



Influence of gag reflex on removable prosthetic restoration tolerance according to the patient section of the short form of the Gagging Problem Assessment Questionnaire

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PURPOSE. To assess removable prosthetic restoration tolerance according to the patient section of the short form of the Gagging Problem Assessment Questionnaire (GPA-pa SF) and the influence of gender, education level and prosthesis type and denture-related mucosal irritation on the GPA-pa SF scores before treatment and over a period of two months after prosthesis insertion. **MATERIALS AND METHODS.** 130 participants who required removable prosthesis were surveyed with a standard form that included questions regarding age, gender, education level, dental attendance, and prosthetic restoration type. Participants answered the GPA-pa SF before restoration (T0) and 1 day (T1), 2 days (T2), 15 days (T3), 1 month (T4), and 2 months (T5) after prosthesis insertion. **RESULTS.** Of the 130 participants, 110 participants completed the prosthetic restoration procedure, but only 93 of these were able to use the prosthesis over the two-month period. The mean GPA-pa SF score obtained at T0 was higher than the scores obtained at the other periods in the total of the sample. Significant difference was present between mean scores obtained at T0-T1 and T2-T3 than scores obtained at other periods ($P < .05$). Female participants and participants with denture-related mucosal irritation had higher GPA-pa SF scores at all time points analysed. Significant difference was present between mean GPA-pa SF scores obtained at T2-T3 than scores obtained at other periods for females and participants with denture-related mucosal irritation ($P < .05$). Education level and prosthesis type did not significantly influence the GPA-pa SF score at any time point analysed ($P > .05$). **CONCLUSION.** GPA-pa SF scores were higher before the restoration procedure began, and decreased over time with the use of prosthesis. Gender and denture-related mucosal irritation affected the GPA-pa SF scores. [J Adv Prosthodont 2014;6:474-82]

KEY WORDS: Gag reflex; Pharyngeal; Prosthodontics; Complete prosthesis; Partial prosthesis

INTRODUCTION

Tooth loss is a major problem worldwide, one with adverse

oral, systemic, and mental health effects. Edentulous participants experience such difficulties as problems chewing food,¹ weakened facial musculature, degradation of the supporting alveolar structures, reduced bite-force and chewing efficiency,² gastrointestinal disorders,³ and difficulties with socialising or forming close relationships.⁴ Rehabilitation with prosthesis can alleviate these adverse effects to some degree and provide a sense of normalcy, allowing the patient to interact with others.⁵

Removable prostheses have been used as one method to make up for missing teeth for a long time.⁶ However, exaggerated gag reflex may lead to problems during the production and wearing of removable complete and partial prosthesis. The gag reflex can be triggered by bad prior dental experiences,⁷ dental anxiety,⁸ the thought of something

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being placed in the mouth,⁹ excess saliva accumulation when the patient refuses to swallow for fear that the denture will dislodge,¹⁰ the touch of the mirror or impression tray on trigger points, or even the sight of these materials.¹¹

The patient part of the short form of the Gagging Problem Assessment Questionnaire (GPA-pa SF) is a shorter version of a longer questionnaire introduced by van Linden van den Heuvel *et al.*¹² and gives information about patient's self-reported gagging severity. The GPA-pa SF is a Likert type scale and includes nine questions about the patient's own perceptions with respect to any gag reflex activity that may occur when procedures involving dental hygiene, examination, or impression taking are being carried out. Conditions which are not suitable for the individuals are rated as not applicable and these questions are not included in the calculation of the total score.¹²

To our knowledge, no study to date has evaluated factors including, gender, education level, prosthesis type and patients' tolerance to removable prosthesis according to the GPA-pa SF. Therefore, the aim of this study was to assess removable prosthetic restoration tolerance according to the patient part of the short form of the GPA-pa SF and influence of gender, education level and prosthesis type on the GPA-pa SF scores over 2 months after prosthesis insertion.

MATERIALS AND METHODS

This study was conducted at Gazi University's School of Dentistry in Ankara, Turkey. The university serves a large patient community, including civil servants, public sector employees and their dependants (housewives or self-employed). It also has the necessary staff and equipment for performing dental procedures under sedation or general anaesthesia. The study was approved by Ankara University Local Ethics Committee (No. 39-5). All participants gave their informed consent in writing before participating in the study.

A medical history was obtained, and a routine dental examination procedure was performed. A total of 130 participants who did not have any chronic or acute disease, and who were not taking medications to treat any chronic or acute systemic disease or dental pathology were started to participate in the study. Participants were excluded if they were pregnant or had any mental or physical disability or psychological disorder. Participants were asked to complete a standard form, containing questions about age, gender, education level, and dental attendance. Participants were administered the Turkish version of the GPA-pa SF, which has been shown to be a valid and reliable translation of the English form.¹³ The type of prosthetic restoration was recorded by a prosthodontist who did not ask the questions on the standard form (Table 1). The GPA-pa SF was com-

Table 1. Standard form used in the study

Protocol number:
 Age:
 Gender: F () M ()
 Education level: Primary school () High school () University and over ()
 Dental Attendance: Regular () Irregular ()
 Definition:
 Regular dental attendance: dental visits in every six months and/or one year in last five years
 Irregular dental attendance: dental visits only at complaint or no regular dental visits in every six months and/or one year in last five years.
 Patient Part of Gagging Problem Assessment Short Form (GPA-pa SF).

1. Brushing your teeth	No ()	Sometimes ()	Often ()	Always ()	NA ()
2. Wearing a removable prosthesis	No ()	Sometimes ()	Often ()	Always ()	NA ()
3. Lying backwards in dental chair	No ()	Sometimes ()	Often ()	Always ()	NA ()
4. Feeling the mirror in front of your mouth	No ()	Sometimes ()	Often ()	Always ()	NA ()
5. Feeling the mirror in your mouth near the anterior teeth	No ()	Sometimes ()	Often ()	Always ()	NA ()
6. Feeling the mirror in your mouth	No ()	Sometimes ()	Often ()	Always ()	NA ()
7. Feeling the mirror between posterior teeth	No ()	Sometimes ()	Often ()	Always ()	NA ()
8. Taking an impression of the upper jaw	No ()	Sometimes ()	Often ()	Always ()	NA ()
9. Taking an impression of the lower jaw	No ()	Sometimes ()	Often ()	Always ()	NA ()

Cases in which a situation is avoided because of gagging problem mark 'always'. Cases which are not applicable mark 'NA'
 Scores given to the answers: No: 1, Sometimes: 2, Often: 3, Always: 4.
 GPA-pa SF: The sum of scores given for each question / The total number of questions answered. The number of questions answered as 'not applicable' is excluded from the total number of answered questions; therefore this does not have an adverse effect on the score.
 Dentures type
 1: both complete maxillary-mandibular dentures
 2: both partial maxillary-mandibular dentures
 3: complete maxillary-partial mandibular or partial maxillary-complete mandibular denture
 4: only maxillary denture (complete or partial)
 5: only mandibular denture (complete or partial)

pleted before the prosthetic restoration (T0), and 1 day (T1), 2 days (T2), 15 days (T3), 1 month (T4), and 2 months (T5) after denture insertion. The questionnaire was read aloud to participants, and they were asked to estimate their sensitivity in terms of gagging for the applicable situations. Situations which were not applicable for patients was marked as not applicable on the questionnaire (for example; “brushing your teeth” was marked as not applicable for edentulous patients).

Preliminary impressions were made with alginate (Cavex CA37; Cavex Holland BV, Haarlem, the Netherlands) by using a stock tray (Inci Dental Tibbi Malzeme San. ve Tic. Ltd., Istanbul, Turkey). For 15 participants (14 females), impressions were made with the aid of a topical anaesthetic solution, (Vemcaine, 10% lidocaine; Nobel Farma İlaç San. ve Tic. A.Ş. Sancaklar, Düzcce) disinfected with Deconex (Borer Chemie, Switzerland). After impressions were sent to the dental laboratory, diagnostic casts were obtained. Custom trays were fabricated on the upper and lower jaws with autopolymerizing acrylic resin (Vertex™, Zeist, Netherlands) by a dental technician.

For complete dentures, border molding was done with an impression compound material (Kerr, Italy), and final impressions of the upper and lower edentulous arches were made with zinc oxide eugenol impression paste (Cavex, Holland). For removable partial dentures, final impressions of the arches were made with alginate. Impressions were disinfected and poured with type III dental stone (Denston 3, Ata Yapı Ürünleri San. Tic. Ltd., Şti. Istanbul, Turkey) to obtain the master casts. Record bases were fabricated from autopolmerizing acrylic resin (Vertex™, Zeist, Netherlands) on the master casts for complete dentures. A metal frame work was made on the master cast for partial arches.

Occlusal rims were made on the temporary record bases or metal frame works, to record the relationship between the maxilla and mandible. Teeth were arranged according to

the recorded jaw relationship. Trial dentures were checked in the participants’ mouths and dentures were constructed with heat-cured acrylic resin (Acron Duo, Associated Dental Products Ltd., Kemdent, Wiltshire, UK) by a conventional denture-making procedure. After deflasking, the dentures were finished, and polished.

Participants were followed-up at T2, T3, T4, and T5. The clinician assessed whether there was any denture-related mucosal irritation due to the denture and where the denture-related mucosal irritation was localised. In order to eliminate mucosal irritations caused by the denture, the intaglio surface and the borders of the denture bases were continually re-adjusted. Prosthesis were made and controlled by a prosthodontist. Laboratory procedures were done by an expert technician.

Data were analyzed with the SPSS software package (Version 22, IBM SPSS Statistics, IBM Corporation, Armonk, NY, USA). Descriptive statistical analyses were performed with chi-square test, Freeman-Halton extension of Fisher’s exact test and repeated measures one way ANOVA test where applicable. All tests were performed with 95% confidence for the determination of any statistical difference ($P<.05$).

RESULTS

Eleven of the 130 participants (9 females) were unable to tolerate the impression procedure. Nine participants (all females) started but did not complete the treatment and were omitted from the study. A total of 110 participants completed the restoration procedure. Flow chart of the study is given in Fig. 1. The characteristics of the participants are summarised in Table 2 (N=110) and the types of the mandibular removable partial dentures are given in Table 2a (N=44). A total of 17 participants could not use dentures after insertion; one patient refused the denture

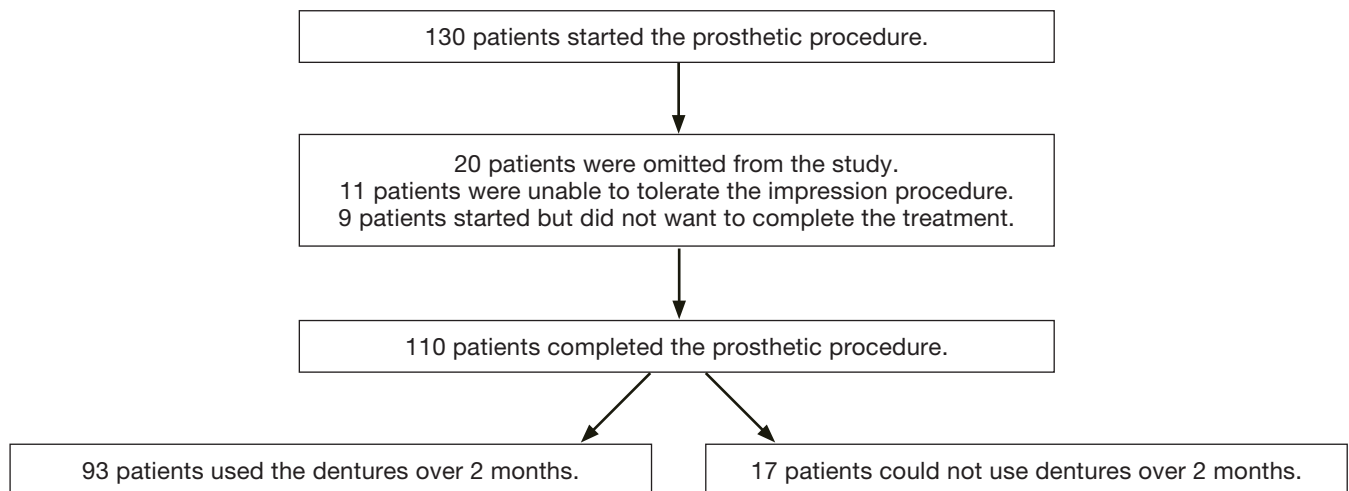


Fig. 1. Flow chart of the study.

Table 2. Characteristics of the participants who completed the prosthetic procedure (N=110)

		Participants used dentures (N=93)		Participants unused dentures (N=17)		Total (N=110)		P value
		N	%	N	%	N	%	
Gender	Female	64	58.2	13	11.8	77	70	.527
	Male	29	26.3	4	3.7	33	30	
Education level	Primary school	65	59.1	15	13.6	80	72.7	.28
	High school	18	16.3	2	1.9	20	18.2	
	University≥	10	9.1	-	-	10	9.1	
Dental attendance	Irregular	91	82.7	17	15.5	108	98.2	.714
	Regular	2	1.8	-	-	2	1.8	
Prosthetic restoration type	A	19	17.3	5	4.6	24	21.8	.549
	B	22	20	3	2.7	25	22.7	
	C	17	15.5	4	3.6	21	19.1	
	D	16	14.5	4	3.6	20	18.2	
	E	19	17.2	1	1	20	18.2	
GPA-pa SF scores at T0 ^b	1.00-1.74	59	53.7	1	0.9	60	54.6	.000
	1.75-3.24	28	25.4	4	3.7	32	29.1	
	3.25-4.00	6	5.4	12	10.9	18	16.3	
Age (mean=56.7±9,5) (range=33-78)	Lower 50	25	22.7	1	1	26	23.7	.134
	50-65	50	45.5	13	11.8	63	57.3	
	Upper 65	18	16.3	3	2.7	21	19	

Gender, Dental attendance = Chi-squared test

Education level, Prosthetic restoration type, GPA-pa SF scores at T0, Age =Freeman-Halton extension of Fisher's exact test

^aA: both complete maxillary-mandibular dentures, B: both partial maxillary-mandibular dentures, C: complete maxillary-partial mandibular or partial maxillary-complete mandibular dentures, D: only maxillary denture (complete or partial), E: only mandibular denture (complete or partial), T0^b: Before restoration

Table 2a. Types of the mandibular removable partial dentures (N=44)

		Participants used dentures (N=36)		Participants unused dentures (N=8)		Total (N=44)	
		N	%	N	%	N	%
Mandibular removable partial dentures	Kennedy Class I	25	22.7	7	6.4	32	29.1
	Kennedy Class II	9	8.1	-	-	9	8.1
	Kennedy Class III	1	0.9	1	0.9	2	1.8
	Kennedy Class IV	1	0.9	-	-	1	0.9

Table 2b. Interaction between gender and education level (chi-square test)

Chi-Square: 17.679 P: .000*		Primary school	High school	University	Total
Female	N	65	8	4	77
	%	84.4	10.4	5.2	100
Male	N	15	12	6	33
	%	45.5	36.4	18.2	100
Total	N	80	20	10	110
	%	72.7	18.2	9.1	100

* P<.05

because of its smell, and 16 participants refused dentures because of gagging. All of these 17 participants opted for implant treatment. A significant correlation was found between gender and education level. The number of females who had completed only a primary school was significantly higher than males. Details are shown in education Table 2b (chi-square 17.679, $P<.05$).

The mean GPA-pa SF scores for participants at T0 was 1.84 which decreased to 1.64 by T4 and was the same at T5. According to repeated measures one way ANOVA test significant difference was present between the GPA-pa SF scores ($F=17.291, P=.000$) and this difference changed significantly among genders ($F=5.262, P=.006$). This difference resulted from T0-T1 and T2-T3 scores in the case when the effect of gender was eliminated. Besides, the difference in the scores obtained for T2-T3 was significant among females and males ($P<.05$). Details for these results are given in Table 3a and Table 3b.

According to repeated measures one way ANOVA test significant difference was present between the GPA-pa SF scores ($F=3.309, P=.014$), however this difference was not significant according to education level ($F=1.212, P=.293$). According to this, significant difference was present between the mean scores obtained at T0 and T1 periods in

the case when the effect of education was eliminated. ($P<.05$) Details for these results are shown in Tables 4a and 4b.

Denture-related mucosal irritation was seen in 52 participants (47.3%). Denture-related mucosal irritation was localised at the vestibule sulcus (24.5%), postdam area (18.2%), retromolar region (12.7%), alveolar ridges (9.1%), lingual sulcus (8.2%), mylohyoid line (8.2%), and mid-palatal area (2.7%). Participants with denture-related mucosal irritation due to denture use had higher GPA-pa SF scores compared to those without such denture-related mucosal irritation. Repeated measures one way ANOVA test revealed significant difference between the GPA-pa SF scores ($F=30.482, P=.000$) and significant difference was found among participants with denture-related mucosal irritation compared to those without such denture-related mucosal irritation ($F=20.551, P=.027$). According to this significant difference was present between the GPA-pa SF scores obtained at T0-T1, T2-T3 and T3-T4 in the case when the effect of denture related mucosal irritation was eliminated. Besides scores obtained at T3-T4 differed significantly in the presence of denture related mucosal irritation ($P<.05$). Details of these results are shown in Table 5a and Table 5b.

Five groups of removable dentures were evaluated.

Table 3a. The GPA-pa SF scores of the participants obtained at different periods during the prosthetic restoration treatment (Descriptive Statistics)

Time	Gender	GPA-pa SF scores	
		Mean	SD
T0	F	2.00	1.073
	M	1.48	0.900
	Total	1.84	1.048
T1	F	1.87	1.095
	M	1.41	0.877
	Total	1.73	1.052
T2	F	1.85	1.095
	M	1.41	0.877
	Total	1.72	1.050
T3	F	1.77	1.088
	M	1.41	0.876
	Total	1.66	1.039
T4	F	1.75	1.086
	M	1.40	0.877
	Total	1.64	1.037
T5	F	1.75	1.086
	M	1.40	0.877
	Total	1.64	1.037

F: Female, M: Male

T0: before restoration, T1: 1st day, T2: 2 days later, T3: 15 days later, T4: 1 month later, T5: 2 months later

Table 3b. Assessment of any variation in the GPA-pa SF scores obtained at different periods during the prosthetic restoration treatment in total and disregarding gender (Repeated measures one way ANOVA)

	Time	F	P value
GPA-pa SF scores	T0-T1	13.064	.000*
	T1-T2	1.094	.298
	T2-T3	7.480	.007*
	T3-T4	3.363	.069
	T4-T5	**	**
* Gender	T0-T1	1.387	.241
	T1-T2	1.094	.298
	T2-T3	5.861	.017*
	T3-T4	0.463	.498
	T4-T5	**	**

*: $P<.05$

** : Statistical value was not computed as the GPA score was same for T4 and T5
T0: before restoration, T1: 1st day, T2: 2 days later, T3: 15 days later, T4: 1 month later, T5: 2 months later

Table 4a. The GPA-pa SF scores at different periods of prosthetic restoration treatment according to education level (Descriptive Statistics)

Time	Education level	GPA-pa SF scores	GPA-pa SF scores
		Mean	SD
T0	Primary School	1.98	1.087
	High School	1.61	1.004
	University≥	1.25	0.354
	Total	1.84	1.048
T1	Primary School	1.86	1.099
	High School	1.55	1.003
	University≥	1.13	0.203
	Total	1.73	1.052
T2	Primary School	1.84	1.099
	High School	1.55	1.003
	University≥	1.13	0.203
	Total	1.72	1.050
T3	Primary School	1.76	1.092
	High School	1.55	1.003
	University≥	1.11	0.184
	Total	1.66	1.039
T4	Primary School	1.74	1.089
	High School	1.51	1.004
	University≥	1.11	0.184
	Total	1.64	1.037
T5	Primary School	1.74	1.089
	High School	1.51	1.004
	University≥	1.11	0.184
	Total	1.64	1.037

T0: before restoration, T1: 1st day, T2: 2 days later, T3: 15 days later, T4: 1 month later, T5: 2 months later

Table 4b. Assessment of any variation in the GPA-pa SF scores obtained at different periods during the prosthetic restoration treatment in total and disregarding education level (Repeated measures one way ANOVA)

	Time	F	P value	
GPA-pa SF scores	T0-T1	8.493	.004*	
	Total	T1-T2	0.267	.606
		T2-T3	2.272	.135
		T3-T4	2.504	.117
		T4-T5	**	**
GPA-pa SF scores	T0-T1	0.385	.682	
* Education level	T1-T2	0.473	.624	
	T2-T3	2.572	.081	
	T3-T4	0.802	.451	
	T4-T5	**	**	

*: P<.05

** : Statistical value was not computed as the GPA score was same for T4 and T5

T0: before restoration, T1: 1st day, T2: 2 days later, T3: 15 days later, T4: 1 month later, T5: 2 months later

Table 5a. Assessment of GPA-pa SF scores and denture-related mucosal irritation (DRMI) at different periods during the prosthetic restoration treatment (Descriptive Statistics)

Time	DRMI	GPA-pa SF scores	GPA-pa SF scores
		Mean	SD
T0	A	1.63	0.959
	P	2.09	1.097
	Total	1.84	1.048
T1	A	1.53	0.956
	P	1.96	1.114
	Total	1.73	1.052
T2	A	1.53	0.956
	P	1.93	1.116
	Total	1.72	1.050
T3	A	1.48	0.943
	P	1.87	1.110
	Total	1.66	1.039
T4	A	1.48	0.937
	P	1.83	1.117
	Total	1.64	1.037
T5	A	1.48	0.937
	P	1.83	1.117
	Total	1.64	1.037

A: absent, P: present

T0: before restoration, T1: 1st day, T2: 2 days later, T3: 15 days later, T4: 1 month later, T5: 2 months later

Table 5b. Assessment of any variation in the GPA-pa SF scores obtained at different periods during the prosthetic restoration treatment in total and disregarding denture-related mucosal irritation (DRMI) (Repeated measures one way ANOVA)

	Time	F	P value	
GPA-pa SF scores	T0-T1	19.869	.000*	
	Total	T1-T2	2.894	.092
		T2-T3	15.837	.000*
		T3-T4	6.032	.016*
		T4-T5	**	**
GPA-pa SF scores	T0-T1	0.284	.595	
* DRMI	T1-T2	2.894	.092	
	T2-T3	0.543	.463	
	T3-T4	4.648	.033*	
	T4-T5	**	**	

* P<.05

** Statistical value was not computed as the GPA score was same for T4 and T5

Table 6a. The GPA-pa SF scores for different types of prosthetic restorations at different periods (Descriptive Statistics)

Time	Restoration type	GPA-pa SF scores	
		Mean	SD
T0	A	1.90	1.116
	B	1.78	0.905
	C	2.09	1.189
	D	2.03	1.177
	E	1.42	0.762
	Total	1.84	1.048
T1	A	1.79	1.104
	B	1.66	0.880
	C	1.94	1.230
	D	1.92	1.214
	E	1.36	0.763
	Total	1.73	1.052
T2	A	1.79	1.104
	B	1.64	0.889
	C	1.93	1.237
	D	1.92	1.214
	E	1.32	0.702
	Total	1.72	1.050
T3	A	1.73	1.091
	B	1.52	0.864
	C	1.87	1.210
	D	1.90	1.224
	E	1.31	0.703
	Total	1.66	1.039
T4	A	1.67	1.094
	B	1.51	0.850
	C	1.87	1.210
	D	1.90	1.224
	E	1.28	0.692
	Total	1.64	1.037
T5	A	1.67	1.094
	B	1.51	0.850
	C	1.87	1.210
	D	1.90	1.224
	E	1.28	0.692
	Total	1.64	1.037

T0: before restoration, T1: 1st day, T2: 2 days later, T3: 15 days later, T4: 1 month later, T5: 2 months later

A: both complete maxillary-mandibular dentures, B: both partial maxillary-mandibular dentures, C: complete maxillary-partial mandibular or partial maxillary-complete mandibular dentures, D: only maxillary denture (complete or partial), E: only mandibular denture (complete or partial)

Table 6b. Assessment of any variation in the GPA-pa SF scores obtained at different periods during the prosthetic restoration treatment in total and disregarding restoration type (Repeated measures one way ANOVA)

	Time	F	P value
GPA-pa SF scores	T0-T1	18.776	.000*
	T1-T2	2.644	.107
	T2-T3	14.266	.000*
	T3-T4	5.000	.027*
	T4-T5	**	**
* Restoration Type	T0-T1	0.311	.870
	T1-T2	0.688	.602
	T2-T3	1.981	.103
	T3-T4	2.314	.062
	T4-T5	**	**

*P<.05

** Statistical value was not computed as the GPA score was same for T4 and T5

Participants with complete maxillary + partial mandibular dentures, partial maxillary + complete mandibular dentures, or only maxillary denture (partial or complete) had higher GPA-pa SF scores in all periods. Repeated measures one way ANOVA test presented significant difference among GPA-pa SF scores (F=10.035, P=.000). However, the dentures type did not have a significant impact on the GPA-pa SF score in any period (F=1.362, P=.157). According to this significant difference was present between the GPA-pa SF scores obtained at T0-T1, T2-T3 and T3-T4 in the case when the effect of dentures type was eliminated (P>.05).

Details of these results are given in Table 6a and Table 6b.

DISCUSSION

Mean GPA-pa SF scores differed among the different periods of prosthetic restoration, with the highest score obtained before starting the restoration procedure. The decreasing of the GPA-pa SF scores with time could be related to several factors. A patient with complete dentures may develop a gagging problem due to the denture itself¹⁰ or psychogenic factors.^{7,9,10} When a denture of the post-dam area extends to the soft palate, the most common factor leading to gag reflex is tactile stimulation of the sensory receptors of the soft palate. The patient may refuse to swallow saliva because of a fear that the denture will dislodge. As a result, saliva can accumulate and trigger the gag reflex.¹⁰ According to Fiske and Dickinson,⁷ experiencing something unpleasant before or during dental treatment may indirectly contribute to an exaggerated gag reflex. Similarly, Ramsay *et al.*⁹ suggested that participants with bad prior dental experiences will approach dental treatment with bias, and will behave the same during similar episodes in the future. Thus, gag reflex may be inevitable when

something is placed in the mouth, or even at the thought of something being so placed.

In patients with removable dentures, mucosal irritation on oral tissues may also affect the gag reflex. Participants with denture-related mucosal irritation had significantly higher GPA-pa SF scores compared to those without this finding. In order to eliminate mucosal irritations caused by the denture, the intaglio surface and the borders of the denture bases were re-adjusted throughout the control period and a corresponding decrease was observed in the gag reflex. It was reported that negative impacts on physical function were caused by the denture in the mouth not sitting firmly as well as by problems caused by the sense of having something in the mouth leading to gagging, pain, soreness and bulkiness.¹⁴ In addition, ill-fitting dentures were reported to be related to gagging.⁷ Our results could be related to this previous observation; as denture-related mucosal irritation decreased over time, the adaptation and retention of the dentures improved, and participants became more comfortable using their prostheses and experienced less gagging.

According to our clinical experience and report of participants, denture-related mucosal irritation in the mouth during chewing could cause loss of adaptation and stability of the dentures, leading to gagging. Upon experiencing denture-related mucosal irritation or pain during chewing, the patient may slide their lower jaw to prevent pain. As a result, the adaptation and retention of the dentures are lost, and the denture detaches from the alveolar ridge, which may cause gagging.

Female participants had higher scores in all periods of restoration. Akarslan and Bicer⁸ reported that females had higher scores on the GPA-pa SF and higher dental anxiety scores on the Modified Dental Anxiety Scale (MDAS). Mohammed¹⁵ reported that females showed a higher incidence of gag reflex than males and attributed this result to women having relatively smaller jaws and being psychologically more sensitive when compared with males thus leading to an exaggerated gag reflex. Females typically report higher overall levels of dental fear compared to males.^{16,17}

Education level was found to have no impact on the GPA-pa SF scores in any time periods analysed in the present study. Randall *et al.*¹⁸ found no correlation between gender, age or education differences in incidents of gagging in the dental clinic. Saita *et al.*¹⁹ reported that gagging problems were more frequent in males than in females.

The number of participants with a low education level was relatively high in this study. In Turkey, the education level is related to income.²⁰ Generally, participants with a low education level earn less income than those who have higher levels of education. Participants with lower education levels (low income) may prefer university clinics for their dental treatments, whereas more educated participants prefer private clinics. The participants in this study were also predominantly female (70%), consistent with previous studies in which most removable denture users were female.^{21,22} Elderly females have more missing teeth and, therefore, are

most in need of prosthetic treatment.²³ Leles *et al.*²³ reported that females had greater aesthetic expectation compared to males. Sociocultural and economic variables have relevant impacts on participants' attitudes towards treatment.

Although a significant difference was not present, participants with complete maxillary + partial mandibular, partial maxillary + complete mandibular, or only maxillary (complete or partial) dentures had higher GPA-pa SF scores in all periods. To our knowledge, no similar study has been performed to which we can compare our findings. Nevertheless, Murphy²⁴ reported that the gag reflex was most aggravated in participants wearing complete maxillary dentures, followed, in order, by partial maxillary, complete mandibular, complete maxillary + mandibular, and partial mandibular dentures. The difference between our findings and those of Murphy may be related to differences in the classification of the restoration types and the description of data between the two studies. We used the GPA-pa SF and repeated measures one way ANOVA test, whereas Murphy used only descriptive statistics of the participants in his study.²⁴ It was reported that the distolingual region of the mandibular dentures can irritate the trigger zones and produce gagging.²⁵ In this study, most of the participants used mandibular dentures with distolingual extension.

Questions from the standard form, including those of the GPA-pa SF, were read aloud to participants. This format may be prone to bias, influencing the results regarding gag reflex. This limitation should be considered during the evaluation of the results obtained from this study.

CONCLUSION

Participants had higher self-reported gagging severity before starting the prosthetic restoration procedure and this decreased with use of the dentures over time. Gender and denture-related traumatic irritation had impacts on the gagging severity during this period.

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