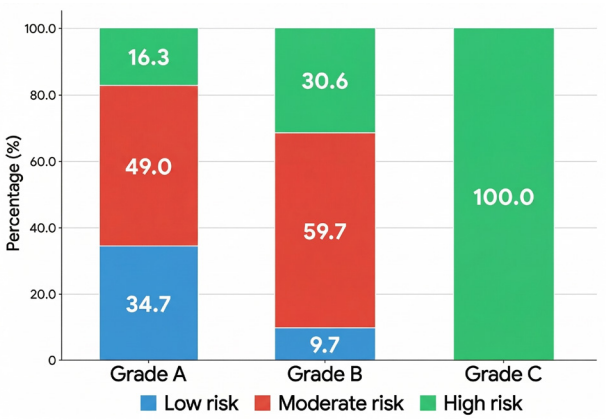

Figure 2. Distribution of periodontal risk levels according to periodontitis grades

4. DISCUSSION

4.1. Periodontal Risk in the Study Cohort

The present study indicates that the majority of patients were classified as moderate risk (47%), followed by low risk (37%) and high risk (16%). These findings align with previous research by Madi et al. and Sujai et al., which observed a similar prevalence of moderate risk in diverse populations [7, 8]. In contrast, studies in Malaysia by Masud et al. reported a higher prevalence of high-risk individuals [9], while several European studies showed a predominance of low-risk patients [10-12]. These discrepancies can be attributed to variations in public health preventive programs, accessibility to dental services, and oral hygiene habits across different geographical regions. The moderate-risk dominance in our study population at the Phu Vang District Medical Center emphasizes the need for a balanced approach to periodontal therapy, focusing on both stabilization and personalized supportive care to prevent these patients from progressing into high-risk categories.

4.2. Relationship Between PRA and Demographic Characteristics

Our results demonstrate that demographic factors significantly influence periodontal risk levels ($p < 0.05$).

Regarding gender, the prevalence of high periodontal risk in males (25%) was significantly higher than in females (8.3%), while the low-risk proportion was higher in females (43.5% vs. 29.3%). This disparity may be attributed to the fact that males often encounter more severe health issues, possess additional risk factors, or exhibit less concern for routine healthcare compared to females. Socio-cultural factors also play a role, as women are generally more encouraged to prioritize oral hygiene. This finding is consistent with the study by Madi et al. (2021) in Saudi Arabia, which confirmed that gender significantly influences periodontal risk profiles [7].

Age also demonstrated a clear association with risk levels ((*p* < *0.05*). The high-risk proportion increased sharply from 5.4% in the group < 40 years old to 25% in in those over 40, while the low-risk proportion decreased from 51.1% to 25%. This trend is primarily due to the aging process, which leads to a decline in the structure and function of periodontal tissues and the immune system. Furthermore, older individuals have had longer exposure to risk factors and a higher prevalence of chronic systemic diseases. Our results align with the findings of Madi et al. (2021), confirming that advancing age significantly elevates periodontal risk [7].

In terms of marital status, married patients exhibited a higher rate of high risk (19.4%) compared to single individuals (2.5%), whereas the low-risk rate was lower in the married group (33.1% vs. 52.5%). Marital status may influence periodontal health through increased stress and family responsibilities. Corridore et al. (2023) noted that chronic stress negatively impacts periodontal tissues by altering behaviors (such as smoking or poor hygiene) and through direct biological pathways, including changes in salivary flow, gingival circulation, and immunity [13]. This observation is supported by Madi et al., who also identified marital status as a factor affecting periodontal risk [7].

Finally, occupational data revealed that the prevalence of high periodontal risk increased progressively from intellectual laborers to farmers, while low-risk proportions followed the opposite trend. Occupation influences risk through the working environment and hygiene conditions. Intellectual workers typically operate in cleaner environments with better sanitary conditions, whereas farmers and industrial workers are more frequently exposed to dust and chemicals, which may increase disease susceptibility. Additionally, occupational stress and pressure contribute to heightened risk. These results are consistent with the research by Madi et al. regarding the link between occupation and periodontal risk [7].

4.3. Relationship between PRA and Periodontal Classification

Our study revealed a highly significant correlation between the clinical diagnosis of periodontal disease and the risk levels determined by the PRA model ($p < 0.001$). Specifically, 60% of patients diagnosed with gingivitis were classified as low risk, while only 1.2% fell into the high-risk category. In contrast, among patients with periodontitis, the proportion of moderate and high risk increased substantially to 53% and 27%, respectively. These findings are in strong agreement with the research of Madi et al. (2021) and Sujai et al. (2015), both of whom reported that patients with more severe periodontal destruction consistently exhibited higher risk profiles [7, 8].

The relationship between periodontitis severity (Stage) and risk levels was also statistically significant ($p < 0.001$). As the disease progressed from Stage I to Stage IV, the proportion of high-risk individuals increased from 0% to 40%. Conversely, the low-risk group decreased from 47.1% in Stage I to 0% in Stage IV. This trend underscores the cumulative nature of the PRA parameters, where advanced bone loss and tooth loss—key components of staging—directly elevate the overall risk score [14]. This observation aligns with the work of Lang and Tonetti (2003), who emphasized that the PRA tool is designed to reflect the biological complexity and severity of the disease [5].

One of the most striking findings in this study was the correlation between the rate of disease progression (Grade) and the PRA risk levels ($p < 0.001$). Notably, 100% of patients categorized as Grade C (rapid progression) were identified as high risk. This perfect convergence demonstrates the high sensitivity of the PRA tool in detecting aggressive disease patterns. Furthermore, the high-risk proportion rose from 7.7% in Grade A to 100% in Grade C.

These results are consistent with the studies conducted by Masud et al. (2021) and Petsos et al. (2020), which highlighted the tool's effectiveness in integrating biological "grade" indicators—such as the bone loss/age ratio and systemic modifiers like smoking and diabetes—into a single prognostic profile [7, 12]. The ability of the PRA model to accurately reflect the 2017 AAP/EFP classification parameters makes it an invaluable clinical asset for identifying patients who require more intensive monitoring and aggressive therapeutic intervention.

This study's primary strength lies in its comprehensive application of the Lang and Tonetti PRA model, integrating clinical, systemic, and environmental factors according to the 2017 AAP/EFP standards to provide a holistic risk profile. This approach facilitates personalized supportive periodontal therapy. However, several limitations exist. As a cross-sectional study, it cannot establish definitive causal relationships. Additionally, the use of convenient sampling at a single medical center may limit the generalizability of the findings to the broader Vietnamese population. Therefore, further

longitudinal studies with larger, multicenter cohorts are warranted to validate these risk profiles and evaluate the long-term effectiveness of risk-based periodontal management in the Vietnamese context.

5. CONCLUSION

The study demonstrates that 47% of patients with periodontal disease at the Phu Vang District Medical Center are at moderate risk, while low and high risk levels account for 37% and 16%, respectively. Risk profiles are significantly associated with demographic factors, including male gender, age over 40, and agricultural labor. Notably, clinical parameters such as the stage and grade of periodontitis are directly proportional to the risk level, with 100% of Grade C patients categorized as high risk. These findings validate the Lang and Tonetti (2003) PRA tool as a reliable instrument for clinical prognosis. Its application facilitates personalized treatment planning and optimized maintenance intervals for long-term periodontal health.

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