ORIGINAL ARTICLE

Correlation between oral health knowledge and awareness and periodontal status in non-syndromic cleft lip and palate patients undergoing orthodontic treatment: a cross-sectional study

Debrinna Rezaumami[1]
Ida Ayu Evangelina [2]*
Avi Laviana[2]
Elih Elih[2]
Sharifah Wade'ah Wafa Syed
Saadun Tarek Waf[3]

[1]Undergraduate Study Program, Faculty of Dentistry,Universitas Padjadjaran, Indonesia
[2]Department of Orthodontics Faculty of Dentistry, Universitas Padjadjaran, Indonesia
[3] Malaysia, Selangor - Avisena Women's and Children's Hospital

* Correspondence:
ida.evangelina@unpad.ac.id

ABSTRACT

Introduction: Children and adolescents with non-syndromic cleft lip and palate (CLP) experience a higher prevalence of caries and periodontal disease compared to those without CLP. This increased prevalence is often attributed to greater plaque accumulation, which can lead to gingival inflammation and periodontal disease. This study aims to analyze the correlation between oral health knowledge and awareness and the periodontal health status of orthodontic patients with cleft lip and palate (CLP). **Method:** This study used a cross-sectional approach. The study population consisted of orthodontic patients with non-syndromic CLP who met the inclusion criteria. The research was conducted at the UNPAD Dental Teaching Hospital (RSGM Unpad) from March to May 2024. Twenty-seven participants with non-syndromic CLP were included in the study. A non-probability, purposive sampling technique was employed. oral health knowledge and awareness were assessed using questionnaires, while periodontal health examinations were evaluated using the Community Periodontal Index (CPI). Correlation analyses were performed using Kendall's Concordance Correlation (W). Additionally, Spearman Rank Correlation Analysis was conducted to identify the dominant variables. **Results:** The analysis revealed a Kendall's Concordance Correlation (W) of 0.544, which is statistically significant ($p < 0.0001$), indicating a 54.4% relationship between the variables. The correlation between knowledge and periodontal health status in orthodontic patients with non-syndromic CLP was 11.16%, with a p-value of 0.0443 ($p < 0.05$) and an r-value of 0.33. The correlation between awareness of oral health and periodontal health status in these patients was 19.85%, with a p-value of 0.0099 ($p<0.05$) and an r-value of 0.45. **Conclusion:** There is a weak correlation between knowledge and awareness of oral health and the periodontal health status in non-syndromic CLP patients undergoing fixed orthodontic treatment.

KEYWORDS

cleft lip, cleft palate, oral health, periodontal diseases, health knowledge, dental indexes

INTRODUCTION

Cleft lip and palate (CLP) is the most common orofacial cleft [1-2] CLP is a congenital abnormality that occurs during the early phase of embryogenesis.[3] This congenital anomalies usually occur in the early stages of pregnancy, particularly on the 4th week post-conception.[4] Cleft lip may be attributed to failure of fusion of the frontonasal and maxillary processes, leading to varying gaps in the lips, alveoli, and base of the nose, while cleft palate occurs due to failure of fusion of

the maxillary palatal shelves.[5] CLP can be syndromic or non-syndromic. Approximately 70% of cleft cases are non-syndromic, a condition in which the cleft is not accompanied by other developmental or physical abnormalities, whereas syndromic clefts occur together with other developmental and physical abnormalities.[6-7]

The overall incidence of non-syndromic CBL (Case-Based Learning) cases is approximately 1.5 per 1000 live births or approximately 220,000 new cases per year, with wide variations across geographic regions, ethnic groups, and the type of cleft lip and palate itself.[8] Children and adolescents with non-syndromic CLP have a high prevalence of caries and periodontal disease.[9-10] Dental caries and periodontal disease are the most common health problems frequently reported by the majority of the Indonesian population; however, they are not considered significant health issues by some people.[6]

Periodontal health plays a vital role not only in oral and systemic health but also plays a role in overall quality of life.[11] Its status can be assessed using a measurement tool called the Community Periodontal Index (CPI). CPI is a modification of the Community Periodontal Index of Treatment Needs (CPITN) which was developed by the World Health Organisation (WHO) in 1997. The purpose of CPTIN is to provide a global standard for screening periodontal disease in populations. This CPI method adds an attachment loss category and eliminates treatment needs.[12]

Children with non-syndromic CLP experience problems in the development of teeth and jaws. Deficiencies in the structure of oral embryonic tissue lead to abnormalities in tooth structure, shape, and number. These abnormalities include crowding, ectopic eruption, and tooth malposition.[7] Children with non-syndromic CLP often require extensive and prolonged orthodontic treatment.[13]

Plaque accumulation has been found to be higher in non-syndromic CLP patients than in normal patient, and this plaque can lead to gingival inflammation and periodontal disease.[2] Alhaija et al., in their research, reported that knowledge about the periodontal health of orthodontic patients is still lacking.[14]

Knowledge, patient motivation, cooperation, and attitude toward treatment are all essential for maintaining oral hygiene during orthodontic appliance therapy. Poor oral hygiene may result from either a lack of knowledge or from patient negligence. However, research is lacking regarding the relationship between dental and oral health awareness and knowledge among patients with cleft lip and palate (CLP).

It is hypothesized that higher levels of oral health knowledge and awareness are positively correlated with better periodontal health status in these patients. Specifically, patients with greater knowledge and oral health awareness are expected to demonstrate improved periodontal health due to their ability to adopt more effective oral hygiene practices and adhere to appropriate care regimens. This study aims to evaluate this correlation in orthodontic patients with CLP.

METHODS

This cross-sectional study assesses the relationship between dental and oral health knowledge and awareness and periodontal health status in orthodontic patients with non-syndromic cleft lip and palate. In this study oral health knowledge (what patients know about proper oral care) and oral health awareness (their understanding of the importance of maintaining good oral hygiene) are the independent variables.

These factors are believed to affect the periodontal health status, the dependent variable, which refers to the condition of the gums and teeth, including gum health and plaque levels. This study hypothesizes that greater oral oral health knowledge and awareness will correlate with better periodontal health.

The study included 27 orthodontic patients with non-syndromic cleft lip and palate (CLP), from the Universitas Padjajaran Hospital who met the pre-

determined inclusion criteria. The research was conducted at the UNPAD Dental Teaching Hospital (RSGM) from March to May 2024 a non-probability sampling technique, specifically purposive sampling method. This approach involved selecting research subjects from the entire population of orthodontic patients with non-syndromic cleft lip and palate based on predetermined inclusion and exclusion criteria.

The inclusion criteria for participants were as follows: willingness to participate in the study, male or female patients aged 14-25 years, diagnosed with non-syndromic CLP, undergoing fixed orthodontic treatment at RSGM Unpad, and no history of systemic diseases such as diabetes. Additionally, participants needed to be using fixed orthodontic appliances. The Exclusion criteria included patients who were unwilling to participate or failed to complete the informed consent process.

A published questionnaire developed and adapted from Alhaija et al. was used in this study[14]. The questionnaire was translated into Indonesian by a certified interpreter and translated back into English by another certified interpreter (No. 3065/2003, Sworn Translator). All questionnaire items demonstrated acceptable validity (r > 0.05). Reliability was assessed using the Spearman Coefficient of Rank Correlation test. The awareness variable showed good reliability (r = 0.75), while the knowledge variable showed weak reliability (r = 0.25).

The 34-item questionnaire was divided into four sections: Oral Health Knowledge(9 items assessing participants' basic knowledge of oral health and orthodontic treatment), General Oral Health Knowledge (6 items, focusing on general knowledge regarding oral health maintenance), Oral Health Awareness (10 questions, measuring participants' awareness of the importance of oral health and preventive practices), and Attitudes (9 questions, which were included in the questionnaire but not included in the analysis). Although all 34 questions were administered, only the first three sections were included in the analysis. Scoring on the questionnaire was based on the total score for each item. Participants' total scores were calculated by summing the item scores within these three sections, with higher scores indicating greater knowledge and awareness (Table 3). This classification helps to understand the overall level of knowledge and awareness in the study population.

The research data was collected using questionnaires and clinical examination. Periodontal health status was measured using the Community Periodontal Index (CPI) developed by the World Health Organization (WHO). The CPI analyzes various domains of periodontal health, including the presence of gingival disease, periodontal pockets, and loss of attachment. Periodontal Health Status, based on the gums condition, was categorized as: "Good" (no visible signs of gum disease), "Moderate" (mild gingival inflammation), and "Poor" (gingival recession or bleeding).

The correlation between the variables was analyzed using non-parametric statistical methods. Spearman's Rank Correlation (rs) was used to determine which variable has the dominant influence on periodontal health status, Kendall's Concordance Correlation (W) was applied to assess the strength and direction of the relationship between the three variables (knowledge, awareness, and periodontal health status). This analysis helps identify the strength of the correlations and reveals which variables have the most significant impact on periodontal health status.

RESULTS

The results of this study are presented in relation to the demographic characteristics of the respondents, as well as the analysis of the relationship between periodontal health status, knowledge, and awareness. The sample consisted of 27 respondents who met the inclusion criteria. The following section outlines the distribution of respondents by gender and age group, as well as the findings from the statistical analyses.

Table 1. Distribution of respondents based on gender and age group

Gender	< 15 years	15-20 years	> 20 years	Total
Female	1 (3.7%)	12 (44.4%)	6 (22.2%)	19 (70.37%)
Male	3 (11.1%)	4 (14.8%)	1 (3.7%)	8 (29.63%)
Total	4 (14.8%)	16 (59.3%)	7 (25.9%)	27 (100%)

Table 1 displays the distribution of respondents based on gender and age group. Of the 27 respondents, 70.37% were female, and 29.63% were male. Among females, the largest age group was 15-20 years (44.4%), while for males, the largest group was also 15-20 years (14.8%). Overall, the majority of respondents (59.3%) were in the 15-20 years age group, with the smallest proportion (14.8%) being under 15 years.

Table 2. Periodontal health status, level of knowledge and level of awareness of non-syndromic cleft lip and palate patients

Gender	Periodontal health	Patient knowledge level	Patient awareness level
			status (CPI Score)
	Good (n=1)	Moderate (n=23)	Poor (n=3)
Female	0 (0%)	17 (62.9%)	2 (7.4%)
Male	1 (3.7%)	6 (22.2%)	1 (3.7%)
Total	1 (3.7%)	23 (85.2%)	3 (11.1%)

Table 2 presents the distribution of respondents based on their periodontal health status, knowledge, and awareness, categorized into three levels: Good, Moderate, and Poor. The majority of respondents (85.2%) fell into the Moderate category, while 11.1% were in the Poor category, and only 3.7% in the Good category. It is common for most orthodontic patients to have moderate periodontal health, particularly those undergoing treatment with braces, as braces can sometimes contribute to inflammation or plaque buildup, even with regular brushing.

The Good category included only one respondent, likely because orthodontic patients, particularly those with cleft lip and palate, are more prone to developing moderate or severe gum issues due to the challenges in maintaining oral hygiene with orthodontic appliances.

Knowledge: This refers to how well respondents understand oral health and hygiene. Respondents with Good knowledge are well-informed about oral hygiene practices and the risks of poor dental care. Those with Moderate knowledge have a basic understanding, while Poor knowledge reflects limited or no awareness of essential oral health topics. The majority of respondents (63.0%) had Moderate knowledge, with women comprising 44.5% and men 18.5%. A significant portion (37.0%) had Poor knowledge.

This suggests that, while most respondents have a basic understanding of oral health, none were classified in the Good knowledge category, indicating a gap in more advanced understanding of specific oral health topics, such as plaque formation or detailed gum care.

Awareness: This measures how much respondents recognize the importance of maintaining oral health. Those with Good awareness understand the significance of oral hygiene and regular dental visits, while Moderate awareness reflects partial understanding, and Poor awareness indicates limited recognition of the importance of oral health. The highest percentage of respondents (59.3%) fell into the Moderate awareness category, with women accounting for 48.1% and men for 11.1%. A notable 37% of respondents had Good awareness, with 22.2% women and 14.8% men. The remaining respondents were categorized as having Poor awareness.

The high proportion of respondents (59.3%) in the Moderate awareness category is typical among orthodontic patients. This suggests that most participants recognize the importance of oral care, but the level of active engagement with recommended practices may be limited.

The correlation test between knowledge and periodontal health status of orthodontic patients with non-syndromic cleft lip and palate revealed a positive but weak correlation. The linkage value was 11.16%, with a p-value of 0.0443 (p < 0.05), and an r-value of 0.33. This indicates that when the level of knowledge is categorized as moderate, the periodontal health status of non-syndromic CLP patients tends to fall into the moderate category (Table 3). Although the correlation is statistically significant, the low r-value suggests that other factors, beyond knowledge alone, may influence periodontal health.

Dental and oral health awareness was found to be positively and significantly correlated with periodontal health status among non-syndromic CLP orthodontic patients., with a correlation value of 19.85%, a p- value of 0.0099, and an r-value of 0.45 (Table 3).

Meanwhile, dental and oral health knowledge and awareness among non-syndromic CLP patients demonstrated a positive but statistically insignificant at 0.88%, with a p-value of 0.3205 and an r-value of 0.09 (Table 3).

Table 3. Spearman coefficient of rank correlation tests

Variable	r	t	p-value	Character	Relationship	Info
Knowledge of and oral health with periodontal health status	,33	1,77	0,0443	Sign:	11,16	Weak correlation
Oral health awareness with periodontal health status	,45	2,49	0,0099	Sign:	19,85	Weak correlation
Knowledge with awareness of oral health	,09	0,47	0,3205	Non-sign	0,88	Poor relationship

p-values: < 0,05

DISCUSSION

In this study, 85% of CLP patients undergoing fixed orthodontics presented with moderate periodontal health (Table 3). This finding contrasts with previous research, including studies by Shafi M which suggest that CLP patients often exhibit poor periodontal and oral hygiene due to difficulties in maintaining optimal cleanliness in the cleft areas. This apparent discrepancy between the generally poor periodontal and oral hygiene status of CLP patients and the moderate health status observed in this study could be attributed to several factors. As the risk of periodontal disease and abnormalities in periodontal tissue increases with age, specifying the age range of the study sample is crucial for proper interpretation of these results.[16]

Fixed orthodontic treatment may help improve alignment and occlusion, potentially leading to better plaque control and periodontal health compared to untreated cases. Furthermore, patients undergoing orthodontic treatment may be more motivated to maintain oral hygiene due to increased awareness of their dental health and the desire for successful treatment outcomes. Regular professional cleanings and monitoring during regular check-ups can positively

impact periodontal health in these patients.

Orthodontic patients often receive increased education and resources regarding oral hygiene practices, which can contribute to better periodontal health. The majority of respondents in this study were aged 15–20-year age group (Table 2), a demographic that exhibit different risk profiles or treatment responsiveness treatment compared to older populations. Consistent with Levriniet al., who found that regular monitoring and reinforcement of oral hygiene were crucial during orthodontic treatment.[18] Previous studies highlighted that younger patients who received early and consistent education on oral hygiene were less likely to develop periodontal issues during treatment. Similarly, this study supports these findings, as younger patients (15–20 years old) may be more compliant with oral hygiene practices, thus reducing their risk of periodontal problems. Both studies emphasize the importance of education and support in promoting better periodontal health outcomes. These factors combined may help explain why the periodontal health status of CLP patients treated with fixed orthodontics was found to be moderate, despite the general trend of poor hygiene status in this population.

Non-syndromic cleft lip and palate (CLP) patients have a high prevalence of plaque, bleeding on probing, and attachment loss, according to research by Qinrui Wu et al.[17] In contrast, Wyrebek B et al. found that attachment loss is minimal—less than 1 mm. This discrepancy may be attributed to the young age of the evaluated patients, as their periodontal disease was primarily at stages 1 and 2.

In this study, most respondents were under 20 years old (see Table 2), and the results showed a high prevalence rates of scores 1 and 2. Bleeding on probing (score 1) was generally observed in the majority of respondents examined. The scoring system used was as follows: 0 = healthy gums (no problems); 1 = bleeding on probing (no other issues); 2 = presence of calculus (with or without bleeding); 3 = shallow pockets (4-5 mm); and 4 = deep pockets (6 mm or more).

Wyrebek B et al. also reported similar findings.[19] Orthodontic treatment can induce both positive and negative tissue reactions in the gingiva, with gingivitis being the primary negative reactions. Plaque accumulation is considered to be one of the main factors in the development of gingivitis. Orthodontic brackets and elastic materials can interfere with the effectiveness of dental plaque removal, thereby increasing the risk of gingivitis.[20]

Patient knowledge, motivation, cooperation, and attitude towards treatment during fixed orthodontic appliance therapy are key factors in maintaining oral hygiene. Good oral hygiene will certainly equate to good periodontal health as well. In this study, the level of knowledge level of non-syndromic CLP patients was 63% (Table 3), consistent with the moderate periodontal health status observed. This may be related to the homogeneity of the samples in terms of age and education. The fact that respondents had received orthodontic treatment for at least 1 year, including regular check-ups with the dentist and scaling, likely also contributed to their moderate periodontal health.

However, non-syndromic CLP patients still require education on selecting appropriate toothbrushes, using proper brushing techniques, and using additional cleaning aids. This is supported by Alhaija et al., who emphasize the importance of teaching correct brushing techniques and frequency. Patients should be educated on proper tooth brushing, using including the use of interdental and orthodontic toothbrushes, and strategies for maintaining oral hygiene and controlling sugar intake.[14]

The results of testing the relationship between knowledge and the periodontal health status of orthodontic patients with non-syndromic CLP indicated that there is a relationship between knowledge about dental and oral health and the periodontal health status of orthodontic patients with non-syndromic CLP. The correlation value was 11.16%, with a p-value of 0.0443 (p-value < 0.05), and r= 0.33 (Table 4). This result is in accordance with the research by Alhaija et al., which states that there is a significant relationship between dental and oral health

knowledge and periodontitis.[14]

One of the most crucial aspects of improving dental and oral hygiene is raising awareness of dental health. A high prevalence of oral and dental issues can be attributed to a lack of proper brushing knowledge among patients. Awareness plays a vital role in adopting a healthy lifestyle, which includes diligently brushing teeth correctly to achieve good dental and oral health. According to Table 3, the findings of this study indicate that patient awareness of dental and oral health is moderate at 59.3%.

According to Alhaija et al., non-syndromic CLP orthodontic patients have a positive and statistically significant correlation between awareness of dental and oral health and periodontal health status, with a value of 19.85%, p-value of 0.0099 (p-value 0.05), and an r value of 0.45 (Table 5). According to Patel F.'s research, maintaining periodontal health necessitates patient awareness. If patients are unaware on how to maintain periodontal health, treatment will be ineffective and will not begin at all. As a result, patient care and oral hygiene instruction should continue, along with education and motivation for professional plaque removal.[21]

The results of testing the relationship between knowledge and awareness of dental and oral health in non-syndromic CLP patients showed no significant correlation, with a correlation value of 0.88%, a p-value of 0.3205 (p-value < 0.05), and r= 0.09. Based on this investigation, researchers still lack sufficient information due to the limited literature on earlier study findings. As a result, certain issues remain unresolved.

In terms of analysis, this research has some shortcomings. Time constraints should be noted. Additionally, the sample size of this study is smaller the ideal. Given these limitations, there is an expectation that future research will address these issues and surpass the current study.

The success of orthodontic treatment in non-syndromic CLP patients is also supported by adequate knowledge, attitudes, and awareness on the part of of both patients and parents regarding the treatment to be carried out. This is especially important, considering that children with this condition require more extensive health care and a longer duration of service than children without non-syndromic CLP.

This research highlights the need for targeted educational interventions to improve knowledge and awareness of oral health among patients and their families, which may ultimately enhance overall health outcomes. Future research should focus on addressing the limitations identified in this study and investigating additional factors that influence periodontal health in this population. Orthodontists play a key role in the treatment of patients with non-syndromic cleft lip and palate (CLP), and improving patient motivation and education regarding dental and oral hygiene is essential to prevent periodontal disease.

However, the study has several limitations. First, the sample size of 27 respondents is relatively small, limiting the generalizability of the findings. A larger sample size would improve the reliability and external validity of the results. Future studies should aim to include a more diverse and larger sample to strengthen the conclusions. Second, the type of orthodontic device used by the patients was not specified, which is another limitation. Different orthodontic devices (e.g., traditional braces, aligners) may have varying impacts on periodontal health, and this should be considered in future research. For instance, patients with fixed braces may be more prone to plaque buildup and gingival inflammation compared to those using removable aligners.

Additionally, it is important to consider whether patients received education directly from their orthodontist or dentist regarding oral hygiene practices. This study did not specifically address whether the patients were educated by dental professionals, which could have influenced their knowledge and awareness levels. Some respondents may have had formal education, while others might have relied

on self-learning or peer advice. Future studies should include this variable to assess its impact on improving oral health knowledge.

CONCLUSION

There is a weak correlation between knowledge and awareness of oral health and the periodontal health status of orthodontic patients with non-syndromic cleft lip and palate, although a correlation does exist between overall knowledge and awareness and periodontal health. The implications of this research should be carefully considered by orthodontic practitioners and teams treating cleft lip and palate patients when preparing orthodontic treatment plans, particularly for patients with non-syndromic cleft lip and palate.

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