Evaluation of quality of life and oral hygiene attitudes of individuals using dental prostheses during the COVID-19 pandemic

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Poor esthetics and oral function because of the loss of natural teeth are problems that can affect oral health-related quality of life (OHRQoL).[1,2] A dental prosthesis can improve the quality of life by restoring oral function and esthetics.[3,4] Based on the number of missing teeth and the expectations of patients, a variety of prosthesis types are available,[5,6] with complete dentures(CDs), tooth-supported fixed partial dentures (FPDs), implant-retained removable dentures (IRDs),and implant-supported fixed partial dentures (IFPDs) being the most common options.[6-10]

The Oral Health Impact Profile (OHIP)-14 index has been widely adopted to investigate the outcome of prosthetic treatment in relation to OHRQoL[11-14] because of its reliability and translation into different languages. The OHIP-14 has been used to assess the effect of different types of prosthetic treatment,

ABSTRACT

Statement of problem. The COVID-19 pandemic impacted every area of our lives, including delaying urgent dental care. However, studies evaluating how patients using dental prostheses have been affected by the pandemic are lacking.

Purpose. The purpose of this study was to investigate how patients using different types of dental prostheses were being affected by the COVID-19 pandemic.

Material and methods. A total of 129 randomly selected individuals from among those who had been examined in the same clinic before the COVID-19 outbreak were included in the study. The study participants were divided into 4 groups according to their type of prosthesis: complete dentures, implant-retained removable dentures, tooth-supported fixed partial dentures, and implant-supported fixed partial dentures. The Oral Health Impact Profile (OHIP-14) questionnaire was implemented by telephone interviews with the study participants, who were also asked about their concerns and steps made regarding prosthetic hygiene during the COVID-19 pandemic. Data were evaluated by the Kruskal-Wallis and post hoc Dunn tests, and multivariate logistic regression analysis with forward selection was carried out to identify predictors of the oral health-related quality of life (OHRQoL) status (α=.05).

Results. OHIP-14 total scores did not vary significantly among the groups (P>.05). When the domain scores of OHIP-14 were considered separately, the analysis revealed that the implant-retained removable denture group had significantly poorer functional limitations when compared with the tooth-supported fixed partial denture (P=.005) and implant-supported fixed partial denture (P=.031) groups. The results of the multivariate logistic regression analysis indicated a statistically significant association between OHRQoL during the COVID-19 pandemic and the frequency of tooth or denture cleaning (1 time a day versus less than 1 time a day: P=.011; 2-3 times a day versus less than 1 time a day: P=.032).

Conclusions. All prosthesis users exhibited increased interest in dental hygiene and an increase in the frequency of prosthesis cleaning during the pandemic. Furthermore, the study determined that the frequency of tooth or denture cleaning was associated with significantly improved OHRQoL during the time of the COVID-19 pandemic. Among the denture groups, those treated with implant-retained removable dentures had the poorest functional limitation in terms of OHRQoL, which can be linked to postponement of routine maintenance appointments. Therefore, providing all patients with scientifically sound information on prosthetic care during a pandemic would be highly beneficial. (J Prosthet Dent 2021;126:51.e1-e7)

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Clinical Implications

How the lives of patients using dental prostheses are affected by the COVID-19 pandemic should be considered. This evaluation offers clinicians some insight into the likely needs of their patients during and after the pandemic.

as well as prosthetic rehabilitation after cancer treatment on the quality of life[2,15]; however, the authors are unaware of published research assessing the impact of global problems such as pandemics on patients using dental prostheses.

The COVID-19 pandemic has been having a negative effect on every aspect of daily life since its onset at the end of 2019. Initially discovered in connection with respiratory complaints from patients in Wuhan, China, the novel beta coronavirus was subsequently isolated and defined as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).[16,17] The World Health Organization (WHO) was quick to describe COVID-19 as a global pandemic.[18] Some reports have stated that the virus can be transmitted via respiratory droplets, with each infected person responsible for the occurrence of 2 to 3 new infections.[19,20] The virus can be transmitted by aerosols, can survive for several days on surfaces, has a period of contagion of between 2 hours and 9 days at room temperature, and remains more contagious in humid environments.[21,22] Isolation and social distancing, increased personal hygiene measures, and wearing a mask have been presented as the main protective measures for preventing the transmission of COVID-19.[21,23]

Dental procedures have been considered among the highest risk categories in terms of viral transmission, including aerosol and nonaerosol transmission.[24,25] The angiotensin-converting enzyme (ACE)-2 receptors expressed by oral epithelial cells provide an easy route for virus penetration.[25] Therefore, the American Dental Association (ADA) advised postponing all dental treatment except for urgent treatment, defined as those involving severe dental pain, osteitis, abscess or cellulitis, and dental trauma such as tooth fracture and avulsion or luxation.[26] Accordingly, nonemergency treatment, including prosthetic treatment and routine maintenance appointments, was delayed.

Older adults with chronic diseases have been reported to be at higher risk of fatalities from COVID-19[19,20,27] and might be expected to prefer postponing oral health and denture maintenance appointments because chronic diseases such as hypertension, cardiovascular disease, and respiratory diseases may require ACE inhibitors and ACE-2 receptor blockers,[28] which can increase the risk of SARS-CoV-2 infection. A report by the

U.S. Center for Disease Control and Prevention (CDC) based on data from 7162 COVID-19 cases in the United States found that chronic medical conditions were present in 37.6% of cases.[29]

Patients may be confused when their denture maintenance appointments are postponed.[30] Therefore, this study aimed to evaluate the impact of the COVID-19 pandemic on patients with different types of dental prostheses by using the OHIP-14 and self-assessments to identify their concerns during the period of the pandemic. The study hypothesis was that concerns and quality of life assessments would not differ significantly according to the different types of prosthesis used by participants.

MATERIAL AND METHODS

The study was approved by the Research Ethics Board of the University of Bolu Abant Izzet Baysal (Ethic decision no: 2020/170) and was conducted between June 30, 2020 and September 30, 2020. The participants were selected by simple random sampling from among those treated with CDs, FPDs, IRDs, or IFPDs at the Department of Prosthodontics, University of Bolu Abant Izzet Baysal. The study population comprised 129 patients from among those who volunteered to participate in the study. The selected sample size was determined with power analysis and was adequate to detect differences between the groups based on the 1-way ANOVA analysis (f=0.30 at 80% power, α=.05). The purpose of the study was explained to the patients during the phone calls. Verbal consent was obtained for a structured telephone interview, and their audio recordings were stored. The interviews were implemented by 2 independent dentists who were trained by the researchers in this study in reading the questions and recording the participants' answers. An author (K.D.) observed the interviews.

A 3-part questionnaire was used to collect data. The questions in the first part were prepared to obtain information on sociodemographic characteristics, oral healthcare habits, and the usage of oral hygiene products during the COVID-19 pandemic. In the second part, the yes or no questions were designed to reveal information about possible concerns regarding prosthesis care. In the third part, the Turkish version of the OHIP-14 was used to assess the participants' quality of life during the COVID-19 pandemic. The OHIP-14 consists of 14 items that explore 7 dimensions of oral health impact: functional limitations, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. Items are scored according to the frequency of impact on a 5-point Likert scale (4=very often, 3=fairly often, 2=occasionally, 1= hardly ever, and 0=never).[31] The possible

Table 1. Demographic data

Variables	Denture Type				P
	CD (n=40)	FPD (n=36)	IRD (n=24)	IFPD (n=29)	
Sex	—	—	—	—	.424
Women	19 (47.5%)	19 (52.8%)	13 (54.2%)	10 (34.5%)	—
Men	21 (52.5%)	17 (47.2%)	11 (45.8%)	19 (65.5%)	—
Age (years)	60.2 ±11.3[a,b]	47.8 ±7.0[a,c]	61.7 ±5.9[c,d]	52.0 ±9.8[b,d]	**<.001**
Marital status	—	—	—	—	.194
Single	-	2 (5.6%)	-	2 (6.9%)	—
Married	40 (100.0%)	34 (94.4%)	24 (100.0%)	27 (93.1%)	—
Dentist visits	—	—	—	—	.608
Regularly	2 (5.0%)	4 (11.1%)	2 (8.3%)	4 (13.8%)	—
When a dental problem occurs	38 (95.0%)	32 (88.9%)	22 (91.7%)	25 (86.2%)	—
Education	—	—	—	—	**<.001**
Primary school or less	23 (57.5%)	11 (30.6%)	9 (37.5%)	3 (10.3%)	—
Secondary or high school	12 (30.0%)	16 (44.4%)	12 (50.0%)	6 (20.7%)	—
College or university	5 (12.9%)	9 (25.0%)	3 (12.5%)	20 (69.0%)	—
Frequency of teeth or denture Cleaning		—	—	—	**<.001**
<once a day	8 (20.0%)	2 (5.6%)	-	-	—
Once a day	19 (47.5%)	17 (47.2%)	23 (95.8%)	7 (24.1%)	—
2-3 times a day	13 (32.5%)	17 (47.2%)	1 (4.2%)	22 (75.9%)	—
Time passed since usage of denture (experience)		—	—	—	.192
<1 year	2 (5.0%)	4 (11.1%)	2 (8.3%)	—	—
1-2 years	21 (52.5%)	14 (38.9%)	13 (54.2%)	17 (58.6%)	—
2-4 years	6 (15.0%)	8 (22.2%)	8 (33.3%)	8 (27.6%)	—
5-10 years	6 (15.0%)	7 (19.4%)	1 (4.2%)	1 (3.4%)	—
>10 years	5 (12.5%)	3 (8.3%)	-	3 (10.3%)	—

CD, complete denture; FPD, fixed partial denture; IFPD, implant fixed partial denture; IRD, implant-retained denture. Mean ±standard deviation or n(%). Bold indicates statistical significance at P<.05 for 1-way ANOVA or Pearson chi-square or Fisher exact test. Same superscript letter indicates statistically significant difference in post hoc comparisons using Games-Howell test.

OHIP-14-total and individual domain scores range from 0-56 and 0-8, respectively, with higher scores indicating poorer OHRQoL.

Statistical analysis was performed with a statistical software program (IBM SPSS Statistics, v25.0 for Windows; IBM Corp). Descriptive data were presented as frequencies (percentages), mean ±standard deviations, and medians (25th to 75th percentile). The Pearson chi-square and Fisher exact tests were used to compare demographic data and responses to the yes or no questions. A Shapiro-Wilk test demonstrated non-normality of distribution for the OHIP-14 scores; therefore, the nonparametric Kruskal-Wallis test was used to compare OHIP-14 scores among groups, and the post hoc Dunn tests were applied for pairwise comparisons (α=.05). The Kruskal-Wallis test preserved the statistical power for nonsymmetrical distributed variables compared with parametric counterpart 1-way ANOVA.[32] OHIP-14 scores were dichotomized by using median splits to test the strength of the associations between OHRQoL and sociodemographic factors, oral healthcare habits, and denture-care concerns. Multivariate logistic regression analysis with forward selection was used to identify the predictors of OHIP-14 and calculate odds ratios (ORs) and 95% confidence intervals (95% CI).

RESULTS

A total of 129 individuals (68 women, 61 men) were enrolled in the study. The results of the statistical tests for demographic data, the distribution of patients according to the groups, oral health habits, and length of time of denture usage are shown in Table 1. No significant differences in sex, marital status, dental visits, or time of usage were found among the groups (P>.05). However, significant differences were found in age (P<.001), level of education (P<.001), and frequency of teeth or denture cleaning (P<.001) among the groups. The CD group included higher number of individuals with a level of education of primary school or less (n=23, 57.5%), and the IFPD group included a higher number of individuals with college or university education (n=20, 69.0%). The number of individuals who cleaned their teeth or dentures once a day or less was more frequent in the CD group (n=20, 20.0%), whereas the majority of those with IFPDs reported that they cleaned their teeth or dentures 2 to 3 times a day (n=22, 75.9%).

The results of Pearson chi-square and Fisher exact tests regarding denture-related concerns during the pandemic are shown in Figure 1. The number of those who felt a need for more frequent cleaning was highest in the IRD group and lowest in the FPD group(P<.05). The
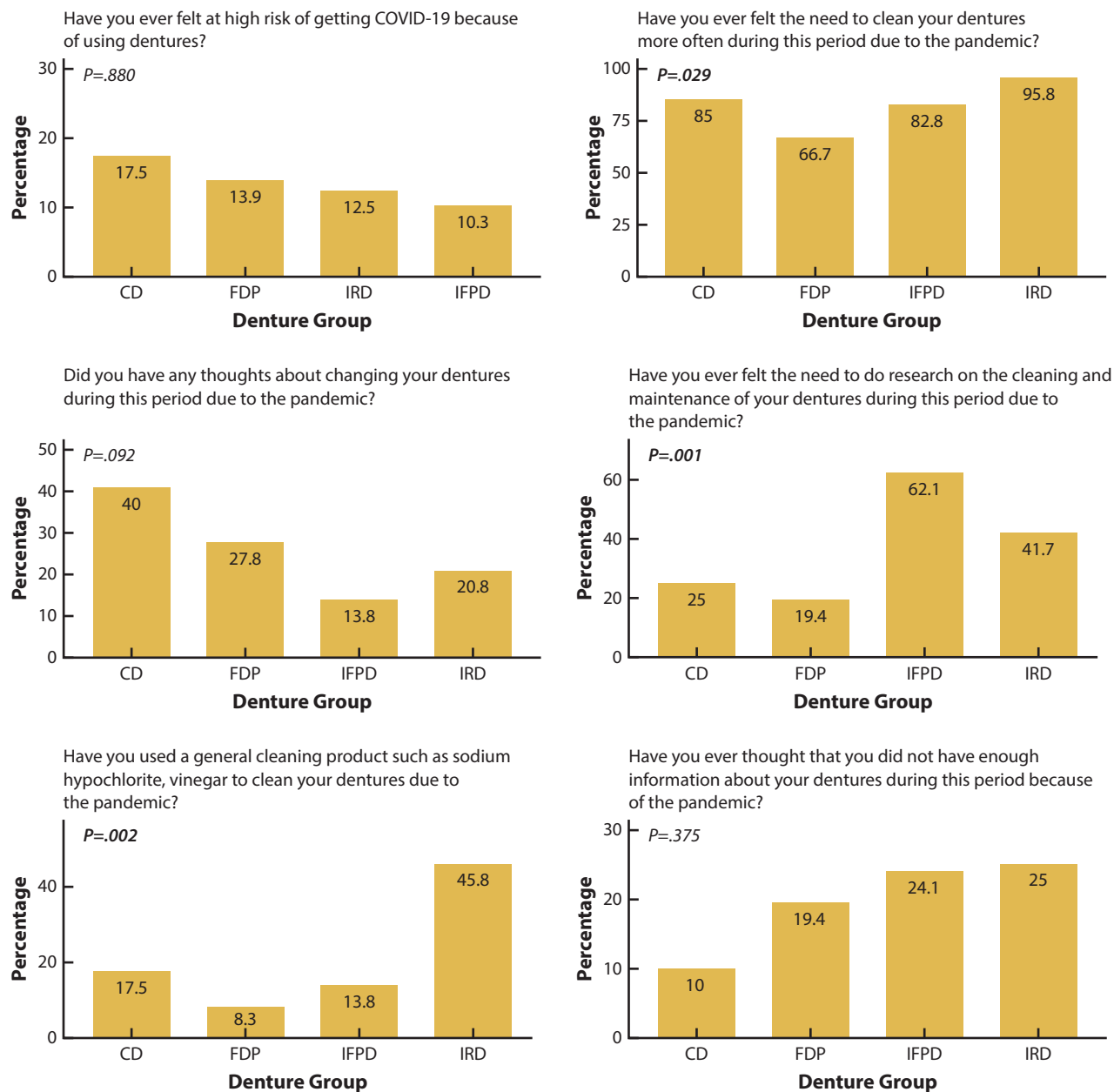
Figure 1. Percentage of "yes" answers to questions related to dentures during COVID-19 pandemic within each group. *P* values based on Pearson chi-square or Fisher exact test. Bold indicates statistical significance at *P*<.05. CD, complete denture; FPD, fixed partial denture; IFPD, implant fixed partial denture; IRD, implant-retained denture.

FPD group also had the lowest number of those who felt a need to research prosthetic care, whereas that number was highest in the IFPD group (*P*<.05). The FPD group had the lowest number of individuals who used a household cleaning product such as sodium hypochlorite or vinegar to clean their dentures, whereas this number was highest in the IRD group.

OHIP-14 total scores and the domain scores of OHIP-14 of the groups are shown in Table 2. Overall OHRQoL during the COVID-19 pandemic, as reflected by the OHIP-14 total scores, had borderline significance

(*P*=.057). The median OHIP-14 total score was the highest in the IRD group (median: 5.5, IQR: 4-9), which was an indication of poorer OHRQoL, followed by the CD (median: 4, IQR: 3-11.3) and IFPD (median: 4, IQR: 2-5) groups. Significant differences were detected in the domains of "functional limitation" (*P*=.006) and "handicap" (*P*=.046). Post hoc comparisons of the groups revealed a poorer functional limitation in the IRD group, as the "functional limitation" domain score was significantly higher when compared with that of the FPD (*P*=.005) and IFDP (*P*=.031) group scores. The CD group

Table 2. Comparison of OHIP-14 ADD scores among denture groups

OHIP-14 Domain	Denture Type				P
	CD (n=40)	FPD (n=36)	IRD(n=24)	IFPD (n=29)	
OHIP-14 total score	6.73 ±5.48	5.61 ±5.74	6.38 ±3.17	4.17 ±2.79	.057
—	4 (3-11.3)	3.5 (2-7)	5.5 (4-9)	4 (2-5)	—
Functional limitation	0.73 ±0.96	0.53 ±0.84[a]	1.54 ±1.32[a,b]	0.52 ±0.57[b]	**.006**
—	0 (0-1)	0 (0-1)	1 (0-3)	0 (0-1)	—
Physical pain	1.33 ±1.47	1.03 ±1.16	1.58 ±0.97	0.97 ±1.15	.093
—	1 (0-2)	1 (0-2)	2 (1-2)	1 (0-1.5)	—
Psychological discomfort	2.10 ±1.17	2.44 ±1.5	2.08 ±1.14	2.07 ±1.41	.758
—	2 (1-3)	2 (1.3-3)	2 (1.3-3)	2 (0.5-3)	—
Physical disability	0.78 ±1.21	0.58 ±1.16	0.42 ±0.58	0.24 ±0.58	.247
—	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-0)	—
Psychological disability	0.78 ±1.31	0.53 ±1.16	0.38 ±0.58	0.21 ±0.77	.149
—	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-0)	—
Social disability	0.53 ±1.09	0.31 ±0.89	0.17 ±0.48	0.07 ±0.37	.091
—	0 (0-0.8)	0 (0-0)	0 (0-0)	0 (0-0)	—
Handicap	0.50 ±0.93[a]	0.19 ±0.62	0.21 ±0.41	0.10 ±0.56[a]	**.046**
—	0 (0-1)	0 (0-0)	0 (0-0)	0 (0-0)	—

CD, complete denture; FPD, fixed partial denture; IFPD, implant fixed partial denture; IRD, implant-retained denture. Mean ±standard deviation and median (25th to75th percentile). **Bold** indicates statistical significance at P<.05 for Kruskal-Wallis test. Same superscript letter indicates statistically significant difference in post hoc comparison among groups.

scored significantly higher for "handicap" when compared with the IFDP group (P=.048).

Multivariate logistic regression analysis with forward selection indicated age, frequency of teeth or denture cleaning, and type of denture to be significantly associated with OHRQoL during the COVID-19 pandemic (Table 3). Aging was associated with poorer OHRQoL (OR: 1.050, 95% CI: 1.005-1.097, P=.031). More frequent teeth or denture cleaning was associated with significantly better OHRQoL during the pandemic (once a day versus less than once a day: OR: 0.106, 95% CI: 0.019-0.600, P=.011; 2 to 3 times a day versus less than once a day: OR: 0.147, 95% CI: 0.025-0.848, P=.032), while individuals with IRDs showed significantly poorer OHRQoL during the COVID-19 pandemic as compared with the patients with CDs (OR: 3.255; 95% CI: 1.011-10.480; P=.048).

DISCUSSION

The impact of the COVID-19 pandemic on attitudes toward dental care and on OHRQoL in patients with different types of dental prostheses was investigated in the study. The study hypothesis was partially rejected. Although OHIP-14 total scores showed only borderline significance according to the type of prosthesis, significant differences were found among the functional limitation scores and handicap scores of the groups, and the responses to "yes or no" questions also varied significantly among the groups.

Well-made complete dentures can improve quality of life,[8] and similar OHRQoL outcomes between complete denture groups and implant-retained denture groups have been stated in previous studies.[9,11] However, Nogawa et al[6] and Kutkut et al[7] reported that different

Table 3. Predictors associated with logistic regression analysis using forward selection

Variables	Overall		
	OR	95% CI for OR	P
Age (in years)	1.050	1.005-1.097	**.031**
Frequency of teeth or denture cleaning	—	—	—
<once a day	reference	—	—
once a day	0.106	0.019-0.600	**.011**
2-3 times a day	0.147	0.025-0.848	**.032**
Denture type	—	—	—
CDs	reference	—	—
FPDs	1.825	0.578-5.759	.305
IRDs	3.255	1.011-10.480	**.048**
IFPDs	1.060	0.324-3.464	.924

CI, confidence interval; OR, odds ratio. Outcome: Dichotomized OHIP-14 total score using median split (median=4). Higher scores of OHIP-14 indicated poorer oral health related quality of life. P-value of .995 in Hosmer-Lemeshow test confirmed goodness of fit of model. **Bold** indicates statistical significance at P<.05.

types of prostheses resulted in different levels of improvement and that it was related to a prosthesis' ability to imitate the function of missing natural teeth. It was reported that implant-supported fixed partial dentures were more likely to improve patient function and comfort than either conventional removable prostheses or tooth-supported fixed partial dentures.[3] Sharka et al[10] suggested that the greater improvements in the quality of life observed with implant-retained removable dentures as compared with complete dentures could be explained by the initial poor quality of life identified among patients wearing maladapted dentures.[10]

Improvements observed in relation to prosthesis usage are highly correlated with both psychosocial and clinical factors, and OHRQoL scores can be affected by the time of usage.[4,12] Geckili et al[11] conducted similar

OHRQoL scores for implant-retained removable dentures and complete dentures, although the improvements were greater with the implant-retained removable dentures over a 4-year follow-up period. Significant improvements in OHRQoL were also reported by patients treated with fixed prostheses, removable partial dentures, and complete dentures after 1 year of follow-up.[5,13] In the study, most participants had been using their dentures for more than 1 year and had completed the adaptation process, indicating good quality of life for all the groups.

In the present study, the functional limitation domain score was significantly higher for the IRD group as compared with the CD group. The IRDs' components may need repair or replacement,[30] and some patients whose IRDs required minor adjustments could be negatively affected by the cancellation of maintenance appointments. Although none of the participants had reported visiting a dentist because of prosthesis-related pain during the pandemic, 1 person in the IRD group reported visiting the dentist because he felt the prosthesis was loose. None of the participants experienced prosthesis-related problems that resulted in a deterioration in OHRQL during the COVID-19 pandemic. However, the attitudes of the participants toward denture care were affected by the COVID-19 pandemic. The frequency of denture cleaning increased regardless of prosthesis type, although the number of patients who felt more frequent cleaning was significantly the highest in the IRD and CD groups. These differences could be because of the structural characteristics of the prosthesis. For example, resin bases and LOCATOR connectors have been reported to cause foreign-body sensations in wearers of removable dentures,[6] which could lead patients to assume their prostheses required cleaning. Also, the participants expressed a greater need to learn about appropriate prosthetic hygiene and care during the COVID-19 pandemic. The IFPD group placed significantly greater importance on learning about hygiene and care, which could be explained by that group's relatively higher level of education in comparison with that of other groups.[16] The importance placed on researching prosthetic hygiene and care may also be related to the increased emphasis on hygiene during the COVID-19 pandemic.[23]

In the present study, some participants with removable prostheses used household products such as vinegar or even sodium hypochlorite for denture cleaning, whereas others with fixed dentures used vinegar as a mouth rinse. Although both sodium hypochlorite and vinegar are capable of eliminating microorganisms from denture surfaces, these cleaning agents must be used at suitable concentrations.[33,34] Their use in dentistry is limited not only because high concentrations can alter the physical properties of prosthetic materials[35] but because insufficient removal following application can cause toxicity to human fibroblast cells.[36] Information regarding ideal methods of prosthesis cleaning should be beneficial for patients during the COVID-19 pandemic. Otherwise, clinicians may find that improper cleaning routines performed by patients during the pandemic period cause the prostheses to deform and require replacement in the postpandemic period.

This study had advantages when compared with online studies. The interviewers explained the questions to respondents, ensuring that they understood the content and were informed about prosthetic care. Limitations of this study included that clinical outcomes could not be assessed. Because clinical examinations could not be evaluated during the pandemic, the results could not be compared with clinical findings. In addition, because the study groups were formed from the records of a single dental faculty, the data reflected the behavior of individuals in 1 region. Future studies can be conducted to compare the behaviors of individuals from different cultures with regard to the effects of pandemics on patients with dental prostheses.

CONCLUSIONS

Based on the findings of this clinical study, the following conclusions were drawn:

1. Patient interest in prosthetic hygiene and the frequency with which patients cleaned their prostheses increased during the COVID-19 pandemic.
2. The postponement of routine maintenance appointments had the greatest effect on the functional limitations of prostheses in patients using implant-retained removable dentures.
3. Patients could benefit from information obtained from reliable scientific sources regarding the proper cleaning of dental prostheses.

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