Original Article

Association of the use of interdental cleaning aids with periodontal disease at the periodontal clinic in a tertiary hospital

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Abstract

Background: Plaque biofilm, the aetiological factor for periodontal disease, forms more in interdental areas of the teeth, which are not easily cleansed with tooth brushes, hence, the need for interdental cleaning aids.

Aim: This study aims to assess the association of interdental cleaning usage with oral hygiene status and periodontal status of patients attending the periodontal clinic of the University of Port Harcourt Teaching Hospital (UPTH).

Methods: This was a cross-sectional study conducted among participants who attended the Periodontology Clinic, UPTH. Data was collected using semi-structured questionnaires and was analysed using SPSS. P values < 0.05 were considered statistically significant.

Results: There were 108 participants (48 males and 60 females), with age range of 17-78 years. 101 (93.52%) of the participants used interdental aids, more females 57(56.4%) used interdental cleaning aids. Majority of participants (71.3%) used wooden toothpicks. Participants who used interdental cleaning aids had mean OHI-S score of 2.48 ± 1.0, while those who did not, had mean OHI-S score of 2.89 ± 1.04 (p = 0.330). Among the participants who used interdental cleaning aids, 8 (7.9%) had CPI 0, 66 (65.3%) had CPI 2 and 19 (18.8%) presented with CPI 3, while among those who did not, 2 (28.6%), 4(57.1%), and 1 (14.3%) respectively had CPI 1, CPI 2, CPI 4 (p = 0.024).

Conclusion: There was a statistically significant association between interdental cleaning aids and periodontal health status but not with oral hygiene status. Gingival bleeding was the most common complaint.

Keywords: Biofilm**,** interdental cleaning aids, oral hygiene status, periodontal health

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Received: 22-06-2025, **Accepted:** 06-07-2025

Access this article online	
Quick Response Code:	**Website:** www.phmj.org.ng
	DOI: https://doi.org/10.60787/phmj.v19i2.202

How to cite this article: Alade GO, Umana-Edeani A. Association of the use of interdental cleaning aids with periodontal disease at the periodontal clinic in a tertiary hospital. Port Harcourt Med J 2025;19(2):83-93.

INTRODUCTION

Periodontal diseases are inflammatory diseases that affect the supporting structures of the teeth (the gingiva, bone and periodontal ligament), which sometimes could lead to loss of tooth and contribute to systemic inflammation in an individual.[1] Periodontital disease is primarily caused by the build up of plaque on teeth surfaces. Plaque resides on both hard tissues and soft tissues of the oral cavity and not easily or sufficiently removed from the surfaces by natural physiologic cleaning process of the tongue, or saliva.[2] Plaque accumulate more in the interdental areas than the facial surfaces, whether anteriorly or posteriorly in the mouth. [3]

The interdental area is the part of the gingiva which extends in between two teeth up to the contact point. [4] The spacing varies within one individual and also from person to person. The interdental embrasure can be pyramidal or have a "Col" shape, the Col varies in depth and width and is not keratinized.[5] The epithelial covering of the Col consists of the marginal gingiva of the adjacent teeth, and because it is not keratinized, this area is much more fragile and vulnerable to periodontal breakdown. The Col is more pronounced in the broad interdental gingiva of the posterior teeth, a possible reason for periodontal disease often starting between the posterior teeth.

Accumulation of food debris and plaque in interdental space, are not readily cleansable and can lead to periodontal disease or even dental caries. The routine toothbrush may not be efficient reaching these areas; thus, proximal areas become the hotspot for microbes to grow and affect the oral health. It is shown that the efficacy of plaque removal following a brushing exercise average around 50% [6] due to limitations of the toothbrushes in the penetration of the proximal areas, hence, interdental cleaning practices have gained attention over the years. [1] Interdental plaque biofilm control measures should be used as adjunctive to toothbrushing to complement the mechanical cleaning. [1] Hence, toothbrushing should be combined with interdental cleaning once every 24 hours, for the maintenance of the periodontal health and caries prevention. A study by Claydon et al [7] reported that the ideal method of plaque control is a combined usage of tooth brushing and interdental cleaning devices. A previous study reported that flossing was associated with lower prevalence of periodontitis,[8] while another study reported no benefit of dental floss above toothbrushing in the removal of plaque removal or reduction of gingivitis.[9]

Common interdental cleaning aids include dental floss, interdental wood sticks, interdental brushes and tapes. The use of these is mostly dependent on the morphology size and shape of the interproximal space, and the patient factor's in maintaining dental hygiene.[9]

While interdental cleaning aids are important in preventing periodontal disease and caries, they can be detrimental to oral health if overused or not appropriately utilized, this may include irritation of the gingiva, gingival bleeding, ulceration, or defects of the gingiva, as reported by Gillete et al [10] There is, however, paucity in literature reporting complaints as a result of misuse of interdental cleaning aids among Nigerians. Hence, the aim of this study is to assess the association of interdental cleaning usage with oral hygiene status and periodontal health status of patients attending the Periodontal clinic in University of Port Harcourt Teaching Hospital, also to assess the complaints of participants with interdental cleaning aids usage.

METHODOLOGY

This was a cross-sectional study conducted among participants, who attended the Periodontology Clinic, University of Port Harcourt Teaching Hospital (UPTH), Port Harcourt, Rivers State, between January and June 2023. A convenient, non-probability sampling technique was used to recruit participants who gave consent. Ethical Approval (UPTH/ADM/90/S.II/VOL.XI/1620) for the study was obtained from the Health Research and Ethics committee of the University of Port Harcourt Teaching Hospital, before commencement of the study. Patient with any systemic disease/condition such as

(diabetes mellitus, pregnancy, leukemia) that affects or modifies the periodontium were excluded from the study.

The semi-structured questionnaire used in this study had three sections. Section A included information on socio-demographics (age, gender, highest educational status, ethnicity, marital status and smoking). Section B included information on participants' oral hygiene practices (toothbrushing and use of interdental aids), while section C included intraoral examination to assess oral hygiene status and periodontal health status. Greene and Vermillion Oral Hygiene Index was assessed using the Simplified Oral Hygiene Index (OHI-S), [11] while Community Periodontal Index (CPI) modified, was used to assess periodontal health status. [12] The examination of signs of periodontal disease was performed with the aid of standardized CPITN-C probe and mouth mirror. The CPITN-C probe has a ball tip of 0.5 mm diameter, and black band markers between 3.5 mm to 5.5 mm from the tip and at 8.5 mm and 11.5 mm from the tip.

CPI Pocket scores
0= Healthy
1= Bleeding on probing
2= Presence of supragingival and subgingival calculus
3= Pocket depth 4-5mm
4= Pocket depth ≥ 6mm
Measurement of Community periodontal index was carried out by dividing the mouth in six sextants: 18-14, 13-23, 24-28, 34-38, 33-43 and 43-48. It was recorded only for index teeth. The indexed teeth in each sextant were examined by running the CPI probe around the whole circumference of the tooth and pocket depths were measured at six sites per tooth (mesio-buccal, mid-buccal, disto-buccal, mesio-, mid-, and disto-lingual/palatal). Using CPI code, Code 0 (Healthy) were categorized as healthy periodontium, code 1 (Bleeding on probing) and code 2 (Calculus detected during probing) were categorized into gingivitis, while code 3 (pocket depth of 4-5 mm depth) and code 4 (pocket depth of 6 mm or more) into periodontitis.
After a face-validity of the questionnaires by the first author and another dentist, the questionnaires were pre-tested among dental house officers to ensure simplicity and ease of understanding by the participants. Data were collected by two examiners and the Cohen's kappa coefficient for inter-examiner variation was 0.84.

Sample size calculation

The sample size was calculated using the Kish and Leslie formula for cross-sectional studies: Sample size = Z^2 pq/ $d^{2,}$ where Z = 1.96, p = prevalence of 7% of dental floss use among patients,[13] q = 1 - p. The minimum calculated sample size was 100.

Statistical Analysis

Statistical analysis was done using the Statistical Product and Service Solution (SPSS) version 25.0 (IBM SPSS Inc., Chicago, Illinois). Continuous variables were expressed as means and standard deviations. Categorical variables were presented as frequencies and percentages. Differences between groups were compared using the chi-square test for categorical variables and independent Student t test for continuous variables. P values < 0.05 were considered statistically significant.

RESULTS

Table 1 shows that one hundred and eight (108) participants were recruited for the study, the age range of the population was 17-78 years with mean age of 40.59 ± 14.33 years. There were 48 males and 60 females with M: F of 1:1.25. Most of the participants (60%) had tertiary education, 56.5% of the participants were married, and majority of the participants (93.5%) were not smokers.

Table 2 shows that 21 (20.8%), 24 (23.8%) and 19 (18.8%) of participants who used interdental cleaning aids, were in 20-29, 30-39, and 50-59 age groups respectively. In regards to gender, 57 (56.4%) of participants who used interdental cleaning aids were females, while the remaining 44 (43.6%) were males.

Concerning educational status, among those who used interdental cleaning aids, 11 (10.9%) had primary school education, 25 (24.8%) attended secondary school, 62 (61.4%) had tertiary education, while 3 (3.0%) attained postgraduate education.

Table 3 shows that 101 (93.5%) of the participants used interdental aids, while 7

(6.48%) of the participants did not use interdental cleaning aids. Among those participants who used interdental cleaning aids, majority (71.3%) used wooden toothpicks, 16.8% used dental floss, 1.0% each used interdental brush, broomsticks, dental floss & toothpicks, and pins & toothpicks. Considering reason why the type of interdental cleaning aids is being used, 46 (45.5%) of the participants claimed they were convenient to use, 42 (41.6%) participants claimed the interdental aids were available, 12 participants (11.9%) claimed they were cheap, while 1.0% gave no response.

Among participants who used dental floss, 4 (23.5%), 12 (70.0%) participants respectively claimed they were available and convenient to use, while one participant did not give any response. Among participants who used wooden toothpicks, 32 (44.4%), 11 (15.3%), and 29 (40.3%) participants respectively claimed they were available, cheap and convenient to use. Only one participant, who used interdental brush, claimed it was convenient to use.

Concerning frequency of use the interdental cleaning aids; 48.5% used them after every meal, 16.8% used them once daily, 25.7% used them 3-4 times weekly, while 8.9% used them once a month. When asked which area of the mouth, the interdental cleaning aids are being used, 62.4% claimed they used the interdental cleaning aids on all teeth in the mouth, while 37.6% claimed they used them on particular teeth.

Figure 1 shows that 21 (20.8%) used them on the molar teeth, while the least teeth where they are used on are the premolar (2.0%).

Figure 2 shows that 28 (27.7%) of the participants had pain when they used the interdental cleaning aids, among those who had pain, 22 (78.6%) used toothpick (df =8, p = 0.001). A little below half of the participants, 47 (46.5%) had bleeding gingiva when they use interdental cleaning aids, among those who had gingiva bleeding, 3 (6.4%) and 36 (76.6%) respectively used dental floss and toothpick (df = 8, p = 0.012). Thirty-two (31.7%) of the participants had gingival damage (gingival ulcer, gingival recession) as a result of use of interdental cleaning aids, among those who claimed they had gingival damage (gingival ulcer, gingival recession), 1(3.1) and 24 (75.0) used dental floss and toothpick respectively (df = 8, p = 0.002).

Table 4 shows that participants who did not use interdental cleaning aids had mean OHI-S score of 2.89 ± 1.04, while those who used interdental cleaning aids had mean OHI-S score of 2.48 ± 1.07. This finding is however, not statistically significant (p = 0.330).

Table 5 shows that among the participants who did not use interdental cleaning aids, 2 (28.6%) of them had CPI 1, 4 (57.1%) presented with CPI 2, while 1(14.3%) had CPI 4, while for the participants who use interdental cleaning aids, 8 (7.9%) had CPI 0, 66 (65.3%) had CPI 2 and 19 (18.8%) presented with CPI 3, none had CPI 4. This finding is statistically significant (p = 0.024).

Considering the frequency of use of the interdental cleaning aids and prevalence of CPI, among those who used interdental cleaning aids after every meal, 4 (8,2%) had CPI 0, 31 (66.3%) presented with CPI 2, while 10 (20.4%) had CPI 3. For those who used interdental cleaning aids once daily, 1 (5.9%) presented with CPI 0, 11 (64.7%) had CPI 2, while 5 (29.4%) had CPI 3. Among those that used interdental cleaning aids once a week, 1 (11.1%) had CPI 0, 6 (66,7%) had CPI 2, while 2 (22.2%) presented with CPI 3. These findings, however, were not statistically significant (p = 0.646).

Table 1: Sociodemographic of participants

Variables		Frequency	Percentage
Age group	17-19	7	6.5
	20-29	22	20.4
	30-39	25	23.1
	40-49	21	19.4
	50-59	22	20.4
	60-69	9	8.3
	70-79	2	1.9
Gender	Female	60	55.6
	Male	48	44.6
Education	Primary	11	10.2
	Secondary	28	25.9
	Tertiary	65	60.2
	Postgraduate	4	3.7
Marital	Single	40	37.0
	Married	61	56.5
	Widow(er)	5	4.6
	Separated	2	1.9
Ethnicity	Igbo	45	41.7
	Yoruba	6	5.6
	Others	57	52.8
Smoking	No	101	93.5
	Yes	5	4.6
	Stopped	2	1.9
	Total	108	100.0

Table 2: Sociodemographic distribution of interdental cleaning aids usage

Variables		
Age group (in years)	< 20	6 (5.9)
	20-29	21(20.8)
	30-39	24 (23.8)
	40-49	20 (19.8)
	50-59	19 (18.8)
	60-69	9 (8.9)
	70-79	2 (2.0)
Gender	Female	57 (56.4)
	Male	44 (43.6)
Educational status	Primary	11 (10.9)
	Secondary	25(24.8)
	Tertiary	62 (61.4)
	Postgraduate	3 (3.0)
	Total	101 (100.0)

Table 3: The use of interdental cleaning aids among the participants

Variables		Frequency	Percentage
Do you use interdental cleaning aids	Yes	101	93.5
	No	7	6.5
Type of interdental cleaning aids used	Dental floss	17	16.8
	Wooden toothpick	72	71.3
	Interdental brush	1	1.0
	Pins	3	3.0
	Fingernails	3	3.0
	Broomsticks	1	1.0
	Dental floss & toothpicks	1	1.0
	Pins & toothpicks	1	1.0
	Fingernails & toothpicks	2	2.0
Why use the type of interdental cleaning aids	Availability	42	41.6
	Cheap	12	11.9
	Convenience	46	45.5
	No response	1	1.0
Frequency of use	After every meal	49	48.5
	Once daily	17	16.8
	3-4 times weekly	26	25.7
	Once a month	9	8.9
Area of teeth used on	All teeth	63	62.4
	Particular teeth	38	37.6

Table 4: Interdental cleaning aids and Simplified Oral Hygiene index (OHI-S) scores among the respondents

Variables		Frequency (%)	Mean OHI-S	
			Mean ± SD	P value
Use of interdental cleaning aids	No	7 (6.48)	2.89 ± 1.04	0.330
	Yes	101 (93.52)	2.48 ± 1.07	

Table 5: Interdental cleaning aids and the prevalence of periodontal disease among the participants

Variables		Community Periodontal Index (CPI)						P value
		0 n (%)	1 n (%)	2 n (%)	3 n (%)	4 n (%)	Total n (%)	
Use of interdental cleaning aids	No	0 (0.0)	2 (28.6)	4 (57.1)	0 (0.0)	1(14.3)	7 (6.5)	**0.024**∗#
	Yes	8 (7.9)	8 (7.9)	66 (65.3)	19 (18.8)	0 (0.0)	101 (93.5)	
Frequency of use of interdental cleaning use	After every meal	4 (8.2)	4 (8.2)	31 (63.3)	10 (20.4)	0 (0.0)	49 (48.5)	0.646
	Once a day	1 (5.9)	0 (0.0)	11 (64.7)	5 (29.4)	0 (0.0)	17 (16.8)	
	3-4 times weekly	2 (7.7)	4 (15.4)	18 (69.2)	2 (7.7)	0 (0.0)	26 (25.7)	
	Once a week	1 (11.1)	0 (0.0)	6 (66.7)	2 (22.2)	0 (0.0)	9 (8.9)	

∗- significant, # Fischer exact

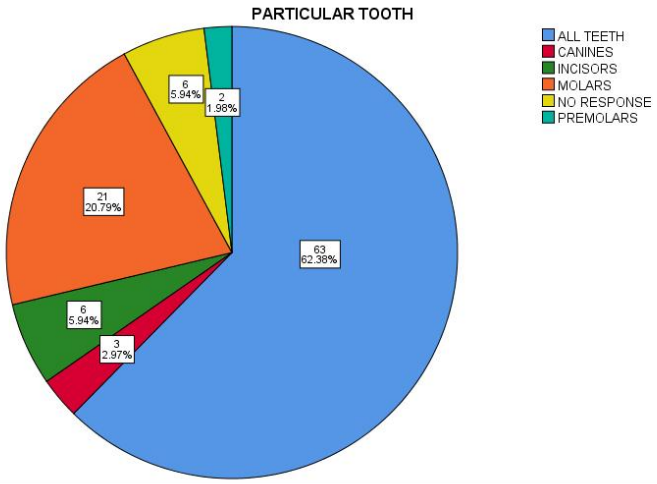

Figure 1: Distribution of interdental cleaning aids usage on the teeth

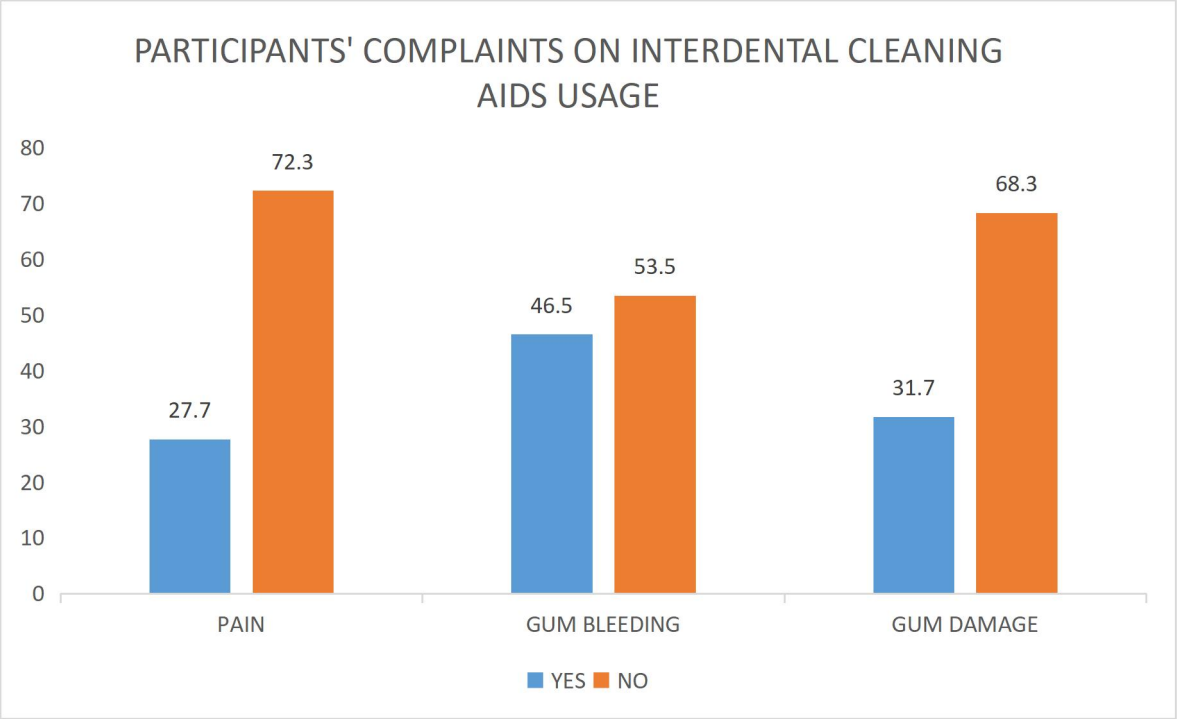

Figure 2: Participants' complaints on the use of interdental cleaning aids

DISCUSSION

In this study, we assessed the use of interdental cleaning aids and its association with oral hygiene status and prevalence of periodontal disease among the participants who attended the Periodontal Clinic at the University of Teaching Hospital. Most of the participants (93.52%) cleaned the interdental area with interdental cleaning aids. This finding is higher than the findings from other studies.[14, 15] While Soroye et al.,[14] reported that 73.1% of the participants cleaned the interdental areas with cleaning aids, Dosunmu et al.,[15] reported only 23.2% of the participants cleaning the interdental areas with cleaning aids. The discrepancy between the finding in this study and that of Soroye et al, could be that the level of knowledge about interdental clinic aids has increased over time, while the study by Dosunmu et al, could be that interdental cleaning aids were not readily available, as stated by the participants in that study. However, the finding of this study is in contrast to the study of Sathwara et al., [13] conducted in 2024 at a dental clinic in Ahmedabad, as majority of the participants were not aware of and did not use interdental cleaning aids. This discrepancy may be as a result of the difference in the location, and level of exposure of the participants, as this present study was conducted in a tertiary hospital, where some of the participants could be students of the University who are aware and conscious of their oral health, while the study by Sathwara et al was conducted in an institutional hospital, where most of the participants were members of the general population and may not be aware of oral health.

Regarding age, the age groups 20-39 years used interdental aids more in this study. This finding is similar to the finding of Chaffee et al.[16] This group represent young adults and it shows that the young adults were more aware of interdental cleaning aids and more conscious of their oral health and appearance than the older population.

Females are reported to be more interested in their health including oral health compared to the males; [17] this was corroborated in this study as more females used interdental cleaning aids than males. Regarding educational status, most of the participants who used interdental cleaning aids had tertiary education. This could be due to fact that higher level of education is reported to be associated with high level of health awareness. Again, the study was conducted in teaching hospital serving the University community around it. So, most of the participants may be staff and students from the University.

Interdental aids are most effective in eliminating interdental plaque. [18, 19] Dental floss was

regarded as the "gold standard" for reducing interdental plaque. [20] It was reported by the American Dental Association that dental floss could remove up to 80% of plaque located in the interdental area. [21] However, only 30% of adults were found to use floss regularly. [22] Despite the fact that dental floss has been reported to be effective in eliminate plaque in the interproximal areas of teeth, [23, 24] its use is technique-sensitive, time-consuming, and requires skills to use it efficiently. [25, 26] Another study considered interdental brush as the most effective aid for cleaning the interdental areas of the teeth, [27] as it was thought to have high patient acceptance, easier to use and have higher efficacy for plaque removal, [28] it has also been reported to reduce periodontal pathogens interdentally. [29] A meta- analysis conducted in 2015, reported that the use of interdental brush combined with brushing resulted in a 34% reduction in gingivitis and a 32% reduction in plaque scores, when compared with toothbrushing alone.[18]

In this study, although, majority of the participants used interdental cleaning aids, only a few used dental floss (16.8%) and interdental brushes (1.0%). This finding is similar to that of Soroye et al, [14] where only 24.4% of the participants used dental floss. Majority (71.3%) of the participants in this study used wooden toothpicks, this is in tandem with a previous study,[14] where most participants (71.2%) used toothpicks. Also, a study by Gufran et al in 2021, [30] revealed that 63.2% of the participants used toothpick as interdental cleaning aids. However, the finding in this study is in contrast to that by Dosunmu et al, [15] where majority (68.4%) of those, who utilized interdental cleaning aids, used dental floss, while 8.8% used dental sticks. The discrepancy between the finding in this study and that of Dosunmu et al, could be that the participants in this study, were not aware of dental floss. This is not encouraging, as the appropriate interdental cleaning aids and the right method of usage, will yield good result and not cause damage to the gingiva. Hence, dental practitioners should educate their patients on the different types of interdental cleaning aids and their appropriate usage.

The choice of interdental cleaning aids was reported to be affected by the patient's type of embrasures, health-care professionals' skills, and motivation to use interdental aids. [31] In this study, however, the participants' choice for particular interdental cleaning aids was based on convenience, availability and cost of the interdental aids. Majority of the participants, who claimed convenience, availability and cheapness, were reasons for usage, used wooden toothpicks. This finding is in tandem with a previous study in Nigeria, where participants used toothpicks, pins and broomsticks because they are cheaper and readily available in shops, market, also toothpicks are often distributed at social gathering. [32] It is imperative for dental practitioners to enlighten the populace of the traumatic effect of these on the gingiva.

Considering the frequency of use of the interdental cleaning aids, it was reported that there is reduction in interproximal caries, periodontal diseases and missing teeth in participants who use interdental cleaning aids for about 4 – 7 times weekly. [33] Another study [34] reported less plaque, calculus, and gingivitis among participants who practised regular interdental cleaning. More participants in this study used them after every meal and this finding is in tandem with the result of Soroye et al, [14] where most participants used interdental cleaning aids after every meal.

Most participants used the interdental cleaning aids on all the teeth, while a few used them on some particular teeth. For the participants who use interdental cleaning aids on particular teeth, most used them on the molar teeth, this may be because the molars are posteriorly located, have larger interproximal spaces and cannot be reached easily with toothbrushes, hence they have more plaque and food deposits interdentally. Also, it has been reported that the interproximal surfaces of molars and premolars, are mostly the sites of residual plaque, and are at higher risk of developing periodontal lesions and caries. [7] However, the premolars were the least teeth where interdental cleaning aids were used in this study.

Interdental cleaning aids are vital in the prevention of periodontal diseases and dental caries; however, they can be detrimental to oral health if overused or not appropriately utilized, such issues include irritation of the gingiva, gingival bleeding, ulceration, or defects of the gingiva.[10] This is corroborated in this study, as some participants reported experiencing some side effects from the use of the interdental

cleaning aids; the most complaints from the participants were gingival bleeding, then gingival damage (such as gingival ulcer, gingival recession) and a few complained of pain. These complaints were commoner among participants, who used dental floss and toothpicks. Although, how long the interdental cleaning aids was left in the interdental space, was not interrogated in the study. It is therefore imperative for dental practitioner to teach the patients and the populace, the appropriate use of interdental aids. Proper guidance and user instructions are essential in minimizing these risks and ensuring that interdental cleaning remains a safe and effective practice.

Considering the effect of interdental cleaning aids on oral hygiene status, in this study, there was no significant difference in the mean OHI-S score of those who used interdental cleaning aids and those who did not, this finding is in tandem with the report that interdental cleaning has more effect in the interdental area than on the facial surfaces, which is affected more with toothbrushing. [35] Conversely, there was statistically significant difference in the periodontal status between the participants who use interdental cleaning aids and those who do not; few of the participants, who used interdental cleaning aids had healthy periodontium (CPI 0) and none had advanced periodontitis (CPI 4). Among those who did not use interdental cleaning aids, none had healthy periodontium and one participant had advanced periodontitis. This finding follows the trends in previous studies. [8, 23, 36] Among those that used interdental cleaning aids, there was no significant different between the frequency of usage and periodontal disease. This may reflect the fact that provided the interdental cleaning aids are appropriately utilized, the timing of use is of little effect.

CONCLUSION

In this study, there was a statistically significant association between the use of interdental cleaning aids and periodontal health status but no statistically significant association between interdental aids and oral hygiene status. Gingival bleeding was the most common complaint associated with interdental cleaning aids.

Financial support and sponsorship

Nil

Conflicts of interest

There are no conflicts of interest.

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