Original Article

Oral Hygiene Practices and Status among Orthodontic Patients in a Nigerian Teaching Hospital

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Abstract

Background: Orthodontic treatment is performed to correct occlusal problems and improve the dentofacial complex; however, it comes with its peculiarities, such that patients require strict adherence to optimum oral hygiene. When oral hygiene is compromised during orthodontic treatment, accumulation of dental plaque on the appliance can lead to periodontal problems and dental caries. **Aim:** To assess the oral hygiene practices and status of orthodontic patients attending the Lagos University Teaching Hospital. **Materials and Methods:** Interviewer-administered questionnaires were used to assess the patients attending the orthodontic clinic for their routine appointments. Their oral hygiene status was assessed using the Simplified Oral Hygiene Index by Greene and Vermilion. The data were analyzed using Statistical Package for the Social Sciences (SPSS version 21.0). **Results:** One hundred and ten subjects (73 females and 37 males) with a female-to-male ratio of 2:1 were recruited for the study. The mean age of the subjects was 20.7 ± 7.89 years. All the subjects used a toothbrush to clean their teeth. Only 22.7% of the subjects brushed their teeth once daily, while 65% of the subjects brushed twice daily and 20% brushed more than twice a day. About 44% had good oral hygiene, 49.1% had fair oral hygiene, while 6.4% had poor oral hygiene. There was no statistically significant difference in the relationship between toothbrushing techniques, frequency of toothbrushing, and oral hygiene status. **Conclusion:** All the patients used toothbrush and toothpaste to clean their teeth. Majority of them had acceptable oral hygiene status irrespective of the frequency of toothbrushing.

Keywords: Oral hygiene, practices, status

Introduction

There is an increasing awareness of orthodontic treatment worldwide,[1,2] which is also widely accepted due to its beneficial effects on oral health. Orthodontic treatment has a positive effect on individuals by improving their dentofacial complex, which directly impacts positively on their overall oral health.[3] It is well documented that deviations from normal occlusion such as crowding, spacing, and deep bite serve as plaque retention areas, thus compromising the ability of the individual to maintain a good oral hygiene.[2,4] Orthodontic treatment is performed to help correct these problems, however, it requires strict adherence to optimum oral hygiene by the patients. If oral hygiene is compromised during orthodontic treatment, accumulation of dental plaque on the appliance can lead to periodontal problems and dental caries.

Previous studies[5-7] have reported an association between fixed orthodontic treatment and increased plaque accumulation around the appliance and its components such as brackets and bands. Hadler-Olsen *et al*.[8] assessed the effect of a comprehensive prophylactic regimen on the incidence of white spot lesions and caries during orthodontic treatment. They observed that orthodontic patients in their study found it difficult to maintain a comprehensive oral hygiene regimen evidenced by a significantly higher risk for developing white spot lesions than untreated patients. This provides a rationale for maintaining proper oral hygiene, which should be performed effectively by patients undergoing orthodontic treatment. Otherwise, it can affect the quality and timing of their orthodontic therapy.[9]

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The use of removable or fixed appliance therapy for orthodontic patients may prevent such patients from cleaning their teeth appropriately.[10] This eventually leads to the development of dental caries and periodontal complications such as gingivitis, periodontitis, gingival recession or hypertrophy, alveolar bone loss, dehiscences, fenestrations, and dark (black) triangles.[11-13] Periodontal problems are common side effects seen during orthodontic treatment.[11,14] It is plausible to reason that when teeth are properly aligned, they can be cleaned more easily, thus leading to a healthier periodontium. Dental plaque has been identified as the most important factor that initiates and leads to the progression of periodontal disease.[15] Periodontal diseases have been associated with poor oral health quality of life and several chronic systemic conditions.[16]

In order to prevent periodontal disease, it is important for orthodontic patients to follow proper plaque control measures. The control and removal of plaque are achieved mechanically or chemically. Mechanical plaque control measures include the use of toothbrushes and interdental cleaning aids such as dental floss. Chemical control is facilitated using topical agents including mouth rinses and toothpastes. The use of fluoride toothpastes and rinses on a daily basis may reduce or prevent dental caries.[17]

Although there are few previous studies[18,19] on oral hygiene practices and status among orthodontic patients in Nigeria, these studies have either emphasized the relationship between occlusal characteristics and other oral hygiene practices or reported the oral hygiene status of orthodontic patients and practices.[19] The present study seeks to emphasize among other factors, the relationship between oral hygiene practices and status of patients undergoing orthodontic treatment. The findings will reinforce the importance of the oral health-care needs and compliance with oral hygiene instructions among our orthodontic patients and provide a scientific basis for improving/modifying the treatment protocol regarding their oral hygiene. Furthermore, it will provide more information for planning future preventive oral health programs.

Therefore, the aim of the study was to assess the oral hygiene practices and status of orthodontic patients attending the Orthodontic Clinic of the Lagos University Teaching Hospital, Lagos, Nigeria, and to determine the association between the toothbrushing technique, frequency, and oral hygiene status.

Materials and Methods

This was a cross-sectional survey, which took place between December 2017 and August 2018 at the Orthodontic Clinic of the Department of Child Dental Health at the Lagos University Teaching Hospital, Lagos, Nigeria. Ethical approval for the study was obtained from the Research and Ethics Committee of the Lagos University Teaching Hospital (ADM/DCST/HREC/APP/2062). Written informed consent was obtained from all subjects who were over 18 years of age, while assent was obtained from subjects under the age of 18 years and informed consent was obtained from a parent or guardian of these subjects. Subjects who were on orthodontic treatment for at least six weeks and who presented for routine checkup/appointment at the orthodontic clinic were recruited for the study. The subjects had not visited the dental hygienist since the orthodontic appliance was fixed for them.

The sample size estimation was determined by utilizing the Fisher's formula for calculating sample size for descriptive cross-sectional research studies.[20]

$$n = \frac{Z^2 pq}{d^2}$$

where n is the estimate of the sample size.

Z is the critical value at the level of the chosen confidence level.

d^2 the level of precision set at 0.05.

p = Estimated proportion of an attribute (proportion of individuals who had knowledge of oral health awareness) that is present in the population (93.5%; 0.935) based on information from the available literature.[21]

$q = 1 - p$

$Z = 1.96$ standard error at 95% level of confidence

$q = 1 - p$

$d = 0.05$

$$\frac{1.96^2 \times 0.935 \times 0.065}{0.0025} = \frac{0.2335}{0.0025} = 93.4$$

From the above calculation, the minimum sample size was 93.4. In order to compensate for attrition, the sample size was adjusted upward by 10%. The sample size eventually used was 110.

Interviewer-administered questionnaires were used to obtain information from the subjects. The questionnaire assessed the sociodemographic characteristics, oral hygiene practices such as toothbrushing techniques, frequency, and the use of oral hygiene adjuncts such as interdental brushes, dental floss, and mouth rinses by the subjects.

The oral hygiene status was assessed using the Simplified Oral Hygiene Index (OHI-S) by Greene and Vermilion.[22] The patients were examined using a dental mirror and probe under good illumination on a dental chair. The standard six tooth surfaces of the designated teeth were examined for debris and calculus. The surfaces examined were the buccal surfaces of the first upper right and left molars, the lingual surfaces of the first lower right and left molar, the labial surface of the upper right central incisor, and the labial surface of the lower left central incisor.

The debris scores for each individual were totalled and divided by the number of surfaces scored to obtain the debris index score. The calculus scores were totalled and divided by the number of surfaces scored to obtain the calculus index

score. The OHI score was obtained by adding the debris and calculus index scores. The OHI was graded as good (0–1.2), fair (1.3–3.0), or poor (3.1–6.0).

The subjects were asked to demonstrate how they brush their teeth using a model and based on their description; their technique of toothbrushing was selected.

The various teeth brushing techniques are as follows.

Bass technique

When the head of the toothbrush is placed in an oblique direction toward the root of the teeth aiming to introduce the bristles on the gingival sulcus, the brush is then shifted in anteroposterior direction, using short rhythmic movements.

Roll technique

With this technique, the bristles are placed at the junction of the crown of the tooth and the gingiva pointing apically toward the roots. The head of the brush is then rotated upward on the lower teeth and downward on the upper teeth toward the occlusal surface.

Circular technique

The teeth are closed together with the toothbrush at 90° to the teeth; a small circular action is used covering the maxillary and mandibular posterior teeth. For the anterior teeth, the incisors are placed edge to edge, and the mouth is opened to clean the remaining surfaces.

Horizontal technique

Here, the toothbrush is placed at an angle of 90° in relation to the dental surface and a horizontal movement is applied. The toothbrush is swept along the teeth backward and forward in long strokes covering all the surfaces.[23]

The data were analyzed using IBM Statistical Package for Social Sciences (IBM SPSS) version 21.0 (IBM Corp., Armonk NY, USA). The results were presented in frequency tables. Pearson's Chi-square test was used to determine the association between frequency of toothbrushing and oral hygiene status, while Fisher's exact test was used to determine the association between toothbrushing technique and the oral hygiene status. The *P* values of 0.05 or less were considered statistically significant.

Results

One hundred and ten subjects, 73 females (66.4%) and 37 males (33.6%), age ranged 9–39 years (mean 20.7 ± 7.89 years), were recruited into the study. Patients on fixed appliance were 106, while those on removable appliance were 4. Table 1 shows the sociodemographic representation of the study population. The majority (57; 51.8%) of the subjects were within the age group of 11–20 years.

Figure 1 shows that all the subjects used toothbrush and toothpaste to clean their teeth daily. Regarding the daily use of adjuncts, 12.8% of the study population made use of mouthwashes, 16.4% used dental floss, 5.5% interdental brush, 11.8% used toothpick, while only 0.9% used oral irrigator.

Table 2 shows the frequency of toothbrushing. Twenty-five (22.7%) subjects brushed their teeth once daily, 65 (59.1%) brushed twice daily, while 20 (18.2%) brushed more than twice daily. Majority (67; 60.9%) of the subjects brushed their teeth both in the morning and at night. Only 17 (15.5%) subjects brushed after every meal.

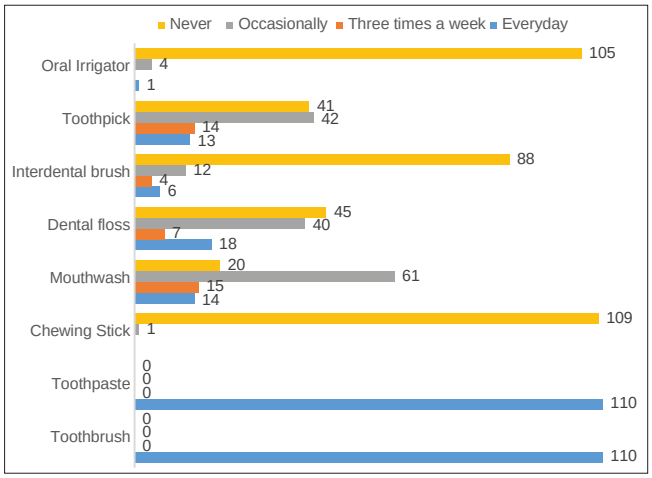

Figure 1: Frequency of use of tooth cleaning aids

Table 1: Sociodemographic characteristics

Variable	Frequency (%)
Age (years)	
1–10	4 (3.7)
11–20	57 (51.8)
21–30	34 (30.9)
31–40	14 (12.7)
41–50	1 (0.9)
Total	110 (100.0)
Mean age	20.7+7.9
Sex	
Female	73 (66.4)
Male	37 (33.6)
Total	110 (100.0)

Table 2: Frequency of toothbrushing

	Frequency (%)
Number of times toothbrushing	
Once only	25 (22.7)
Twice	65 (59.1)
More than twice	20 (18.2)
Total	110 (100.0)
Times of toothbrushing	
After every meal	17 (15.5)
Morning alone after meals	6 (5.5)
Morning alone before meals	20 (18.2)
Morning and night	67 (60.9)
Total	110 (100)

Table 3 shows the method of toothbrushing employed by the subjects.

Forty-five (40.9%) subjects had no particular method of toothbrushing. This was followed by 22 (20%) of the subjects who employed the horizontal technique of toothbrushing. Fourteen (12.7%) subjects employed the circular technique, 18 (16.4%) used the roll technique, and 11 (10%) used the bass technique.

Table 4 shows the oral hygiene status of the subjects. Forty-nine (44.5%) subjects had good oral hygiene, 54 (49.1%) had fair oral hygiene, and 7 (6.4%) had poor oral hygiene.

Table 5 shows the gender difference in the oral hygiene status of the subjects. The mean OHI in the entire study population was 1.57 ± 0.786, males (1.76 ± 0.983) and females (1.47 ± 0.831). There was also no statistically significant difference between the mean OHI of male and female subjects ($P = 0.099$).

Table 3: Toothbrushing techniques employed by the subjects

Variable	Frequency (%)
Toothbrushing method	
Bass	11 (10.0)
Roll	18 (16.4)
Circular	14 (12.7)
Horizontal (Scrub)	22 (20.0)
No particular method	45 (40.9)
Total	110 (100.0)

Table 4: Oral hygiene status of the subjects

Oral hygiene grades	Frequency (%)
Good (0-1.2)	49 (44.5)
Fair (1.3-3.0)	54 (49.1)
Poor (>3.0)	7 (6.4)
Total	110 (100.0)

Table 6 shows that there was no statistically significant association between the frequency toothbrushing and the oral hygiene status ($P = 0.790$).

Table 7 shows no statistical significance between the toothbrush technique and oral hygiene status ($P = 0.998$).

Discussion

The majority of the subjects (57; 51.8%) in the present study were within the age group of 11–20 years. This observation is in agreement with other studies which have reported that this is the predominant age group that present for orthodontic treatment in Nigeria.[18,24] There were more females (66.4%) than males (33.6%) in the entire study population. This observation has been corroborated by other studies[18,24-27] that show that female subjects seek more orthodontic treatment than their male counterparts. Ajayi and Azodo[18] and Lee *et al*.[27] reported that more females sought orthodontic treatment than male subjects. Mahajan[26] equally reported in her study that females sought orthodontic treatment than males. The reason for the higher number of females seeking orthodontic treatment could be because females tend to show more concern for their appearance. Mahajan[26] equally reported that females gave more importance to aesthetics than male subjects, hence sought orthodontic treatment more than their male counterparts. However, this observation was contrary to a study by Adeyemi and Otuyemi[28] who reported more males in their study than females.

All the subjects in the present study used toothbrush and toothpaste as a cleaning tool. This is in agreement with most studies on oral hygiene practices in orthodontic patients.[18,27,29-31] The reason for this could be because after treatment, orthodontic patients are given instructions on oral hygiene practices. These practices encourage them to use toothbrush and toothpaste, which is the most common method of tooth cleaning and widespread personal oral hygiene care practice.[27]

Table 5: Gender differences in mean oral hygiene indices

Gender	Male	Female	Total study population	*T*-test	*P*
n	37	73	110	1.665	0.099
Mean OHI	1.76	1.47	1.57		
Standard Deviation	0.983	0.831	0.786		

Test of statistics used Student's *t*-test. OHI: Oral hygiene index

Table 6: Association between frequency of toothbrushing and oral hygiene status

	OHI Grades			Total, *n* (%)	Pearson's chi-square test χ^2	*P*
	Good, *n* (%)	Fair, *n* (%)	Poor, *n* (%)			
Frequency of toothbrushing						
Once	13 (11.8)	10 (9.1)	2 (1.8)	25 (22.7)	1.704	0.790
Twice	26 (23.6)	35 (31.8)	4 (3.6)	65 (59.1)		
More than twice	10 (9.1)	9 (8.2)	1 (0.9)	20 (18.2)		
Total	49 (44.5)	54 (49.1)	7 (6.4)	110 (100)		

Test of statistics used - Pearson's chi-square test, *P* value significant at ≤0.05

Table 7: Association between toothbrushing technique and oral hygiene status

	OHI GRADES			Total, *n* (%)	Fisher's Exact test	*P*
	Good, *n* (%)	Fair, *n* (%)	Poor, *n* (%)			
Toothbrushing technique						
Bass	4 (3.6)	6 (5.5)	1 (0.9)	11 (10.0)	2.038	0.994
Roll	8 (7.3)	9 (8.2)	1 (0.9)	18 (16.4)		
Circular	7 (6.4)	6 (5.5)	1 (0.9)	14 (12.7)		
Scrub	9 (8.2)	12 (10.9)	1 (0.9)	22 (20.0)		
No Particular method	21 (19.1)	21 (19.1)	3 (2.7)	45 (40.9)		
Total	49 (44.5)	54 (49.1)	7 (6.4)	110 (100)		

Test of statistics used - Fisher's exact test

The use of oral hygiene adjuncts such as mouth rinses and interdental brushes was not popular among the subjects in the present study. This was similar to the study by Baheti and Toshniwal,[29] where only 31.33% of their subjects used mouth rinses and 22.66% used interdental brushes in addition to using toothbrush and toothpaste. Atassi and Awartani[30] equally reported low use of adjuncts such as dental floss, interdental brush, and toothpick in their study. Khraisat *et al*.[31] also documented a low use of interdental brushes and mouthwashes. On the contrary, Lee *et al*.[27] reported that the majority (64%) of their study population used mouthwashes during orthodontic treatment. The reason for the non enthusiastic use of adjuncts in the present study could be because most patients may prefer to adhere to their traditional method of toothbrushing technique[32] and may not easily embrace additional cleaning aids that require some form of manual dexterity and probably extra expense on the part of the subjects.

The present study revealed that more than half of the subjects brushed twice daily. This is in agreement with several studies.[27,30-35] Many of these studies reported that brushing twice daily during orthodontic treatment is enough to maintain a good oral hygiene. Atassi and Awartani[30] reported that 54% of the subjects in their study brushed their teeth twice daily. Similarly, studies by Ajayi and Azodo,[18] Khraisat *et al*.,[31] and Nadar and Dinesh[35] reported that the majority of the subjects in their studies brushed twice daily.

The majority of the subjects in the present study did not adopt any particular technique of toothbrushing. On the contrary, Atassi and Awartani[30] reported that the majority of their patients used the horizontal method of toothbrushing, while Nadar and Dinesh[35] reported that the majority of the patients in their study brushed using circular strokes. Despite the existence of many toothbrushing techniques, many reports have suggested the use of the modified bass technique as a more effective method in removing food debris and plaque from fixed orthodontic appliances among orthodontic patients.[32,35,36] The subjects in the present study who did not adopt any particular method of toothbrushing may not have been instructed on the use of any toothbrushing technique at the commencement of orthodontic treatment. They may have been given instructions on the maintenance of good oral hygiene with emphasis on removal of food debris and deposits around orthodontic brackets.

Overall, the oral hygiene status of the subjects in the present study was fair (mean = 1.57). Similarly, Ajayi and Azodo[18] reported good oral hygiene status among orthodontic patients in their study. Onyeaso *et al*.[19] also reported a good oral hygiene status among the patients in their study. The findings of the present study, however, contrasts with that of Atassi and Awartani[30] who reported unsatisfactory oral hygiene in more than half of their patients even though they brushed twice daily. The fair oral hygiene status in the present study could be that the patients were diligently taught on how to maintain oral hygiene during orthodontic treatment and these instructions were reinforced during routine appointments. Wang *et al*.[37] equally reinforced this notion in their study where they observed that detailed oral hygiene instructions and communication of the required information significantly improved oral hygiene status of patients.

There was no statistically significant difference between the mean OHI in females and males in the present study ($P = 0.099$). Similarly, Ajayi and Azodo[18] reported no statistically significant gender difference in the distribution of oral hygiene status in orthodontic patients in their study. The reason for the finding in the present study could be because all the subjects received similar oral hygiene instructions irrespective of gender and probably adhered strictly to the post-treatment instructions given to them.

Pearson's Chi-square test showed that the frequency of toothbrushing did not significantly affect the oral hygiene status of the subjects in the present study ($P = 0.790$). The majority of the patients in the present study achieved satisfactory oral hygiene status irrespective of the frequency of toothbrushing. On the contrary, Atassi and Awartani[30] reported that their patients had poor oral hygiene despite the fact they brushed twice daily; they therefore suggested that emphasizing frequency of toothbrushing alone may not be adequate for achieving good oral hygiene status in these patients. Motivation and continuous reinforcement are equally necessary in helping the patient achieve good oral hygiene status.

In the present study, toothbrushing techniques did not significantly affect the oral hygiene status of the subjects ($P = 0.994$). Majority of the subjects had fair oral hygiene irrespective of their toothbrushing techniques. On the contrary, Nassar *et al*.[36] reported that the bass technique of

toothbrushing was found to be most effective in the reduction of periodontal clinical parameters in patients with fixed orthodontic appliances.

Conclusion

All the subjects adopted toothbrushing as their tool for oral hygiene practices in the present study. Majority of them brushed twice daily, and their oral hygiene status was satisfactory. There was no significant association between the frequency of toothbrushing and oral hygiene status. Similarly, there was no significant association between toothbrushing technique and oral hygiene status.

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Conflicts of interest

There are no conflicts of interest.

References

1. Nattrass C, Sandy JR. Adult orthodontics-a review. Br J Orthod 1995;22:331-7.
2. Gottlieb EL, Nelson AH, Vogels DS. Orthodontic practice study Part I. Trends J Clin Orthod 1997;31:675-684.
3. Nadar S, Saravana D. A questionnaire study about oral hygiene awareness among orthodontic patients. Int J Orthod Rehab 2016;7:97-100.
4. Kapoor D, Gill S, Singh A, Kaur I, Kapoor P. Oral hygiene awareness and practice amongst patients visiting the Department of Periodontology at a Dental College and Hospital in North India. Indian J Dent 2014;5:64-8.
5. Topaloglu-Ak A, Ertugrul F, Eden E, Ates M, Bulut H. Effect of orthodontic appliances on oral microbiota-6 month follow-up. J Clin Pediatr Dent 2011;35:433-6.
6. Kim K, Heimisdottir K, Gebauer U, Persson GR. Clinical and microbiological findings at sites treated with orthodontic fixed appliances in adolescents. Am J Orthod Dentofacial Orthop 2010;137:223-8.
7. Migliorati M, Isaia L, Cassaro A, Rivetti A, Silvestrini-Biavati F, Gastaldo L, *et al*. Efficacy of professional hygiene and prophylaxis on preventing plaque increase in orthodontic patients with multibracket appliances: A systematic review. Eur J Orthod 2015;37:297-307.
8. Hadler-Olsen S, Sandvik K, El-Agroudi MA, Øgaard B. The incidence of caries and white spot lesions in orthodontically treated adolescents with a comprehensive caries prophylactic regimen-a prospective study. Eur J Orthod 2012;34:633-9.
9. Cozzani M, Ragazzini G, Delucchi A, Mutinelli S, Barreca C, Rinchuse DJ, *et al*. Oral hygiene compliance in orthodontic patients: A randomized controlled study on the effects of a post-treatment communication. Prog Orthod 2016;17:41.
10. Olympio KP, Bardal PA, de M Bastos JR, Buzalaf MA. Effectiveness of a chlorhexidine dentifrice in orthodontic patients: A randomized-controlled trial. J Clin Periodontol 2006;33:421-6.
11. Talic NF. Adverse effects of orthodontic treatment: A clinical perspective. Saudi Dent J 2011;23:55-9.
12. Alfuriji S, Alhazmi N, Alhamlan N, Al-Ehaideb A, Alruwaithi M, Alkatheeri N, *et al*. The effect of orthodontic therapy on periodontal health: A review of the literature. Int J Dent 2014;2014:1-8.
13. Preoteasa CT, Ionescu E, Preoteasa E. Chapter 18 risks and complications associated with orthodontic treatment. In: Bourzgui F, editor. Orthodontics-Basic aspects and Clinical Considerations. Rijeka, Croatia: In Tech.; 2012. p. 403-28.
14. Dannan A. An update on periodontic-orthodontic interrelationships. J Indian Soc Periodontol 2010;14:66-71.
15. Genco RJ, Borgnakke WS. Risk factors for periodontal disease. Periodontol 2000 2013;62:59-94.
16. Arigbede AO, Babatope BO, Bamidele MK. Periodontitis and systemic diseases: A literature review. J Indian Soc Periodontol 2012;16:487-91.
17. Travess H, Roberts-Harry D, Sandy J. Orthodontics. Part 6: Risks in orthodontic treatment. Br Dent J 2004;196:71-7.
18. Ajayi EO, Azodo CC. Oral hygiene status among orthodontic patients attending university of Benin teaching hospital, Benin city. Nigeria J Dent Health Oral Disord Ther 2014;1:97-9.
19. Onyeaso CO, Arowojolu MO, Taiwo JO. Oral hygiene status and occlusal characteristics of orthodontic patients at University College Hospital, Ibadan, Nigeria. Odontostomatol Trop 2003;26:24-8.
20. Charan J, Biswas T. How to calculate sample size for different study designs in medical research? Indian J Psychol Med 2013;35:121-6.
21. Ajayi EO, Azodo C. O Oral health knowledge, attitude and practice among orthodontic patients seen at the university of Benin teaching hospital, Nigeria. Ann Biomed Sci 2015;14:16-25.
22. Greene JC, Vermillion JR. The simplified oral hygiene index. J Am Dent Assoc 1964;68:7-13.
23. Wainwright J, Sheiham A. An analysis of methods of tooth brushing recommended by dental associations, toothpaste and toothbrush companies in dental texts. Br Dent J 2014;217;1-4.
24. Onyeaso CO. Demand and referral pattern for orthodontic care at University College Hospital, Ibadan, Nigeria. Int Dent J 2004;54:250-4.
25. Motloba DP, Sethusa MPS, Ayo-yusuf OA. The psychosocial impact of malocclusion on patients seeking orthodontic treatment at a South African oral health training centre. S Afr Dent J 2016:71:200-5.
26. Mahajan M. Are adults enough motivated for orthodontic treatment: A questionnaire study. Indian J Multidiscip Dent: 2017;7:87-93.
27. Lee JH, Abdullah AA, Yahya NA. Oral hygiene practices among fixed orthodontic patients in a university dental setting. Int J Oral Dent Health 2016;2:1-4.
28. Adeyemi TE, Otuyemi OD. The pattern of presentation of malocclusion at Aminu Kano Teaching Hospital, Kano, Nigeria. West Afr J Orthod 2016;5:23-6.
29. Baheti MJ, Toshniwal NG. Survey on oral hygiene protocols among orthodontic correction-seeking individuals. J Educ Ethics 2015;5:8-13.
30. Atassi F, Awartani F. Oral hygiene status among orthodontic patients. J Contemp Dent Pract 2010;11:E025-32.
31. Khraisat HM, Al-Shdeifat NA, Al-Alawneh AM, Al-Zyood AI, Al-Maani MO. Oral hygiene practices among fixed orthodontic patients in Az-zaarqa. Jordan Pakistan Oral Dent J 2016;36:404-7.
32. Laing E, Ashley P, Gill D, Naini F. An update on oral hygiene products and techniques. Dent Update 2008;35:270-2, 275-6, 278-9.
33. Elanchezhiyan S, Raja. Awareness on gingival health among orthodontic correction seeking individuals. J Indian Acad Dent Specialist 2010;1:19-21.
34. Al-Shammari KF, Al-Ansari JM, Al-Khabbaz AK, Dashti A, Honkala EJ. Self-reported oral hygiene habits and oral health problems of Kuwaiti adults. Med Princ Pract 2007;16:15-21.
35. Nadar S, Dinesh SP. A questionnaire on the study of oral hygiene awareness among orthodontic patients. Int J Orthod Rehab 2016;7:97-100.
36. Nassar PO, Bombardelli CG, Walker CS, Neves KV, Tonet K, Nishi RN, *et al*. Periodontal evaluation of different toothbrushing techniques in patients with fixed orthodontic appliances. Dental Press J Orthod 2013;18:76-80.
37. Wang SY, Yang Y, Chang HO. The effect of an oral hygiene instruction intervention on plaque control by orthodontic patients. J Dent Sci 2007;2:45-51.