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Assessment of oral hygiene practice during active orthodontic treatment in Saudi Arabia

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ABSTRACT

Background: Good oral hygiene is a critical factor to ensure good orthodontic treatment. Maintaining good oral hygiene in orthodontics is one of the essential factors related to compliance. Assessment of oral hygiene practices is crucial for adequate understanding of the patients' oral healthcare need, which may influence the quality and timing of the therapy. *Methods:* This is an epidemiological study based on electronic survey questionnaire. This research was performed among active orthodontic patients in Saudi Arabia. The study group included at least 384 aged above 18 years. The outcomes of this study will be analysed using the SPSS program using a pre tested questionnaire. *Results:* 505 individuals in total, with a mean age of 24.6 ± 11.8 years and ages ranging from less than 14 to 60. 448 (88.7%) of the participants or 274 women (54.3%), go to private clinics. Participants in the study practice cleaning their teeth. A total of 418 participants (82.8%) brushed their teeth. Brush and electric were both typical for 58.1% and 12.2% of individuals who complied with TB, respectively. Regarding frequency, 42.6% of subjects had TB once, while 37.6% had it twice. *Conclusion:* More than half of the participants in the study had poor self reported oral hygiene, particularly when it came to how frequently they used mouthwash and other oral hygiene techniques like brushing. The majority of patients reported using subpar procedures and just a small percentage of participants performed dental care in accordance with best practices.

Keywords: Orthodontic Treatment, Oral Hygiene, Tooth brushing practice.

1. INTRODUCTION

Orthodontic treatments are directly linked to oral health-related quality of life (OHRQOL) and the benefits of cosmetics, oral facial functionality and psychological well being are some of the main reasons for obtaining orthodontic treatment (Paes et al., 2020). Oral hygiene has essential role during orthodontic treatment, which may change quality and timing of

orthodontic treatment (Al-Jewairet al., 2011). Good oral hygiene is very critical factor to ensure good orthodontic treatment (Guo et al., 2020). A high level of oral hygiene plays a major role for successful orthodontic treatment because side effects, such as enamel demineralization, gingival inflammation and halitosis, negatively affecting their quality of life (Camm et al., 2017; Hamilton and Coulby, 1991). In addition to encouraging biofilm deposition, the use of orthodontic appliances raises the number of cariogenic bacteria in the dental biofilm, increasing the risk of negative effects associated with bio films (e.g; enamel demineralization). Even though the majority of patients report practicing daily oralhygiene, biofilm related oral diseases continue to be very common among orthodontic patients (Ren et al., 2014). Due to the diminished impact of mechanical chewing and the cleansing action of saliva on food residues, self cleansing is also more challenging. Plaque build-up, gin givitis, dental decay and periodontitis are all conditions that can result from poor oral hygiene and prolong or even end orthodontictherapy. The patients must completely adhere to the oral hygiene instructions that should be given to them (Nadar and Saravana, 2016). Due to the benefits, it confers on the dentofacial complex, orthodontic therapy is generally acknowledged and approved in routine dental practice. Fixed orthodontic appliances allow doctors to provide patients with functional occlusion establishment, oral health improvement and dentofacial complex esthetic improvement (Chen et al., 2010).

Oral health can be affected by orthodontic treatment, abnormalities in the development of the face and jaws and other factors. Lack of space, tooth rotation or an open-bite, a deep-bite and a cross bite are examples of deviations from the normal tooth arrangement and position that encourage the build-up of dental plaque (Kang and Kang, 2014). Using motivational approaches, which are potentially more useful to achieve behavioural changes than conventional health education (Fjeldsoe et al., 2009). There plaque accumulation and gingival inflammation both might be equally reduced in well motivated patients (Lang et al., 1999). Also, text messaging can help people maintain better dental hygiene compliance in orthodontic patients. In dentistry, telephone calls and text messages may reduce appointment no show rates (Cozzani et al., 2016; Foley and Neill, 2009). Several studies have recently demonstrated that a telephone call or a text message from a healthcare provider during the first hours following orthodontic treatment significantly decreases post procedural pain and anxiety. According to research by Lee et al., (2016) 64% of orthodontic patients used mouthwash while undergoing treatment. However, according to other studies, orthodontic patients use mouthwash less frequently (Kulshrestha et al., 2020).

According to a Swedish study, even after two years of fluoride toothpaste intervention, clients' attitudes toward and behaviour's related to using it and their brushing routines were noticeably unsatisfactory. Most sample participants cited "fresh breath" as their top reason for practicing oral hygiene. Perhaps dental professionals could use this as a motivator when promoting health (Nordstrom and Birkhed, 2017). Plaque build-up and gingival irritation can both be reduced in motivated patients. Orthodontic patients are encouraged to use 20 ml of mouthwash twice a day as a supplement to brushing and flossing (Hamilton and Coulby, 1991). Nevertheless, in patients who are motivated, plaque build-up and gingival irritation can both be decreased in equal measure. As a result, it is crucial to emphasis oral hygiene advice to orthodontic patients receiving treatment with a fixed appliance (Al-Jundi, 2014).

The primary objectives are to assess the practice of oral hygiene procedures in active orthodontic patients in Alahsa Saudi Arabia through an online self reported questionnaire and the secondary objectives is to compare the practice of oral hygiene procedures according to age group, gender and treatment facility (government private).

2. MATERIALS AND METHODS

Study design

This is an epidemiological Study: Cross sectional study based on online questionnaire survey was conducted between August 2021 to 2022 October. This research was performed among active orthodontic patients in Saudi Arabia.

Sample size

The Sample size was estimated using the formula: n= P (1-P)* Zα2 / d ^{2}with a confidence level of 95%

n: Calculated sample size

Z: The z-value for the selected level of confidence (1- a) = 1.96.

P: An estimated prevalence of knowledge

Q: (1 – 0.50) = 50%, i.e., 0.50

D: The maximum acceptable error = 0.05.

So, the calculated minimum sample size was: n = $(1.96)^2$ X 0.50 X 0.50/ $(0.05)^2$ = 384.

Study variables

1. Type of tooth brushing
2. Frequency of tooth brushing
3. Duration of tooth brushing
4. Frequency of mouthwash
5. Duration of mouthwash
6. Type of interdental cleansing
7. Frequency of interdental cleansing

Method for data collection and instrument

For collecting the data, a Self reported online questionnaire distributed among Alahsa people in social media. The survey involved characteristics of the target population, specialty. The participants asked about their practice. In order to determine the feasibility, application and clarity of the study, pilot research was conducted on 10% of the collected sample, but no adjustments were made. The nurses who participated in the pilot experiment weren't part of our sample.

Data management and analysis

Data were collected and analysed using statistical software IBM SPSS version 22 (SPSS, Inc. Chicago, IL). All statistical analysis was done using two tailed tests. Pvalue less than 0.05 was statistically significant. Descriptive analysis using frequency and percent distribution was done for all variables including demographic data, mouth washing practice, inter dental cleaning and tooth brushing. Cross tabulation was used to assess distribution of participant's mouth hygiene according their personal data. Relations significance was tested using Pearson chi square test.

3. RESULTS

The study included 505 participants whose ages ranged from less than 14 years to 60 years with mean age of 24.6 ± 11.8 years old. Exact of 274 (54.3%) participants were females and 448 (88.7%) attend private clinics (Table 1).

Table 1 Demo graphic characteristics of study participants, Saudi Arabia

Demographic data	No	%
Age in years		
< 14 Yrs.	31	6.1%
14-25	240	47.5%
26-40	182	36.0%
> 40 Yrs.	52	10.3%
Gender		
Male	231	45.7%
Female	274	54.3%
Clinic type		
Private	448	88.7%
Public	57	11.3%

Table 2 shows Tooth brushing practice among study participants. Exact of 418 (82.8%) participants did tooth brushing. Brush was normal among 58.1% of those who compliant to TB and electric among 12.2%. Regarding TB frequency, it was for once among 42.6% of the participants and twice among 37.6%. Considering duration of TB, 55.7% of the respondents' brush for 1-2 minutes and 21.3% for lessthan 1 minute as for quality of brushing, it was useless among 2.6%, bad among 13.2%, with errors among 37.1%, inadequate among 24.4% while 7.1% did it good or very good.

Table 2 Tooth brushing practice among study participants, Saudi Arabia

Tooth brushing data		No	%
Tooth brushing	Yes	418	82.8%
	No	87	17.2%
Toothbrush type	Normal	243	58.1%
	Electric	51	12.2%
	Ortho brush	124	29.7%
Tooth brushing frequency	< once	31	7.4%
	Once	178	42.6%
	Twice	157	37.6%
	> twice	52	12.4%
Tooth brushing duration	< minute	89	21.3%
	1-2 minutes	233	55.7%
	3-5 minutes	82	19.6%
	> 5 minutes	14	3.3%
Quality of brushing	Useless	11	2.6%
	Bad	55	13.2%
	With errors	155	37.1%
	Inadequate	102	24.4%
	Adequate	65	15.6%
	Good	24	5.7%
	Very good	6	1.4%

Table 3 illustrates interdental cleansing practice among study participants. Interdental cleansing was reported among 314 (62.2%) participants. The most reported tool was floss (44.6%) followed by inter dental brush (38.9%) and water pick (16.6%). Considering ID cleansing frequency, it was less than once among 23.2% of the participants and once among 44.9% while twice among 24.5% of the respondents.

Table 3 Interdental cleansing practice among study participants, Saudi Arabia

Interdental cleansing	No	%
Interdental cleansing		
Yes	314	62.2%
No	191	37.8%
Interdental cleansing tool		
Floss	140	44.6%
Water pick	52	16.6%
Interdental brush	122	38.9%
Interdental brushing frequency		
< once	73	23.2%
Once	141	44.9%
Twice	77	24.5%
> twice	23	7.3%

Table 4 demonstrates mouth washing practice among study participants. Mouth washing was reported by 212 (42%) participants. It was done for less than once daily among 26.4% of the participants and for once daily among 43.9% while 25% did mouth washing twice daily. As for duration of mouth washing, it was for less than 30 seconds among 50% of the participants, for 30-60 seconds among 42% and for more than 60 minutes among 8%. About quality of mouth washing, it was inadequate among 75.9%, adequate among 17%, while good to excellent among 7.0% (Figure 1).

Table 4 Mouth washing practice among study participants, Saudi Arabia

Mouth washing	No	%
Yes	212	42.0%
No	293	58.0%
Mouth washing frequency		
< once	56	26.4%
Once	93	43.9%
Twice	53	25.0%
> twice	10	4.7%
Mouth washing duration		
< 30 seconds	106	50.0%
30-60 seconds	89	42.0%
> 60 seconds	17	8.0%
Quality of mouth washing		
Inadequate	161	75.9%
Adequate	36	17.0%
Good	7	3.3%
Very good	2	.9%
Excellent	6	2.8%

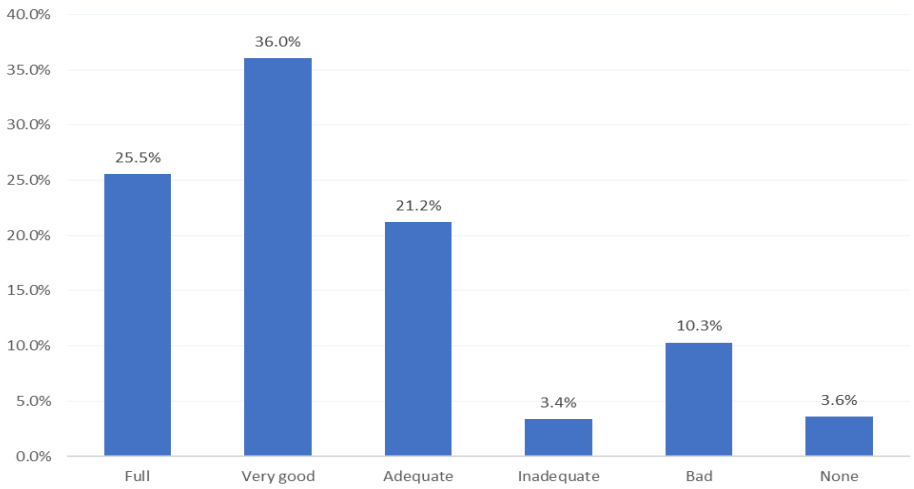

Figure 1 Practice of dental hygiene weighted among study participants

Table 5 shows distribution of mouth hygiene according to participant's demographic data. Tooth brushing was reported among 88.5% of those who aged more than 40 years compared to 77.4% of participants aged less than 14 years with no statistical significance (P=.547). As for gender, 88.7% of females brush tooth compared to 75.8% of males with statically significance (P=.001). Considering interdental cleansing, 73.1% of participant's aged more than 40 years did ID cleansing compared to 35.5% of those who were below 14 years (P=.001). Also, 70.8% of the females did interdental cleansing in comparison to 51.9% of males (P=.001). Besides, interdental cleansing was reported by 64.5% of participants at private clinics compared to 43.9% of those at public clinics (P=.002). With regard to mouth washing, it was done by 49.6% of participants aged 14-25 years compared to 25.8% of those blow 14 years (P=.003). Mouth washing was done by 43.4% of females compared to 40.3% of males (P=.472). Also, 42.9% of participants at private clinics reported for mouth washing compared to 35.1% of those at public clinics (P=.263).

Table 5 Distribution of mouth hygiene according to participant's demographic data

Demographic data	Tooth brushing		Interdental cleansing		Mouth washing	
	No	%	No	%	No	%
Age in years						
< 14 Yrs.	24	77.4%	11	35.5%	8	25.8%
14-25	200	83.3%	135	56.3%	119	49.6%
26-40	148	81.3%	130	71.4%	70	38.5%
> 40 Yrs.	46	88.5%	38	73.1%	15	28.8%
P-value	.547		.001*		.003*	
Gender						
Male	175	75.8%	120	51.9%	93	40.3%
Female	243	88.7%	194	70.8%	119	43.4%
P-value	.001*		.001*		.472	
Clinic type						
Private	368	82.1%	289	64.5%	192	42.9%
Public	50	87.7%	25	43.9%	20	35.1%
P-value	.294		.002*		.263	

*P: Pearson X^2 test * P < 0.05 (significant)*

Figure 2 shows Practice with quality among study participants, poor practice was reported by 71.3% participants and 17.2% was no practice.

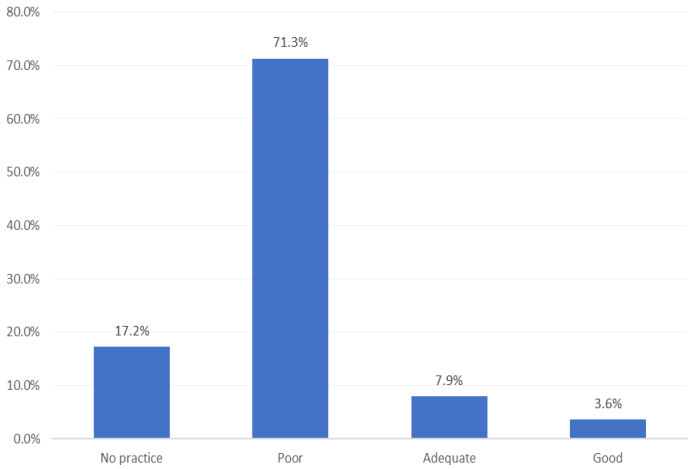

Figure 2 Practice with quality among study participants

4. DISCUSSION

The current paper aimed to assess self reported oral health practice among ortho patients and to detect oral care profile among sampled patients. Proper oral hygiene is playing a significant role to ensure effective orthodontic treatment (Daamehand Da, 2011). Continuous good oral hygiene in orthodontics is a key factor reflecting compliance (Aljabaa et al., 2015). Evaluation of oral hygiene practices is mandatory for comprehensive understanding of the patients' oral healthcare needs (Al-Shammari et al., 2007). However, Hadler-Olsen et al., (2012) reported the difficulty to applya thorough oral hygiene routine for patients with orthodontics. The current study assessed selfreported tooth brushing, Inter dental cleansing and mouth wash practice.

As for tooth brushing, the current study results showed that more than three quarters of the study participants brush their tooth for more than once using normal tooth brush among half of them. Brushing for 1-2 minutes was reported by half of the respondents. About one third of the participants reported that they brush their tooth with error and one quarter of them undergo inadequate brushing. Good and very good brushing was reported among very few participants. Considering Interdental cleansing, it was done among more than two thirds of the study patients using floss by less than half of them and using Interdental brush by

nearly one third of the respondents. Cleansing for once daily was reported by about 45% of the participants while nearly 23% told they do Interdental cleansing for less than once. As for third part covering mouth wash, it was practiced among less than half of the study participants mainly of once and for less than 30 seconds among half of the patients. It was inadequate among three quarters of the patients but adequate among only 17% of them. On the other hand, only one out of each four participants reported full dental hygiene which was also very good among one third, adequate among less than quarter of the patients. Near three quarters of the patients reported poor quality practice of oral hygiene. As for determinants of quality of oral hygiene among study patients, old aged female patients reported higher level of oral hygiene practice.

Higher levels of oral hygiene practice were reported by many other studies Lee et al., (2016) reported that 42.5% sampled ortho patients brushed twice daily or three times every day (44.4%). Soft bristles were the most used brushes (54.4%). Authors also found Patients reported using an interdental brush (68.6%), mouthwash (64.4%), dental floss (29.9%) and toothpicks (22.2%) daily for oral hygienewhich are somewhat similar to the current study findings. Unlike the current study findings, other studies showed that most patients brushed twice daily or more (Ajayi, 2014; Al-Shammari et al., 2007; Elanchezhiyan and Raja, 2011). Estimated unsatisfactory oral hygiene among their patients although more over half brushed twice every day and one-fifth brushed three times per day daily (Atassiand Awartani, 2010).

On the contrary, other studies reported that orthodontic patients brush twice dailywas associated with good clue in keeping good oral hygiene (Ajayi, 2014; Park et al., 2018). Brushing twice daily mostly indicates brushing both before bed and in the morning. In India, Gualie et al., (2018) showed similar findings to the current study. Authors found that 58.8% of the participants had never visited a dentist. Also, 62.3% of the participants cleaned their tooth using different tools and dentifrices. Among the students who clean their tooth 88.9% brushed once daily, 3.8% brushed twice and 1.5% brushed three times per day. Exact of 50.9% used chewing stick only to clean their teeth, (24.7%) used a toothbrush but 21% used both chewing stick and toothbrush.

In Saudi Arabia, revealed that 11.5% reported that they do not brush their teeth and 40.7% brush only once a day (AlGhamdi et al., 2020). Also, 35.5% of students who brushed their teeth had a healthy periodontium compared to 26.9% who did not brush (Alrumyyan et al., 2020). In Riyadh, revealed that about 57% of adults wear fixed dental prostheses had poor oral health related quality of life, which was associated with female gender, full time employment and low income. All of our previous results indicate that none of the irrigating solutions used were completely effective in removing the smear layer. Further researches are needed to develop intracanal irrigation regimens that are capable to completely clean and disinfect the root canals.

5. CONCLUSION

In conclusion, the current study showed that the results of this study showed that more than half of the study participants had poor self reported oral care especially for the frequency of practicing oral hygiene measures including brushing and mouth wash. Inadequate practices were reported among the majority of patients where very few participants do the oral care in the correct way. Oral health status like systemic diseases, both negatively affect person's quality of life. Dentists should pay more effort to improve public awareness, attitude regarding the importance of keeping proper oral hygiene which will in turn improve their practice.

Ethical approval

Prior to start of data collection, all necessary official approvals were secured from the research ethics committee of King Faisal University, Saudi Arabia, with letter number (KFU-REC/2020-11-06). All physicians were informed that their participation is optional. All collected data were kept confidential.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

REFERENCES AND NOTES

1. Ajayi EOAC. Oral hygiene status among orthodontic patients attending university of Benin Teaching Hospital, Benin City, Nigeria. J Dent Health Oral Disord Ther 2014.
2. AlGhamdi AS, Almarghlani AA, Alyafi RA, Kayal RA, Al-Zahrani MS. Gingival health and oral hygiene practices among high school children in Saudi Arabia. Ann Saudi Med 2020; 40(2):126–35.
3. Aljabaa AJ, McDonald F, Newton JT. A systematic review of randomized controlled trials of interventions to improve adherence among orthodontic patients aged 12 to 18. Angle Orthod 2015; 85(2):305–13.
4. Al-Jewair TS, Suri S, Tompson BD. Predictors of adolescent compliance with oral hygiene instructions during twoarch multibracket fixed orthodontic treatment. Angle Orthod 201 1; 81(3):525–31.
5. Al-Jundi A. Periodontal Health Status of Saudi Patients Undergoing Orthodontic Treatment. Int Arab J Dent 2014; 5 (2):51–8.
6. Alrumyyan A, Quwayhis S, Meaigel S, Almedlej R, Alolaiq R, Nafesah RB. Oral Health related Quality of Life and Oral Hygiene Practice of Adults with Fixed Dental Prostheses in Riyadh, Saudi Arabia. J Int Soc Prev Community Dent 2020; 10(1):62.
7. 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 2022; 1 6(1):15–21.
8. Atassi F, Awartani F. Oral Hygiene Status among Orthodontic Patients. J Contemp Dent Pract 2010; 11(4).
9. Camm AJ, Accetta G, Ambrosio G, Atar D, Bassand JP, Berge E. Evolving antithrombotic treatment patterns for patients with newly diagnosed atrial fibrillation. Heart 2017; 103(4):307–14.
10. Chen M, Wang D, Wu L. Fixed Orthodontic Appliance Therapy and Its Impact on 2010; 80(1):4–8.
11. Cozzani M, Ragazzini G, Delucchi A, Mutinelli S, Barreca C, Rinchuse DJ. Oral hygiene compliance in orthodontic patients: A randomized controlled study on the effects of a post treatment communication. Prog Orthod 2016; 17(1).
12. Daameh D, Da M. Oral hygiene measures in orthodontic treatment in Northern Jordan. Pakistan Oral Dent J 2011; 31(2).
13. Elanchezhiyan S and Raja. Awareness on gingival health among orthodontic correction seeking individuals. J Indian Acad Dent Spec 2011; 1:19-21
14. Fjeldsoe BS, Marshall AL, Miller YD. Behavior Change Interventions Delivered by Mobile Telephone Short Message Service. Am J Prev Med 2009; 36(2):165–73.
15. Foley J, Neill OM. Use of mobile telephone short message service (SMS) as a reminder: The effect on patient attendance. Eur J Acad Paediatr Dent 2009; 10(1):15–8.
16. Gualie YT, Tayachew AT. Assessment of knowledge, attitude and practice toward oral hygiene among governmental secondary school students in Debre Tabor Town, Amhara Region and North Central Ethiopia 2018: Institutional based cross-sectional survey. Int J Oral Heal Sc 2018; 8(2):92.
17. Guo J, Li L, Guan G, Bennani F, Mei L. Oral health knowledge and practice among orthodontic clients in china and new zealand. Can J Dent Hyg 2020; 54(3):124–32.
18. Hadler-Olsen S, Sandvik K, El-Agroudi MA, Ogaard 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 2022; 34(5):633–9.
19. Hamilton ME, Coulby WM. Oral health knowledge and habits of senior elementary school students. J Public Health Dent 1991; 51(4):212–9.
20. Kang JM, Kang KH. Effect of malocclusion or orthodontic treatment on oral health related quality of life in adults. Korean J Orthod 2014; 44(6):304–11.
21. Kulshrestha R, Shah K, Shenava S, Hawaldar C. Evaluation of oral hygiene and perception of patients undergoing orthodontic treatment attending OPD at Terna Dental College, Mumbai, Maharashtra. Int Dent J Student's Res 2020; 6(4):81–4.
22. Lang NP, Attstrom R, Loe H. European workshop on mechanical plaque control. Br Dent J 1999; 187(10).
23. Lee JH, Abdullah A, Yahya NA. Oral Hygiene Practices among Fixed Orthodontic Patients in a University Dental Setting. Int J Oral Dent Heal 2022; 2:27.
24. Lee JH. Oral Hygiene Practices among Fixed Orthodontic Patients in a University Dental Setting. Int J Oral Dent Heal 2016; 2(2):2–5.
25. Nadar S, Saravana Dinesh S. A questionnaire study about oral hygiene awareness among orthodontic patients. Int J Orthod Rehabil 2016; 7(3):97.
26. Nordstrom A, Birkhed D. Attitudes and behavioural factors relating to toothbrushing and the use of fluoride toothpaste among caries active Swedish adolescentsa questionnaire study. Acta Odontol Scand 2017; 75(7):483–7.
27. Paes da Silva S, Pitchika V, Baumert U, Wehrbein H, Schwestka-Polly R, Drescher D. Oral health related quality of life in orthodontics: A cross sectional multicentre study on patients in orthodontic treatment. Eur J Orthod 2020; 42(3):270–80.

28. Park SH, Cho SH, Han JY. Effective professional intraoral tooth brushing instruction using the modified plaque score: A randomized clinical trial. J Periodontal Implant Sci 2018; 48(1):22–33.
29. Ren Y, Jongsma MA, Mei L, Van HC, Busscher HJ. Orthodontic treatment with fixed appliances and biofilm formation: A potential public health threat? Clin Oral Investig 2014; 18(7):1711–8.