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Oral Hygiene Maintenance Behavior and Community Periodontal Index in Systemic Lupus Erythematosus Patients: A Correlational Study

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ABSTRACT

Introduction: Systemic Lupus Erythematosus (SLE) is an autoimmune disorder that commonly presents with oral manifestations, including xerostomia, mucosal ulcerations, dental caries, and periodontitis. Periodontitis, characterized by progressive destruction of tooth-supporting tissues, is frequently aggravated by inadequate oral hygiene practices. This study aimed to investigate the correlation between oral hygiene maintenance and periodontal health in patients diagnosed with SLE.

Methods: This study employed a cross-sectional correlation design. It involved 100 participants, comprising 50 SLE patients and 50 healthy controls subjects, recruited through purposive sampling. Periodontal health was assessed using the Community Periodontal Index (CPI). Oral hygiene maintenance behavior was assessed using a self-administered structured questionnaire, adapted and modified from the Hiroshima University–Dental Behavioral Inventory (HU-DBI). Differences in community periodontal index between the SLE and control groups were analyzed using a Mann-Whitney test. The relationship between oral hygiene behaviors and CPI scores was examined using Spearman's rank correlation test.

Results: The results revealed that SLE patients exhibited poorer oral hygiene knowledge, attitudes, and practices compared to healthy controls subjects, along with significantly worse periodontal health ($p < 0.05$). Furthermore, Spearman's rank correlation test showed significant negative correlations between oral hygiene maintenance behaviors and CPI scores in the SLE group ($r = -0.156$, $p < 0.05$; $r = -0.148$, $p < 0.05$; $r = -0.148$, $p < 0.05$, respectively) indicating that patients who practiced better oral hygiene tended to have lower CPI scores and, consequently, healthier periodontal status.

Conclusion: Improved oral hygiene practices are significantly correlated with enhanced periodontal health in patients with SLE. These findings underscore the importance of emphasizing effective oral hygiene measures as part of comprehensive periodontal management strategies for SLE patients.

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INTRODUCTION

Systemic Lupus Erythematosus (SLE) is a chronic autoimmune disease characterized by the loss of immune tolerance, leading to systemic inflammation and damage to various organs (1). In the oral cavity, SLE often manifests as xerostomia, mucosal ulcerations, dental caries, and periodontitis, reflecting the disease's systemic effects and immune dysfunction (2).

Periodontitis, a severe manifestation of periodontal disease, is a chronic inflammatory condition marked by the progressive destruction of the periodontal ligament and alveolar bone, resulting in tooth-supporting structure loss (3). The condition is driven by dysbiotic microbial biofilms and an exaggerated immune response, leading to irreversible tissue damage. The Community Periodontal Index (CPI) serves as a crucial tool for assessing disease progression by measuring inflammation, periodontal pocket depth, and tissue destruction (4). Poor oral hygiene, a primary contributor to periodontitis, fosters bacterial accumulation and triggers inflammatory processes, exacerbating disease severity (5).

In individuals with SLE, immune system dysregulation heightens vulnerability to periodontal infections, creating a bidirectional relationship between periodontitis and SLE-related systemic inflammation (6). The overactivity of B and T lymphocytes and autoantibody production in SLE may exacerbate periodontal tissue destruction, highlighting the importance of maintaining good oral hygiene to mitigate systemic inflammation and disease severity (7). However, current evidence remains inconclusive regarding the extent and behavioral determinants of periodontal disease among SLE patients, particularly in Southeast Asian populations. Most previous studies have focused on biological mechanisms, with limited attention to how patients' oral hygiene behaviors relate to clinical periodontal outcomes (8). This study aims to analyze the correlation between CPI and oral hygiene maintenance behavior in SLE patients and provide valuable insights into the interplay between these conditions and strategies to improve their oral and systemic health outcomes.

METHODOLOGY

Research Type

This quantitative study employed a cross-sectional correlational design. Purposive sampling technique was used to recruit 100 adolescents aged 15 to 30 years in Surakarta City, divided into two groups: 50 patients with Systemic Lupus Erythematosus (SLE) and 50 non-SLE controls subjects. Data were assessed in October 2024 using the validated Community Periodontal Index (CPI) to evaluate periodontal status and multiple-choice questions to assess oral hygiene maintenance behavior, including knowledge, attitude, and practice.

Population and Sample/Informants

The study population comprised patients diagnosed with SLE and healthy controls, with a total sample size of 100 participants equally divided into two groups: 50 SLE patients and 50 non-SLE controls. Patients with SLE were recruited from the Tittari Foundation, an organization supporting individuals diagnosed with SLE, while healthy controls were selected from the local community. Participants were recruited using consecutive sampling until the required sample size was achieved. Inclusion criteria for the SLE group were: (1) a confirmed diagnosis of SLE by an internal medicine specialist according to the 2019 European League Against Rheumatism (EULAR)/American College of Rheumatology (ACR) classification criteria (9), and (2) active membership in the Tittari Foundation. Exclusion criteria included: (1) unwillingness to participate in the study. The healthy control group consisted of individuals without a history of autoimmune diseases who met the same exclusion criteria as the SLE group.

Research Location

The study was conducted in Auditorium of Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia on October 15, 2024.

Research Instrument

This quantitative study employed a validated questionnaire, the Community Periodontal Index (CPI) to estimate the depth of periodontal disease by measuring gingival inflammation and its severity, pocket formation, as well as masticatory function. The assessment of oral hygiene maintenance behavior in this study was conducted

using a 30-item multiple-choice questionnaire adapted and modified from the Hiroshima University–Dental Behavioral Inventory (HU-DBI) (10). Previously, the HU-DBI questionnaire showed a good Cronbach alpha value with a coefficient of 0.73, based on a sample of 517 students over a four-week period. In this study, the modified version of the HU-DBI questionnaire showed a good Cronbach's alpha value with a coefficient of 0.81. This indicates that the instrument used has good reliability and validity because the coefficient value obtained is > 0.7 (11).

Data Collection Procedures

The periodontal status in this study was assessed using the Community Periodontal Index (CPI), a method widely recognized for its reliability in representing full-mouth periodontal conditions, as supported by previous findings from Dhingra and Vandana (2011) (12). The assessment of oral hygiene maintenance behavior was conducted using a self-administered structured questionnaire after the examination of the patients participating in this study.

The knowledge section comprised multiple-choice questions assessing participants' understanding of oral health, including the number of teeth sets in a lifetime, the total number of deciduous and permanent teeth, the purpose of tooth brushing, the meaning of dental plaque and gum bleeding, the effects of sweet food retention on teeth, the role of fluoride, and the impact of oral health on overall health. Participants were also asked about the causes of oral cancer and whether irregularly placed teeth could be corrected.

The attitude section consisted of yes/no questions evaluating participants' perspectives on the importance of regular dental visits, the harmful effects of gutkha and tobacco use, smoking, the necessity of toothpaste for effective cleaning, the impact of toothbrush bristle hardness on teeth and gums, the necessity of replacing missing teeth, and the role of dentists in both treatment and prevention.

The behavior section included multiple-6choice and yes/no questions assessing participants' oral hygiene practices. Questions covered the frequency of tooth brushing, rinsing habits, use of brushing materials, careful brushing techniques, tongue cleaning, and harmful habits such as tobacco chewing and smoking. Additional questions assessed participants' experiences with gum bleeding, white deposits on teeth, bad breath, and whether they visited the dentist only when experiencing toothache.

Responses were scored and classified into three categories based on predefined thresholds. Participants scoring ≥80% of the total points were categorized as having good oral hygiene maintenance behavior, those scoring between 60 and 79% were classified as moderate, and those scoring below 60% were considered to have poor oral hygiene maintenance behavior.

Data Analysis

The distribution of the data was assessed using the Shapiro-Wilk test, while the homogeneity of variances between groups was evaluated using Levene's test. The difference in the Community Periodontal Index between SLE group and control (non-SLE) group was compared using a Mann-Whitney test, with a significant p-value of < 0.001. Spearman's correlation test was conducted to examine the correlations between the community periodontal index and oral hygiene maintenance behavior.

Ethical Approval

The study received approval from the Research Ethics Committee of the Faculty of Medicine, Universitas Sebelas Maret (211/UN27.06.11/KEPEC/2024, approved on September 25, 2024) and was conducted in accordance with the Helsinki Declaration. Informed consent was obtained from all participants prior to enrolment.

RESULTS

Baseline Characteristics

Table 1 summarizes the baseline characteristics of the SLE and control groups. Gender distribution significantly differed between the groups (p = 0.012). The median age for the SLE group was 19.50 years (IQR = 16.00 – 25.25) and 20.00 years (IQR = 16.00 – 26.00) for the control group. No significant differences were found in age (p = 0.664), BMI (p = 0.382), or education level (p = 0.318) with the majority of participants in both groups having completed secondary education.

Table 1. Baseline Characteristics of Participants

Variable	SLE group (n=50)	Control group (n=50)	P-value
Gender			
Male, n (%)	11 (22%)	24 (48%)	0.012
Female, n (%)	39 (78%)	26 (52%)	
Age (years)			
Median (IQR)	19.50 (16.00 - 25.25)	20.00 (16.00 - 26.00)	0.664
Body Mass Index (BMI)			
Mean ± SD	22.6 ± 3.2	23.1 ± 2.9	0.382
Education level			
Primary or Below, n (%)	14 (28%)	10 (20%)	
Secondary, n (%)	23 (46%)	25 (50%)	0.318
Tertiary, n (%)	13 (26%)	15 (30%)	

Source: Primary Data

Comparison of oral hygiene knowledge, attitude, and practice between SLE patients and controls is presented in Figure 1. The majority of SLE patients had poor knowledge, while a higher proportion of healthy controls had good knowledge. Most controls exhibited a good attitude, whereas more SLE patients had moderate or poor attitudes. The control group also had more participants with good oral hygiene practices, while SLE patients were more likely to exhibit moderate or poor oral hygiene practices. The SLE group had a significantly higher mean of 0.858 ± 1.77 ($p < 0.05$), indicating poorer periodontal health in the SLE group. This difference was statistically significant, highlighting the impact of SLE on periodontal health.

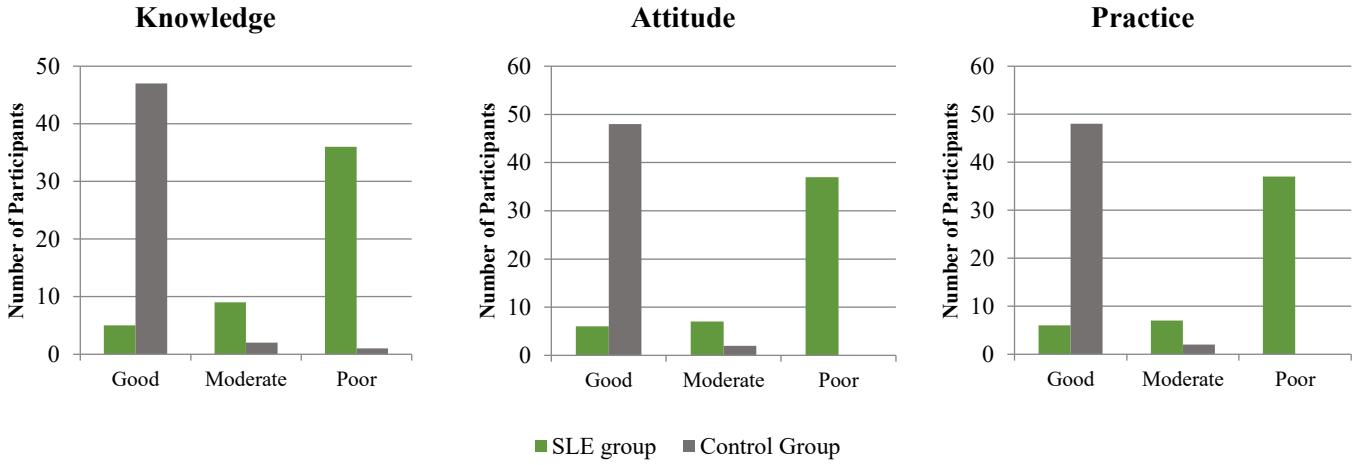

Figure 1. Oral Hygiene Maintenance Behavior and Periodontal Index in SLE and Healthy Control Group

Spearman's correlation analysis (Table 2) in the SLE group revealed significant negative correlations between knowledge, attitude, practice, and the Community Periodontal Index ($r = -0.156$, $p < 0.05$; $r = -0.148$, $p < 0.05$; $r = -0.148$, $p < 0.05$, respectively). In the control group, significant negative correlations were found only between attitude, practice, and the Community Periodontal Index ($r = -0.808$, $p < 0.05$, $r = -0.862$, $p < 0.05$, respectively). These results indicate that higher levels of oral health knowledge, attitudes, and practices are associated with lower CPI scores, reflecting better periodontal health in both groups.

Table 2. Correlation between Community Periodontal Index and Oral Hygiene Maintenance Behavior on SLE and Control Group

Community Periodontal Index	Oral Hygiene Maintenance Behavior		
	Knowledge	Attitude	Practice
Control group			
R	- 0.652	- 0.808	- 0.862
p-value	0.113	< 0.001	< 0.001
SLE group			
R	- 0.156	- 0.148	- 0.148
p-value	< 0.001	0.003	0.002

Source: Primary Data

DISCUSSION

Mechanisms Underlying Poor Periodontal Health in Patients with SLE

The significantly higher mean community periodontal index observed in SLE patients compared to healthy controls reflects the multifactorial nature of periodontal disease in individuals with SLE (6). This association can be attributed to a combination of systemic inflammation, immune dysregulation, and the effects of SLE-related treatment (13). SLE is characterized by chronic systemic inflammation mediated by an overactive immune system (14). Zian et al. (2021) reported elevated salivary levels of TNF-α, IL-6, and IL-17 in patients with SLE. These findings were derived from several studies comparing periodontitis occurrence in SLE patients and healthy controls, indicating a potential link between systemic inflammation and periodontal pathology in SLE (15). These cytokines promote osteoclast genesis, leading to alveolar bone resorption, a key feature of periodontal disease (16,17). Additionally, TNF-α and IL-6 enhance the expression of matrix metalloproteinases (MMPs), which degrade extracellular matrix components in periodontal tissues, further exacerbating tissue breakdown (6,18). The dysregulated immune response in SLE also contributes to impaired wound healing and increased susceptibility to infections. Neutrophil dysfunction and impaired phagocytosis compromise the host's ability to control the microbial biofilm, allowing pathogenic bacteria such as *Porphyromonas gingivalis* to proliferate (19). These bacteria release virulence factors that trigger a hyperinflammatory response, creating a self-perpetuating cycle of inflammation and tissue damage (20). Another contributing factor is oxidative stress, which is elevated in both SLE and periodontal disease (21). Reactive oxygen species (ROS) generated during chronic inflammation can damage periodontal tissues directly by inducing DNA, protein, and lipid oxidation (22,23). ROS also activates pro-inflammatory pathways, including nuclear factor kappa B (NF-κB), further amplifying the inflammatory response and contributing to periodontal tissue destruction (24).

Oral Hygiene Maintenance Behavior of SLE Patients and Healthy Controls

The findings reveal significant disparities in oral hygiene behaviors between SLE patients and healthy controls. The SLE patients demonstrated poorer knowledge, attitudes, and practices. These gaps not only affect their ability to maintain oral health but also underscore the systemic and behavioral challenges inherent in managing chronic diseases.

In the SLE group, oral hygiene knowledge showed a significant correlation with the community periodontal index ($r = - 0.156$, $p < 0.001$), unlike in the control group where the relationship was non-significant ($r = - 0.652$, $p = 0.113$). This suggests that for SLE patients, awareness plays a more pivotal role, likely due to their heightened susceptibility to periodontal disease. However, knowledge alone is insufficient without the attitudinal and practical changes needed to drive consistent oral hygiene behaviors (8,24).

Attitude, as the bridge between knowledge and practice, showed significant correlations with periodontal health in both groups (SLE: $r = - 0.148$, control: $r = - 0.808$). Positive attitudes are crucial as they reflect an individual's belief in the importance of oral health and their ability to implement hygiene practices (25). However, the moderate or suboptimal attitudes observed in many SLE patients may be influenced by the psychological burden of chronic illness and physical limitations such as fatigue and joint pain, which constitute perceived barriers under HBM. Consequently, interventions should incorporate behavioral and motivational component, such as individualized counselling, peer support, and strategies to reduce perceived obstacles, to cultivate more proactive attitudes toward oral health (26).

Practice is the ultimate determinant of health outcomes, and the study confirms a significant relationship between oral hygiene practices and periodontal health in both groups. However, poor practices among SLE patients highlight systemic barriers, including reduced dexterity, medication side effects like xerostomia, and limited access to dental care (26). Within the HBM framework, these factors represent additional perceived barriers and challenges to self-efficacy, highlighting the necessity of multifaceted strategies. Such strategies may include the provision of adaptive oral care tools, integration of dental services into routine SLE management, and enhancement of accessibility through community-based programs or telehealth initiatives, which function as external cues to action facilitating sustained preventive behaviors (27,28).

Limitations and Cautions

This study has certain limitations, including a relatively small sample size with consecutive sampling, which restricts generalizability. The cross-sectional design precludes causal inference, and the reliance on self-reported questionnaires introduces potential response bias. Moreover, unmeasured factors such as disease duration, activity, medication use, and socioeconomic status may have influenced the results.

Recommendations for Future Research

Future studies should include larger, more diverse populations and adopt longitudinal designs to clarify causal relationships between oral hygiene behaviors and periodontal health in SLE patients. Controlling for disease activity, medication use, and socioeconomic factors will strengthen the validity of findings. Interventional research is recommended to evaluate whether oral health education and integrated dental care can improve both periodontal and systemic outcomes.

CONCLUSION

This study highlights the strong association between SLE and periodontal health among patients in Surakarta, Indonesia. SLE patients demonstrated poorer oral hygiene behaviors, including knowledge, attitudes, and practices, compared to healthy controls, and these behaviors were significantly correlated with their periodontal status. The findings underscore the importance of culturally tailored, community-based strategies to promote effective oral hygiene and address both systemic and behavioral factors affecting health outcomes in this population.

AUTHOR'S CONTRIBUTION STATEMENT

All authors contributed equally to the conception, design, data collection, analysis, and writing of this manuscript. All authors have read and approved the final version of the manuscript.

CONFLICTS OF INTEREST

The authors report no conflict of interest.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors acknowledge the use of AI-assisted tools, using Grammarly for language editing and refinement of clarity. The study design, data analysis, interpretation of findings, and preparation of the final manuscript were carried out independently by the authors without reliance on generative AI tools. The authors retain full responsibility for the accuracy, integrity, and originality of the manuscript.

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