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ORIGINAL RESEARCH

Evaluating problems and function of complete denture prostheses

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Abstract

Background: The use of complete dentures is increasing as the average age in communities rises. Dentures might cause various problems in some patients. This study aimed to evaluate the challenges and functionality of complete dentures among these patients.

Materials and Methods: This cross-sectional retrospective study, examined 138 patients who received dentures last year (55 women and 83 men) with a mean age of 64.8±9.3. Oral lesions and denture function were evaluated using a self-assessment questionnaire based on the Patient's Denture Assessment. Additionally, distribution of impaction, occlusion, occlusal plane, and vertical dimension of occlusion in patients were assessed. Data were analyzed by using Chi-square and student t-test ($p < 0.05$).

Results: The average age of dentures was 12.1±6.8. Mean scores for denture function included: esthetic and speech 2.8±0.9, lower jaw function 2.9±0.8, patients' expectations 3.7±0.7, upper jaw was 2.5±0.7, and denture importance 2.7±0.7. Prevalence rates were 12.3% for stomatitis, 9.4%ulcers, 16%angular cheilitis, and 7.2% for epulis fissuratum. False denture occlusion occurred in 52.9% with false centric jaw relation in 56.5%. The vertical dimension of occlusion was low in 66.6% of cases and high in 10.9% of cases. Inadequate denture retention was seen in 45.2%, with the denture base fracture and artificial teeth fractures at 10.2% and 10.95, respectively.

Conclusion: In this study, patients noted average denture function and experienced lip and mucosal lesions. The main complaint was poor denture retention. Improved design and replacement of worn dentures could enhance function and reduce problems.

Keywords: Complete denture; Dental prosthesis; Patient satisfaction; edentulous

Introduction

Despite the reduction in the edentulous adult population, there are increasing edentulous patients who need to receive prostheses due to the world's increasing population (1). Nowadays, people who lose their teeth are decreasing because of progressive preventive dentistry. On the other hand, there is a considerable increase in number of edentulous patients due to the expanded life expectancy and the quality of life (2,3).

Loss of natural teeth results in various functional and psychological outcomes for patients and these problems can be somewhat treated by dentures. Nevertheless, the results of denture replacement are different depending on some factors such as the skill of dentists, laboratory technicians, and factors associated with patients(4).

Success or failure in treatment with a complete prosthesis is predictable. The majority of patients' complaints resulted from inadequate preparedness for physical, oral, and mental issues, as well as misinformation regarding the nature of a complete prosthesis(5). Complete prosthesis support means the resistance of remaining ridges (bone-mucus) against vertical pressures of the prosthesis toward the ridge

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(6). Prosthesis bases should be completely compatible with their underlying tissues to have desirable support so that occlusion surfaces will be placed on each other properly. A suitable support guarantees prosthesis retention and stability(6).

A denture is a set of artificial teeth replacing lost natural teeth providing convenience, esthetics, and health for the patient. Although removable prosthodontics were invented several years ago and some progress occurred in this field, sometimes some dental prostheses may cause problems with patient convenience, unstable occlusion, and esthetics issues harming underlying tissue so that patient cannot use dentures anymore. Moreover, complications caused by dentures are severe in patients with some diseases such as diabetes (7).

Although denture helps an edentulous patient, who has lost some teeth with chewing and food digestion and guarantee beauty and convenience for the patient, inappropriate dentures may cause severe harm to healthy oral tissues. For instance, physical harm caused by dental prostheses, accumulation of bacterial plaque on a denture, or allergic and toxic reaction to constituents of acrylic materials of denture may stimulate mucus reaction producing lesions in underlying tissue (8)

Since patients have high expectations from treatment, it is essential to warn them about possible problems post-treatment. In this case, the dentist can give patients beneficial and perfect teachings to solve post-treatment problems (9).

To achieve a successful treatment, materials affecting the quality of dentures should be evaluated perfectly. The quality of the denture depends on various factors such as retention, stability, vertical dimension, occlusion, esthetic, food impaction under the denture, speaking, and chewing. In the majority of cases, treatment does not match with patients' expectations. On the other hand, the patient's complaints about the denture are related to lack of retention and stability, pain, food impaction under the denture, difficulty in speaking, bone loss, and growth of soft tissue under the denture. Of the problems mentioned, more complaints were about pain. Some cases such as systematic problems and the use of various drugs may cause such problems (5,7).

Therefore, when visiting edentulous patients, the dentist should plan a suitable treatment and use a correct method based on an accurate examination, testing physical and psychological modes of the patient, paying attention to logical and illogical demands of patients, predicting possible outcomes of treatment, and considering all of the patient's oral conditions. In this regard, dentists should be aware of patients' expectations, making them aware of possible problems and solving upcoming problems(10,11)

Since removable dental prostheses are more used than implants due to their inexpensive cost that is matched with the economic status of most patients and with consideration of a wide range of the mucosal lesions caused by dentures, this study was conducted to examine reasons for failure in complete dentures. The findings of this study can give extra information about complications of complete dentures to be used when advising patients (12,13).

Materials and Method

This was a cross-sectional and retrospective study conducted in Ardabil in 2017. Studied patients were selected as consecutive selections based on the date of complete prosthesis receipt in 2017 considering the study metrics. The sample size was calculated based on the prevalence of problems caused by dentures such as problematic application, eating, social relationships in at least 90% of patients (14), and dependence of complications with older ages; accordingly, the sample size obtained to n=138 based on the Cochrane formula (z=1.96) and error interval (e) of 5%.

Samples were evaluated after authenticating necessary metrics. The study was implemented like other similar studies based on the examination and filling out questionnaire(15,16) .

Patients were asked to refer to dental clinics in Ardabil city regarding free oral-dental examinations. Some questions were asked about possible complications of the prosthesis during examinations (questionnaire). The items asked were based on the questionnaire applied in similar studies (15,16). These questions were related to problems caused by the use of dentures such as placing and removing the prosthesis and pain, eating problems (chewing problems, pouring food from the mouth, displacement of denture, and food accumulation under the denture), problems related to social relationships (disturbed speaking and laughing), problems related to beauty (satisfaction with color and shape of denture), and problems related to quality of life (bad smell of mouth, sleep disorder and self-confidence level). Some explanations were given to patients about how to answer questions.

In this research, 2 questionnaires were employed; a questionnaire adapted from similar studies and a questionnaire obtained from dentist's examinations.

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To check complications and outcomes of the complete denture, a self-assessment questionnaire of PDA was employed; this questionnaire consisted of 22 items in 6 scopes to evaluate, function, and esthetic, complete mandibular denture, complete maxillary denture, patients' expectations, and prosthesis necessity. This questionnaire was revised in 2014 by Komagamine et al. and designed in two English and Japanese languages (14); the validity, internal consistency, and reliability of this questionnaire have been proved (17). Questions and scoring methods were modified in the present study to determine the validity of the questionnaire simply. In this regard, questions were measured based on the 5-point Likert Scale (from strongly high (5) to strongly low (1)) instead of a scoring range of 0-100 on the pain visual analog scale (VAS). In this case, higher scores indicated the worsened status of the complete denture, and lower scores indicated better status (reverse case in some questions). This questionnaire was translated into the Persian language by an English translator. After modifications, the validity of the questionnaire was approved by 3 dentists using the content validity index (CVI) and content validity ratio (CVR). Its reliability was measured using Cronbach's alpha coefficient, and pretest-post test on 15 patients who had complete dentures within a 2-week interval and the reliability value of 0.74 was obtained indicating an acceptable level.

The inclusion metrics of the study were as follows: 1) wearers of complete removable prostheses 2) informed consent of patients for participation 3) at least one year wearing of denture. Exclusion metrics consisted of 1) patients with systematic and chronic diseases such as diabetes, immune deficiency, rheumatoid arthritis, salivary gland disorders, and malignancy, 2) receptor of oral and topical antifungals and corticosteroids 3) patients with Mental and physical disabilities, 4) pregnant and lactating women, 5) smokers.

The gathered data were coded then inserted into SPSS 19 Software and analyzed using analytical methods of T-test and Chi-square. The significance level was considered lower than 0.05 in all of the mentioned tests.

Results

The Patients' Demographic and clinical information are displayed in table 1.Of the evaluated 138 patients, 55 members (39.8%) were women, and 83 members (60.2%) were men. The minimum and maximum ages of patients were 45 and 89 and the average age of patients was 64.8. 21% were 45-55 years old, 23.2% 56-65, 39.1% 66-75, and 10.1% 76-84. There was not any difference between the average age of adults in this research (P=0.09).

Table 1. Patients' Demographic and clinical information

Variable	Parameter	Frequency	Percent
Gender	Male	83	60.1
	Female	55	39.9
Age	45 – 55	29	21.1
	56 – 65	32	23.2
	66 – 75	54	39.1
	76 - 84	14	10.1
Denture Age	1 – 5	27	19.68
	6 – 10	26	18.8
	11 – 15	7	5
	Over 16	48	34.9
Denture Retention		151	55
Denture Stomatitis		22	15.9
Angular Cheilitis		13	13
Denture Ulcer		20	14.5
Epulis Fissuratum		10	7.3
Denture Base Fracture	Maxillary	6	4
	Mandibular	8	6.2
Teeth Fracture	Maxillary	7	5.1
	Mandibular	8	5.8
Occlusion	Correct	68	
Bite	Normal	31	22.5
	Open Bite	15	10.9
	Deep Bite	92	66.6
Denture-Centric Relation	Correct	78	56.5
	Incorrect	60	43.5

The range of denture use was 1- 31 years. 44.2% of respondents have been using dentures for 1-5 years, 13.8% for 6-10 years, 16.7% for 11-15 years, and the rest (25.3%) have been using dentures for more than 15 years.

Results obtained from the 22-item questionnaire showed the average satisfaction of patients with complete dentures concerning function, esthetic, and speaking. Moreover, patients reported more problems in the lower jaw compared to the upper jaw such as food impaction under the prosthesis and displacement of denture. Patients had relatively high expectations from dentures. In the case of necessities such as

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denture care, patients scored relevant questions at an average level. In addition, there was not any significant difference between men and women in terms of questionnaire scopes (P=0.09).

125 cases (90.5%) of lack of retention of denture were reported by respondents; of that, 29 cases (23.2%) were related to lack of retention in maxillary denture and 96 cases (76.8%) to mandibular denture.

The complications of mucosal complications of patients consisted of denture stomatitis, inflammation of the lips, ulcer, and Epulis fissuratum; of 138 members, 62 patients (44.9%) had mucosal lesions, 17 patients (12.3%) suffered from denture stomatitis, 13 patients (9.4%) had inflammation of the lips, 22 patients (16%) had ulcer, and 10 patients (7.2%) suffered from Epulis fissuratum. According to chi-square test results, there was not any relationship with mucosal lesions except for Epulis fissuratum (P>0.05).

Among 62 members with lesions, 9 members (14.52%) had more than one lesion; there were 22 maxillary lesions (35.5%), 27 mandibular lesions (43.54%), and 13 lesions in the corner of lips (20.96%). There is a significant relationship between the prevalence of Epulis fissuratum and the female sex (P=0.04, R=0.2) according to the chi-square test, while this difference was significantly more in women (P=0.045) according to the chi-square test.

In the case of dentures, there were 14 cases (10.2%) of denture base fracture; of that, 6 cases were in maxillary dentures and 8 cases were in mandibular dentures.

In the case of dentures, there were 15 cases (10.9%) of artificial teeth fracture; of that, 7 cases were in maxillary dentures and 8 cases were in mandibular dentures. There were two cases of simultaneous base denture and artificial teeth fracture.

In the case of patients' occlusion, 68 members (47.1%) had proper occlusion, and the rest of the patients had false occlusion. Appraisal of the vertical dimension of occlusion was high in 15 members (10.9%), normal in 31 members (22.5%), and low in 92 members (66.6%).

The average angle between the fox plane and the interpupillary line was 2.74 of 5° and the average angle of the posterior occlusal plane was equal to 8.54 of 20, 4.94 of 20, and 1.74 of 30° for superior, middle, and inferior points of the tragus, respectively. The positive angle shows a low fox plane versus Ala-tragus and the negative angle shows a higher fox plane angle versus Ala-tragus.

Evaluation of centric jaw relation showed 78 (56.5%) correct cases and 60 (43.5%) false cases.

The following findings were obtained from Spearman and student t-test:

There was not any significant relationship between gender and the studied variable according to the student t-test (P>0.05).

There was not any significant relationship between the age of participants and studied variables except for the age of the denture (P=0.00, R=+1).

There was a direct relationship between lack of retention and low vertical dimension of occlusion (P=0.04, R=+0.2), higher age of denture (P=0.02, R=-0.2), and false occlusion (P=0.04, R=-0.2).

There was a significant relationship between female gender and Epulis fissuratum (P=0.04, R=0.2).

There was a direct relationship between teeth fracture and false occlusion (P=0.01, R=+0.41).

Discussion

This study was conducted to evaluate the problems and function of removable complete prosthodontics in edentulous patients. According to the findings of the present study, function of the denture obtained an average score lower than the score expected by patients- without a significant relationship with the sex of patients and maxillary or mandibular dentures based on the PDA questionnaire. There were more problems in the lower jaw than the upper jaw in the case of food impaction under the prosthesis, and denture displacement. Patients had higher expectations from dentures. In the case of necessities such as denture care, patients gave average scores. Pain, impaired swallowing and speech, lack of esthetic, noisy chewing, remaining foods under the denture, lack of retention, and lack of denture adaptability with jaw were some factors asked from patients in the PDA questionnaire; these factors were similar to problems among patients who worn denture in similar studies (5,13,18,19).

Moreover, there was no significant difference between men and women in the case of the questionnaire's scope; this finding was in line with the results obtained by Gosavi et al. (5) and Ogunrinde et al. (20).

The main reasons for problems among studied patients consisted of mucosal lesions, design and manufacturing of dentures, and worn dentures.

Mucosal lesions not only cause pain and inflammation but also may increase denture dysfunction. In this research, the prevalence value of Stomatitis, ulcer, angular cheilitis, and Epulis fissuratum was obtained to 12.3%, 16%, 9.4%, and 7.2%, respectively. Various

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rates of mucosal lesions caused by dentures have been reported in similar studies (5,11,13,16,18,21,22).

There was a significant relationship between Epulis fissuratum prevalence and the female sex and this result was in line with results obtained from a study conducted by Tohidast et al (23).

According to a study conducted by Bilhan et al. (13), there was 47.5% ulcer or inflammation, 9.1% stomatitis, and 5.1% angular cheilitis among patients who wear dentures; in this study, stomatitis prevalence rate varied between 9 and 16.7% in different dentures. Moreover, ulcers or mucosal inflammation harmed patients' speaking. Singh et al(11). reported 56% stomatitis, 32% angular cheilitis, and 58% ulcer in men (42%, 28%, and 68%, respectively in women) as common mucosal lesions among denture wearers; mucosal lesions were more prevalent in their study compared to the present paper. Gosavi et al.(5) reported ulcer and pain (29.9%) as the most prevalent complaints of patients with complete dentures; in this case, older adults had more complaints without any connection to their sex. Tuominen et al. (24) conducted a study on the oral health of old Finnish men who were denture wearers and reported 66.9% of patients with mucosal harm. In Iran, Toheedast et al. (23) reported prevalence rate of stomatitis, angular cheilitis, and Epulis fissuratum equal to 38.3%, 23.2%, and 55%, respectively. that these rates are higher than rates obtained in present study due to quality and quantity of denture manufacturing, oral-dental health level, studied population, time of denture wearing and inclusion criteria of the study; respondents of present study had begun denture wearing at least one year ago while in mentioned study respondents entered to the study at the time of denture wearing beginning.

Although using denture can improve the quality of life, its inefficiency may worsen the quality of life of wearers (25). Inappropriate design is accompanied by some cases such as food impaction, denture displacement, denture movement, impaired chewing and speaking, ulcer, noise, Vagus nerve stimulation, impaired tongue movement, face defamation, and bad smell of mouth(13,18,25,26). The most important evaluated factors of design consisted of retention rate, occlusion plane, vertical dimension of occlusion, and centric jaw relation.

Prevalence of lack of retention reported to 45.2%; 76.8% lack of mandibular retention and 23.2% lack of maxillary retention. According to a study conducted by Gosavi et al.(5), most of the complaints related to lack of denture retention with a 35.4% prevalence. Findings obtained by Menon et al.(27) showed an optimal rate of 37.5% maxillary denture retention and 52.8% mandibular denture retention ,In a study done by Nevalainen et al(28) lack of suitable retention in maxillary and mandibular dentures was obtained 24% and 65% . The prevalence of lack of suitable retention in the present study was higher than the mentioned studies; and the most reported problem was poor retention of mandibular denture. Similar to the present study, the three above-mentioned studies indicated a higher prevalence of suitable maxillary retention. Suitable retention is one of the significant factors in patients' satisfaction with dentures (4).

Obtaining Proper vertical dimension of occlusion (VDO) is a critical step in prosthodontic treatment for edentulous patients(29). Inappropriate vertical height leads to oral-facial problem such as bruxism, painful chewing muscles, and temporomandibular disorders. Increased VDO may lead to premature tooth contact resulting in trauma to underlying tissue and displacement of denture. Hence, decreased vertical dimension of occlusion weakens chewing power leading to facial deformation that is not optimal aesthetically (30). Evaluation of the vertical dimension of occlusion indicated its rate was 10.9% above normal level and 66.6% lower than normal level. According to studies conducted by Bilhan et al(18), the vertical dimension of occlusion was normal in 26.5% of cases, increased in 3.1% of cases, and decreased in 70.35 of cases; this result was somewhat matched with the results of the present study.

Denture base and artificial teeth fracture rates were obtained at 10% and 10.9%, respectively in our research. In research conducted by Bilhan et al. (13,18), the prevalence rate of complete denture base fracture was 26.35 and 27.5% and the artificial teeth fracture prevalence rate was equal to 31.4%; these rates are higher than the rates obtained in the present study. There was not any significant relationship between the vertical dimension of occlusion and artificial teeth fracture; this result is in line with the study conducted by Bilhan et al.(18) in Türkiye. In addition, there was a significant relationship between the vertical dimension of occlusion and lack of retention; in this case, patients with lower retention experienced a reduction in the vertical dimension of occlusion. This finding does not match with results obtained from a study conducted by Bilhan et al. (18). The reason for more cases of denture fracture in the mentioned studies may be due to ignoring fracture records in the present paper.

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According to the results of occlusion appraisal, 49% of cases were correct occlusion and 51% false cases; Nevalainen et al. (28) reported 43% correct occlusion and 57% false occlusion these rates are somewhat in line with our results.

According to the evaluation of centric jaw relation in this research, 78 cases (56.5%) were correct, and 60 cases (43.5%) were false. Results of a study conducted by Bilhan et al(18) showed that this relation was correctly designed for 64% of patients and false for 35.9% of patients indicating better outcomes than our study in this context. There was a significant relation between centric jaw relation and artificial teeth fracture in our findings was in agreement with the study by Bilhan et al. (18).

Suitable design of the occlusal plane plays a vital role in efficiency or complications caused by dentures such as chewing, stability, and speaking; in this regard, proper landmarks for the occlusal plane or hybrid use of landmarks contribute to better results (31). Schema of the occlusal plane indicated a 2.74° angle average between the fox plane and the interpupillary line.

The occlusal plane in a half-faced view indicated the angle between the fox plane and ala-tragus line equal to 8.54°, 4.94°, and 1.74° for the superior point, middle point, and inferior point, respectively. Therefore, there was higher parallelism between the fox plane line and the inferior point of the ala-tragus. Nayar et al.(32) reported angle values of 5.75, 4.78, and 3.91 for superior, middle, and inferior points, respectively; therefore, the fox plane angle between the ala-tragus line and middle point obtained in our study is matched with study by Nayar et al.(32).

The higher age of the denture can reduce the quality of the denture by deforming it. In our study, an increase in the age of dentures led to reduced occlusion within the vertical dimension. It has been proved that poor vertical dimension is one of the important complaints of patients(28). The vertical dimension of occlusion affects the face of patients aesthetically and functionally(33). Moreover, lack of retention was another substantial problem of patients that was related to the lower vertical dimension in our research.

Conclusion

According to the findings of this study, the efficiency rate of removable complete dentures was at an average level among edentulous adults living in Ardabil, Iran. Moreover, there were fewer mucosal lesions in these patients compared to other studies conducted inside and outside of Iran. Suitable design considering retention, occlusal plane, and vertical dimension besides worn denture replacement can solve problems of denture wearers.

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