



Patient's Perception of Cleaning Removable Orthodontic Appliance

Safa I. Khawwam ⁽¹⁾
Dheaa H. Al-Groosh ^{(2)*}

^(1,2) Department of Orthodontics, College of Dentistry, University of Baghdad, Iraq.

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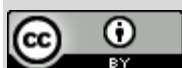
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*Corresponding Author:

Email:

d.al-groosh@codental.uobaghdad.edu.iq

⁽¹⁾ Professor, Department of Orthodontics, College of Dentistry, University of Baghdad, Iraq.

Abstract

Aim: The aim of this study was to evaluate patient's perception of cleaning acrylic-based removable orthodontic appliances.

Method: A questionnaire was applied to patients who use the acrylic-based removable appliance with age range 7-18 that included demographic information and behavioural characteristics. Data were collected and analysed using Pearson's Chi-square test and Fisher's exact test.

Result: Most patients used acrylic-based removable appliance aged 9-13 years (31.9%) and 42% of patients wore their appliance 8-16 hours/day. Active acrylic-based removable appliance was the most appliance wore by patients. A significance difference was found ($p < 0.05$) in hygienic frequency with the cleaning regimes used. Cleaning with toothbrush and toothpaste was the most method used. Nevertheless, no significant difference was found between hygienic frequency and age, type of school, type of appliance and wearing time.

Conclusion: The prevalence of patients used toothbrushes and toothpaste to clean removable orthodontic appliances (ROA) twice a day. The hygienic frequency significantly was associated with the cleaning regime used.

Introduction:

Removable orthodontic appliances (ROA) are often used in everyday orthodontic practice, as the primary method of treatment or as the first intervention before the use of fixed appliances or after the use of fixed appliances for retention ⁽¹⁾. ROA are made from various materials such as auto polymerizing acrylic resin, heat-polymerizing acrylic resin, and light polymerizing acrylic resin. These materials have some inherent properties that render them prone to bacterial adhesion and biofilm formation ⁽²⁾. Opportunistic pathogens were found in removable retainer wearers and acrylic-based appliances ⁽³⁾. Previous observational research presented evidence that during the first three months after orthodontic treatment with ROAs, there was a rise in the amount of aerobic and anaerobic bacteria on the dental surfaces ⁽⁴⁾. ROA can increase *Candida* levels and oral candida density ⁽⁵⁾. Another study showed that ROA colonized by streptococcus mutans; which is the main cause of decay ⁽⁶⁾, this does not necessarily enhance the risk of dental caries. Nevertheless, maintaining good oral hygiene requires that ROAs be thoroughly cleansed to reduce the risk of dental caries, candida-associated stomatitis ⁽⁷⁾, and bad breath, also it may prevent infection or re-infection especially in immunocompromised patients ⁽⁸⁾. Oral health determines orthodontic success. Inflamed oral tissues, ulcerations, and compromised periodontal tissues complicate orthodontic treatment ⁽⁹⁾, thus the ROA's microbiological changes in the oral cavity demand the need for strict oral hygiene ⁽¹⁾. Various hygiene methods, such as toothbrushes, toothpaste, commercial mouthwash, denture cleansers, and others, have been proposed to keep these appliances clean during treatment ⁽²⁾. ROAs can be difficult to clean; toothbrush seldom reaches clasps, expansion screws, marginal crevices, and surface indentations. Plaque accumulates on acrylic surfaces with depressions greater than 0.2 μm ⁽¹⁰⁾. Toothpaste and toothbrushes may cause abrasion more than water, cleaning foams or tablets ⁽¹¹⁾.

As early as 1989, chemical tablets were introduced as a method for ROAs cleansing, eliminated most plaque, even at crucial locations, mostly by oxygen release and enzymatic proteolysis ⁽¹²⁾. The alkaline solution disinfects and deodorizes by oxidizing the organic contaminants. Various research investigated the effect of different cleaning regimens for acrylic ROA that may prevent biofilm-related dental diseases. Denture cleansers, enzymatic solutions, chlorhexidine, sodium hypochlorite, or "homemade" vinegar or citric acid solutions have been documented ⁽¹³⁾. It has been demonstrated that 2% Chlorhexidine has antimicrobial activity against *Staphylococcus aureus*, *Escherichia coli*, and *Salmonella* ⁽¹⁴⁾. The immersion in dental cleaners can cause changes in the structure of acrylic resin, whereas sprays with chlorhexidine solutions provide rapid inactivation of pathogenic microorganisms without causing any adverse effects to the appliance ⁽¹⁵⁾. The aim of this questionnaire was to assess the patient's beliefs, despite scientific evidence, of cleaning and hygienic frequency of the ROA.

Materials and methods**Study design and setting:**

This cross-sectional study was conducted in the Orthodontic Clinic at the College of Dentistry-University of Baghdad in addition to two specialized dental clinics at AL-Karkh City and two specialized dental clinics at Al-Risafa City in Baghdad. Ethical approval was obtained from the Ethics Committee of the College of Dentistry-University of Baghdad in April 2022 with issue no.598.

Two hundred questionnaires were distributed to patients who wear an acrylic-based ROA with an age range 7-18 years after obtaining a signed informed consent. The survey questions were translated to Arabic and designed to be as simple as possible so that the participants could easily understand them. Identifiable data were kept anonymously. A short

explanation of the study was provided on the front page of the questionnaire.

Study measures

The questionnaire was divided into two parts, the first part elicited information about socio-demographic data for patients (age, gender, type of school). The second part included questions to assess information about the appliance hygiene of the patients, the questions were as listed.

1. Question about whether the orthodontist advised to clean the appliance.
2. Question about the type of appliance they wear.
3. Question about the wearing time.
4. Question about the hygienic frequency.
5. Question about the cleaning method used.

Statistical analysis

The data was analysed using the Statistical Package for Social Science (SPSS) version 25 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics were used to define the characteristics of the study variables. A Chi-square test was used to assess relationships between categorical variables and Fisher's Exact test was used when more than 20% of cells had expected frequency <5. A conventional P value of <0.05 was the criterion for statistically significant.

Results

One hundred thirty-five out of 200 questionnaires were responded by orthodontic patients, 75 (55.6%) female and 60(44.4%) males with age range of 7–18-year-old. Most patients aged 9-13 years 43(31.9%). 108(80%) attend public school while 27(20%) attend private school. Most orthodontists (86.7%) advised their patients on how to clean their appliances as reported by the patients. The appliance used was active ROA intended to align their crooked teeth properly. 57(42.2%) of patients reported to wearing their appliance 8-16 hours/day and 48(35.6%) of patients cleaned their appliance

twice/day. The most cleaning regime reported to be used was cleaning with toothbrush and toothpaste 48(35.6%). The distribution of the patients according to the investigated factors is presented in Table (1).

Table (2) shows the bivariate analysis between age groups and hygienic frequency among ROA wearers. No significant difference was found among the groups ($p\text{-value}>0.05$). The majority of patients (39.5%) at age group 9-13 years cleaned their appliance twice a day.

No significant difference was found between the type of school and hygienic frequency of cleaning the appliance ($p\text{-value}>0.05$). The majority of patients attend public school cleaned their appliances twice daily (35.2%) as shown in Table (3).

No significant difference was found between the type of appliance and hygienic frequency of patients ($P\text{-value}>0.05$), the majority of patients (34.7%) who wear active ROA cleaned their appliance twice a day as shown in Table (4).

The results showed no significant difference between the time of appliance wear and hygienic frequency of patients. The majority of patient (31.6%) wear their appliance 8-16 hours/day cleaned the appliance twice a day as shown in Table (5).

Significant difference was found among the cleaning regimes and hygienic frequency. 37.5% of patients cleaned by brushing the appliance with toothpaste cleaned their appliance twice a day as shown in Table (6).

Discussion

This questionnaire study designed to assess patient's perceptions of cleaning acrylic-based removable orthodontic ROA. The study enrolled 135 who used acrylic-based removable orthodontic. The majority of patients aged 9-13 years, this comes in accordance with ⁽¹⁾. The prevalence of patients was female, this higher percentage of females in comparison to males agrees with other studies that found a greater number of female's demand orthodontic treatment

compared to males ⁽¹⁶⁾⁽¹⁷⁾. This may reflect the greater interest in achieving better dental and facial appearance by females. The majority of patients reported to attend public school this could be due to that the data was obtained from public health care centres, which include low-cost orthodontic treatment with ROA, however, no significant difference was found in respect of hygienic frequency. Most patients reported wearing their appliance 8-16 hours/day, this comes in accordance with ⁽¹⁸⁾. Regarding the hygiene frequency of cleaning the ROA, many patients who cleaned their appliance twice and three times a day used a toothbrush and toothpaste for cleaning. Indeed, this method was reported to be effective to maintain the health of mucosa in contact with acrylic appliances ⁽¹⁹⁾. This come in accordance with ⁽²⁰⁾ who reported that patients typically clean their acrylic-based removable appliance with a toothbrush and toothpaste. Paranhos et al. ⁽²¹⁾ reported that the use of a single hygiene method without a chemical disinfectant has been criticized for its ineffective removal of biofilm from acrylic surfaces and inadequate control of microbial load and could result in poor biofilm removal from acrylic surfaces, particularly in protected niches with porous surfaces, and inaccurate control of the microbial load. Furthermore, the efficacy of brushing and denture cleaning tablets is greater than brushing alone for cleaning ROAs ⁽²²⁾. However, another studies found that there was no significant difference between brushing the Essex retainer then immersion in a cleaning tablet on the bacterial load ⁽²³⁾. The result showed that cleaning with toothbrush and immersion in denture cleanser is the least method used. This could be explained by the lack of sufficient information regarding the ROA cleaning methods and the cost of the denture cleansers. Furthermore, patients' perceived instruction for the cleaning

method used. It was reported that brushing with water, soap or toothpaste was the preferred method for cleaning ROA by the Greek orthodontists ⁽¹⁾. Three patients reported not to clean their appliances and one patient cleaned their appliance less than once although high percentage of orthodontist (86.7%) who advised to clean the ROA. This could be due to the lack of patient compliance toward the ROA. It is important to acknowledge the presence of limitations in our study. The sample size of 135 was determined based on the availability of participants within the study period; the sample size might consider one of the study limitation. The level of participation in our research was limited, as only 67.5% completed the questionnaire. However, the data was collected from a multicentre that which increase the generalizability of the study. Further studies are required to asses' the orthodontist's recommendation for the cleaning regimes used for ROA and to investigate the proposed cleaning regimes effectiveness in removing the bacterial biofilm from the acrylic-based ROA. Raising patients' awareness by using instructions leaflets and verbal communication through webinars and other social media network might be helpful.

Conclusion

1. The patient's response about cleaning ROA was consistent with the available published evidence.
2. The prevalence of patients using toothbrush and toothpaste to clean ROA twice a day. The hygienic frequency significantly was associated with the cleaning regime used.
3. Most patients wear their appliance 8-16 hours/day.

Table (1): Socio-demographic and behavioural characteristics of patient's users of acrylic-based removable orthodontic appliances (ROA), (N=135).

Variable	Category	n	%
Gender	Female	75	55.6
	Male	60	44.4
Age (years)	7-9	36	26.7
	9-13	43	31.9
	13-15	23	17.0
	15-18	33	24.4
Type of school	Public	108	80
	Private	27	20
Did the orthodontist advised you to clean your appliance?	Yes	117	86.7
	No	18	13.3
The type of appliance used	Active	72	53.3
	Myo-functional	41	30.4
	Retainer	22	16.3
Wearing time (hours/day)	1-8	37	27.4
	8-16	57	42.2
	16-24	41	30.4
Hygienic frequency	Less than once	17	12.6
	Once a day	34	25.2
	Twice a day	48	35.6
	Three times daily	33	24.4
	More than that	3	2.2
Cleaning regime used	Water	14	10.4
	Soap and water	9	6.7
	Brushing with toothbrush and water	38	28.1
	Brushing with toothpaste	48	35.6
	Immersion in denture cleansers (e.g., effervescent tablets)	12	8.9
	Brushing and imersion in denture cleanser	11	8.1
	Others	3	2.2

Table (2): Bivariate analysis of hygienic frequency of removable appliances wore by the patients according to age of the patients (N=135).

Age (years)	Hygienic frequency										P-value
	Less than once		Once a day		Twice a day		Three times daily		More than that		
	n	%	n	%	n	%	n	%	n	%	
7-9	8	22.2	7	19.4	14	38.9	6	16.7	1	2.8	0.233
9-13	5	11.6	6	14	17	39.5	14	32.6	1	2.3	
13-15	2	8.7	7	30.4	7	30.4	7	30.4	0	0	
15-18	2	6.1	14	42.4	10	30.3	6	18.2	1	3	

Pearson's Chi-square test/*P<0.05

Table (3): Bivariate analysis of hygienic frequency of removable appliances wore by the patients according to type of school (N=135).

Type of school	Hygienic frequency										p-value
	Less than once		Once a day		Twice a day		Three times daily		More than that		
	n	%	n	%	n	%	n	%	n	%	
Public school	11	10.2	30	27.8	38	35.2	27	25	2	1.9	0.293
Private school	6	22.2	4	14.8	10	37	6	22.2	1	3.7	

Fisher's Exact Test/*P <0.05

Table (4): Bivariate analysis of hygienic frequency of removable appliances wore by the patients according to type of ROA (N=135).

Type of removable appliance	Hygienic frequency										P-value
	Less than once		Once a day		Twice a day		Three times daily		More than that		
	n	%	n	%	n	%	n	%	n	%	
Active	12	16.7	19	26.4	25	34.7	16	22.2	0	0	0.299
Myo-functional	3	7.3	9	22.0	15	36.6	11	26.8	3	7.3	
Retention	2	9.1	6	27.3	8	36.4	6	27.3	0	0	

Pearson's Chi-square test/*P <0.05

Table (5): Bivariate analysis of hygienic frequency of removable appliances wore by the patients according to wearing time (N=135)

Wearing time hours/day	Hygienic frequency										P-value
	Less than once		Once a day		Twice a day		Three times daily		More than that		
	n	%	n	%	n	%	n	%	n	%	
1-8	8	21.6	10	27	14	37.8	4	10.8	1	2.7	0.167
8-16	7	12.3	15	26.3	18	31.6	15	26.3	2	3.5	
16-24	2	4.9	9	22	16	39	14	34.1	0	0	

Fisher's Exact Test /*P <0.05

Table (6): Bivariate analysis of hygienic frequency of removable appliances wore by the patients according to cleaning method (N=135).

Cleaning method	Hygienic frequency										P-value
	Less than once		Once a day		Twice a day		Three times daily		More than that		
	n	%	n	%	n	%	n	%	n	%	
water	3	21.4	5	35.7	4	28.6	1	7.1	1	7.1	0.028*
Soup and water	1	11.1	2	22.2	5	55.6	0	0	1	11.1	
Brushing	6	15.8	8	21.1	13	34.2	10	26.3	1	2.6	
Brushing with toothpaste	3	6.3	12	25	18	37.5	15	31.3	0	0	
Immersion in denture cleansers (e.g., effervescent tablets)	0	0	3	25	3	25	6	50	0	0	
Brushing and immersion in denture cleanser	1	9.1	4	36.4	5	45.5	1	9.1	0	0	
Others	3	100	0	0	0	0	0	0	0	0	

Pearson's Chi-square test/*P<0.05

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