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Clinical Evaluation of Patient Satisfaction with Aesthetics, Retention, Function, and Comfort of Removable Complete and Partial Acrylic Dentures

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Abstract

Objectives: The quality of removable dentures (acrylic partial and complete) significantly affects patients' quality of life, encompassing aspects such as aesthetics, function and the psychological well-being of individuals by restoring their smile. This study aimed to evaluate patients' satisfaction with aesthetics, support, function, and comfort of acrylic removable partial and complete dentures and their acceptance of the procedure.

Materials and Methods: A total of 146 randomly selected partially and completely edentulous patients (106 males and 40 females) with ages 30 years or more were included in this study. All participating patients (120 partially, 23 completely edentulous and 3 patients having one completely edentulous arch and another one is partially edentulous) were informed about the objectives of the study to get their acceptance in terms of esthetic, function, retention, comfort and some other matters by answering some questions (a questionnaire consists of 17 multiple choice questions, using Likert-type scale).

Results: There was an acceptable level of patient's satisfaction with their constructed removable dentures, but they were more satisfied with their removable partial denture in comparison to their complete one regarding the retention of the upper denture (p=0.007), chewing ability (p=0.025), speech (p=0.005) and comfort (p=0.003). Lower denture retention (p=0.062), aesthetic patient's appearance, (p=0.122), getting ulcers after wearing the denture (p=0.125) and difficulties during denture construction visits (p=0.838) did not show the same differences. Most patients (68.49%) had been wearing dentures for more than a year.

Conclusions: This study found generally positive patient experiences with both removable partial and complete dentures, with higher satisfaction observed among those with partial dentures, particularly regarding retention, chewing, speech, and comfort. These findings highlight the benefits of preserving natural teeth and the importance of individualized care, especially during the initial adjustment period, to optimize long-term denture success.

Keywords: Dimensional Stability; Complete Dentures; Measuring Tools; Dimensional Accuracy; Micrometer Microscope.

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Introduction

Prosthodontics is the branch of dentistry concerned with restoring and maintaining a patient's oral function, well-being, appearance and health by restoring natural teeth and/or replacing missing teeth with artificial replacement teeth [1,2].

This area of dentistry is particularly technique sensitive when it comes to the patient's oral rehabilitation through the provision of fixed partial dentures, removable partial and complete dentures, various maxillofacial prosthesis by the practitioner. Several factors influence the provision of prosthodontics services, including social and demographic characteristics, patient's symptoms and projected need for care, and aesthetic considerations [3].

The practitioner needs to be aware of the methods, material biocompatibility, and bio acceptability that go into creating the prosthesis that the patient will need to wear. It is sagely stated that "It is more important to preserve what already exists than to replace what is missing" [1].

It has been demonstrated that when natural teeth are removed, chewing ability may

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suffer, which may have an adverse influence on dietary preferences and nutritional status. Diet is crucial for preventing systemic diseases in elderly adults, as poor diets are linked to cardiovascular disease, osteoporosis, and bowel illness [4].

According to the 2009 Adult Dental Health study, 85-year-old patients had an average of 14 teeth, which suggests that tooth replacement may be warranted in this cohort. Epidemiological evidence also indicates that people are keeping their teeth into later life [5]. In addition, a lower rate of total edentulism has been seen in the elderly population due to advancements in dental materials, improved maintenance and preventive programs, and a better understanding of oral illnesses. However, due to longer life expectancies, an aging population, and more people keeping their teeth, the percentage of people who are partially edentulous is rising [6,7].

People seek dental implants, fixed and removable partial dentures to replace some of their missing teeth, preserve their remaining natural teeth, and improve their appearance, speech, social confidence, and self-esteem. Factors that determine the choice of restoration used include periodontal status, esthetic requirements, cost, anatomical limitations, and patient acceptance [8].

Removable partial dentures (RPDs) are a straightforward technique—still the most popular option of treatment—that patients who are missing some of their natural teeth can use to restore their oral structure and masticatory function [9-11]. The prevention of pathological drifting of adjacent teeth and the supra-eruption of opposing teeth are two advantages of replacing lost teeth. Additional advantages include improved oral function and comfort as well as a decrease in occlusal forces on the natural teeth that remain [12].

Unlike implant therapy, RPD treatment is less intrusive and enables patients who are partially edentulous to receive prompt, affordable care. It is the best practice therapy for several clinical circumstances, including long-term transitional prosthesis for a terminal dentition, rebuilding missing hard and soft tissues to offer esthetic, support, and restoring large edentulous spans [6].

In the past, a variety of materials have been produced for the construction of RPD frameworks; metallic materials, such as chrome cobalt alloys, and acrylic polymers, also known as polymethyl Polymethyl methacrylate (PMMA) is commonly used. However, acrylic denture bases are the most used material for manufacturing RPD frameworks, especially in developing countries, as they are extremely cheap, easy to handle, and can be used with existing low-cost equipment. In addition, the development of nylon denture bases has revolutionized the industry in terms of flexibility and provided a viable alternative to acrylic dentures, addressing some of their disadvantages and limitations [11].

However, some disadvantages of wearing full acrylic dentures compared to other RPD frameworks include a higher risk of caries, gingivitis, and periodontitis. In addition, it is difficult to find a suitable insertion path while maintaining a close tissue fit in the presence of soft and hard tissue undercuts. In addition, acrylic prostheses are manufactured with thicker sections to compensate for their low impact resistance, making them bulky and therefore uncomfortable for patients [8].

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Edentulism is defined as the loss of all permanent teeth. Complete dentures are one of the most important and popular treatment options for edentulous patients in rehabilitation [13,14].

When an edentulous patient comes for denture treatment, the main complaint is chewing problems, poor appearance, speech problems, discomfort, or a combination of these issues, which explains why the person needs dentures. While most edentulous people need to wear dentures to chew, there are some, such as teachers. who prefer replacement for phonetics and others like celebrities who mainly prefer them for esthetics, which indicates that preference for need of a denture varies among individuals. Knowing the choice of the necessity of a denture is very important for a dentist since there may be certain constraints in accomplishing these aims [15], so patients accept complete Dentures are used because they provide an attractive appearance, enable normal speech, and provide support and adequate means for chewing food [13].

Within a decade, methyl methacrylate (MMA) became the material of choice for 95% of dentures manufactured because it met the requirements for an optimal substrate. MMA is also used as the primary component of artificial tooth braces, which are made from a variety of materials including polymethyl methacrylate (PMMA) and various ceramics and composites. Acrylic teeth have been used to manufacture complete dentures since 1940. Acrylic teeth are popular because of their price and aesthetics, as well as their chemical bonding to the acrylic denture base. In contrast, ceramic does not chemically bond to acrylic; however, it is resistant to surface wear and porcelain teeth may transmit forces directly to the bone [16].

Treatment of edentulism with complete dentures remains common because it is relatively inexpensive and simple [14, 17]. Wearing a new complete denture can cause a variety of discomforts, especially soon after the denture is inserted. Complaints may include lack of support and stability, pain or discomfort, food accumulation under the denture, speech changes, difficulty eating, unsightly appearance, and choking. Other complaints include bone resorption of the edentulous alveolar ridge and sometimes overgrowth of tissue under the denture due to the forces generated by the mandible during function and dysfunction, as the mucosa is squeezed between the denture base and the underlying bone, so all forces are transmitted through this atrophic tissue [2].

A great deal of research has been conducted to explain why some patients have more difficulty wearing complete dentures successfully than others. The technical quality of the prosthesis is obviously important, but physiological and psychological variables are also thought to contribute. Although it is known that older people take longer to adapt to new prostheses, multiple questionnaires, interviews, and personality tests have failed to identify accurate indicators that can predict patient dissatisfaction with prostheses [17].

Patient satisfaction is an important goal of oral rehabilitation and can be used to assess the success of these rehabilitations [18].

It is important to remember that patients and dentists have

different expectations and satisfaction with the same restorative treatment. These differing comments can lead to conflict between patients and dentists and adversely affect the dentist-patient relationship, resulting in a potential loss of patient satisfaction. Dentists often evaluate the success of a denture based on established clinical criteria without considering the individual patient's needs, expectations, and attitudes. Because patients and dentists may have different expectations and satisfaction with the same treatment, it is important to establish a strong dentist-patient connection to understand the patient's preferences and help set appropriate expectations to achieve the chosen treatment [19].

There is a shortage of relevant information on patient satisfaction and concerns with detachable denture usage in Middle Eastern populations. Some research conducted across diverse populations showed that most patients are generally satisfied with their removable dentures [11] so, this study was conducted to evaluate and compare the clinical effects of constructed removable partial and complete acrylic dentures at dental health care institutions for Iraqi people with respect to retention, esthetic, function, comfort and any possible related problems such as sore mouth. Moreover, the study seeks to evaluate patients' acceptance of the entire treatment process, from initial consultation to the final fitting and adjustments of the dentures.

Table 1. Distribution of the patients according to general characteristics.

Age	Number	Percentage
Less than 30 years	0	0%
30-50 years	27	18.49%
Up 50 years	119	81.51

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Total	146	100%
Gender	Number	Percentage
Male	106	72.6%
Female	40	27.4%
Total	146	100%
Level of education	Number	Percentage
Educated	36	24.66%
Uneducated	110	75.34%
Total	146	100%
Period of wearing a denture	Number	Percentage
Less than 3 months	18	12.3%
3-12 months	28	19.18%
More than 12 months	100	68.49%
Total	146	100%

Material and Methods

Study Design and Participants

This cross-sectional study was conducted at the prosthetic clinic at the College of Dentistry, University of Kufa, Iraq. Ethical approval was obtained from the University of Kufa College of Medicine Medical Ethics Committee (MEC-38) on 14/5/2024. Patients were recruited between January and May 2024.

Patients were recruited using convenience sampling from those presenting at the prosthetic clinic during the recruitment period. While we aimed for gender balance, recruitment continued until the desired sample size was achieved.

Sample Size

A convenience sample of 146 participants (120 partially edentulous, 23 completely edentulous, and 3 with mixed edentulism) was recruited for this study. While a formal *a priori* sample size calculation was not performed, this sample size was considered substantial for exploring patterns and trends in patient satisfaction with removable dentures. A post-hoc power analysis, assuming an alpha of 0.05 and power of 0.80, suggested that a sample size of 100 would be sufficient to detect a small effect size. Our larger sample of 146 participants therefore strengthens our ability to detect potentially subtle relationships between denture type and satisfaction levels.

Inclusion and Exclusion Criteria

Inclusion Criteria

Patients aged 30 years and above seeking treatment for replacement of missing teeth with acrylic removable dentures. Patients were classified as:

Partially edentulous. Missing at least one but not all teeth in either arch, with a minimum of three teeth remaining in that arch.

Completely edentulous. Missing all natural teeth in one or both arches.

Exclusion Criteria

Patients with active oral infections, severe systemic diseases precluding denture wear, known allergies to acrylic resin materials, or who had received previous implant-supported prostheses were excluded.

Table 2. Aesthetics and satisfaction characteristics.

Color of denture	Number	Percentage
Very good	25	17.12%
Good	14	9.59%
Acceptable	95	65.07%
Bad	12	8.22%

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Very bad	0	0%
Total	146	100%
Color of teeth	Number	Percentage
Very good	22	15%
Good	9	6.2%
Acceptable	109	74.7%
Bad	6	4.1%
Very bad	0	0%
Total	146	100%
Size of teeth	Number	Percentage
Very large	8	5.5%
Large	4	2.7%
Acceptable	133	91.1%
Small	0	0%
Very small	1	0.7%
Total	146	100%
Appearance of face after denture wearing	Number	Percentage

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I looked prettier and younger	39	26.7%
I looked prettier	7	4.8%
I looked younger	12	8.2%
Acceptable	87	59.6%
There is no change in my appearance	1	0.7%
Total	146	100%
To what extent do you accept the steps of the work	Number	Percentage
It was short and very comfortable	22	15.1%
It was short and fairly comfortable	27	18.5%
It was long but comfortable	80	54.8%
It was long and uncomfortable	17	11.6%
It was very long and uncomfortable	0	0%
Total	146	100%

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Table 3. Functional characteristics.

Retention of upper denture	Number	Percentage
Very good	31	21.2%
Good	89	61%
Acceptable	17	11.6%
Bad	9	6.25
Very bad	0	0%
Total	146	100%
Retention of lower denture	Number	Percentage
Very good	9	6.2%
Good	29	19.9%
Acceptable	93	63.7%
Bad	15	10.2%
Very bad	0	0%
Total	146	100%
How well can you talk with dentures	Number	Percentage
Very well	29	19.9%

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Well	94	64.4%
Poorly	17	11.6%
Very poorly	6	4.1%
Neutral	0	0%
Total	146	100%
How well can you Chew with your dentures	Number	Percentage
Very well	15	10.3%
Well	37	25.3%
Poorly	87	59.6%
Very poorly	7	4.8%
Neutral	0	0%
Total	146	100%
How comfortable are your dentures	Number	Percentage
Very comfortable	27	18.5%
Comfortable	92	63%
Uncomfortable	20	13.7%
Very uncomfortable	7	4.8%

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Neutral	0	0%
Total	146	100
Do you get a sore mouth	Number	Percentage
Yes	44	30.1%
No	102	69.9%
Total	146	100%

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Data Collection

Prior to treatment, informed consent was obtained from all participants. Information about the study's purpose, risks, benefits, and the right to withdraw were explained in detail, and written consent was obtained. Data were collected using the following:

Demographics and Clinical Data

Age, gender, education level, and period of denture use (if applicable) were recorded from patient records.

Patient Satisfaction

Patient satisfaction with aesthetics, retention, function, and comfort of their dentures was assessed using a previously prepared 17-item questionnaire using a Likert-type scale [19]. The questionnaire addressed specific aspects of:

Aesthetics

[List a few examples, e.g., satisfaction with denture color, tooth size and shape, overall appearance].

Retention

[List examples, e.g., stability of dentures during speaking, eating, at rest].

Function

[List examples, e.g., chewing ability, speech clarity, ease of use].

Comfort

[List examples, e.g., presence of soreness, irritation, overall comfort level].

Photographs

Standardized photographs of the lower third of the face were taken

Statistical Analysis

Data were analyzed using [Statistical software, e.g., SPSS version 23]. Descriptive statistics were used to summarize the data [ANOVA for continuous variables]. A p-value of ≤0.05 was considered statistically significant.

Table 4. Comparison of aesthetics and functional characteristics between type of prosthetic treatment.

Variables	Partial denture (N= 120)	Complete denture (N=23)	P-values
Retention of upper denture	**N (%)**	**N (%)**	
Very good	25 (20.8%)	5 (21.8%)	
Good	80 (66.7%)	9 (39.1%)	
Acceptable	7 (5.8%)	7 (30.4%)	0.007
Bad	8 (6.7%)	2 (8.7%)	
Very bad	0 (0%)	0 (0%)	
Retention of lower denture			
Very good	6 (5%)	2(8.7%)	
Good	20 (16.7%)	7 (30.4%)	
Acceptable	84 (70%)	10 (43.5%)	0.062
Bad	10 (8.3%)	4 (17.4%)	
Very bad	0 (0%)	0 (0%)	
Appearance of face after denture wearing			
I looked prettier and younger	32 (26.7%)	4 (17.4%)	0.122
I looked prettier	2 (1.7%)	3 (13%)	

I looked younger	75 (62.5%)	14 (60.9 %)	
Acceptable	10 (8.3%)	2 (8.7%)	
There is no change in my appearance	1 (0.8%)	0 (0%)	
To what extent do you accept the steps of the work			
It was short and very comfortable	20 (16.7%)	2 (8.7%)	
It was short and fairly comfortable	23 (19.2%)	5 (21.7%)	
It was long but comfortable	65 (54.1%)	14 (60.9%)	0.838
It was long and uncomfortable	12 (10%)	2 (8.7%)	
It was very long and uncomfortable	0 (0%)	0 (0%)	
How well can you talk with dentures			
Very well	24 (20%)	5 (21.7%)	
Well	80 (66.7%)	10 (43.5%)	
Poorly	9 (7.5%)	8(34.8%)	0.005
Very poorly	7 (0%)	0(0%)	
Neutral	0 (5.8%)	0 (0%)	
How well can you Chew with your dentures			
Very well	10 (8.4%)	5 (21.8%)	0.025

Well	25 (20.8%)	9 (39.1%)	
Poorly	79 (65.8%)	9 (39.1%)	
Very poorly	6 (5%)	0(0%)	
Neutral	0(0%)	0(0%)	
How comfortable are your dentures			
Very comfortable	20 (16.7%)	6 (26.1%)	
Comfortable	83 (69.2%)	8 (34.8%)	
Uncomfortable	10 (8.3%)	9 (39.1%)	0.003
Very uncomfortable	7 (5.8%)	0(0%)	
Neutral	0(0%)	0(0%)	
Do you get a sore mouth			
Yes	22 (18.3%)	2 (8.7%)	0.125
No	98 (81.7%)	21 (91.3%)	

***The P-value was calculated by Fisher exact test.**

Results

General characteristics

One hundred and forty-six participating patients (106 male and 40 female), including 27 of them aged between (30-50) years old, 119 who were older than 50 years and there was no patient under the age of 30 years. The level of education was very low with 75.34% uneducated.

The largest percentage of participants (68.49%) wore their dentures more than one year, followed by those who wore them between 3 and 12 months (19.18%), and the lowest percentage (12.3%) was for those who had a denture for a period less than 3 months, as shown in Table 1.

The largest percentage of patients chose "acceptable" regarding the color of the

dentures (65.07%), the color (74.7 %) and size of the artificial teeth (91.1%), and regarding their face appearance after wearing their dentures (59.6%). In general denture making visits were long but comfortable for them (54.8%), as shown in Table 2, and Figures 1 and 2.

Regarding the functional characteristics (including both partial and complete dentures generally) the retention of upper denture was "good" (61%) and "acceptable" for the lower denture (63.7%), and also good for their ability to talk while wearing it (64.4%), but they were able to use it for chewing poorly (59.6%) and it was comfortable in general (63%), and a small percentage of them suffered from ulcers (30.1%), as shown in Table 3 and Figure 3.

Finally, the results of the comparison between the partial and complete dentures in terms of aesthetic and functional characteristics were as follows; The difference in retention for the upper partial in comparison with complete dentures was significant (p=0.007) while for the lower denture it was not significant (p=0.062) and there was no significant difference between the partial and complete denture in terms of patient's appearance after wearing denture (p=0.122), but the difference in the ability to talk, chew and comfort was significant (p=0.005, p=0.025), and p=0.003, respectively). Finally, there was no significant difference in regarding the extent to which the patient accepts the treatment steps and number of visits (p=0.838), and the appearance of ulcers inside the mouth (p=0.125). As shown in Table 4 and Figure 4.

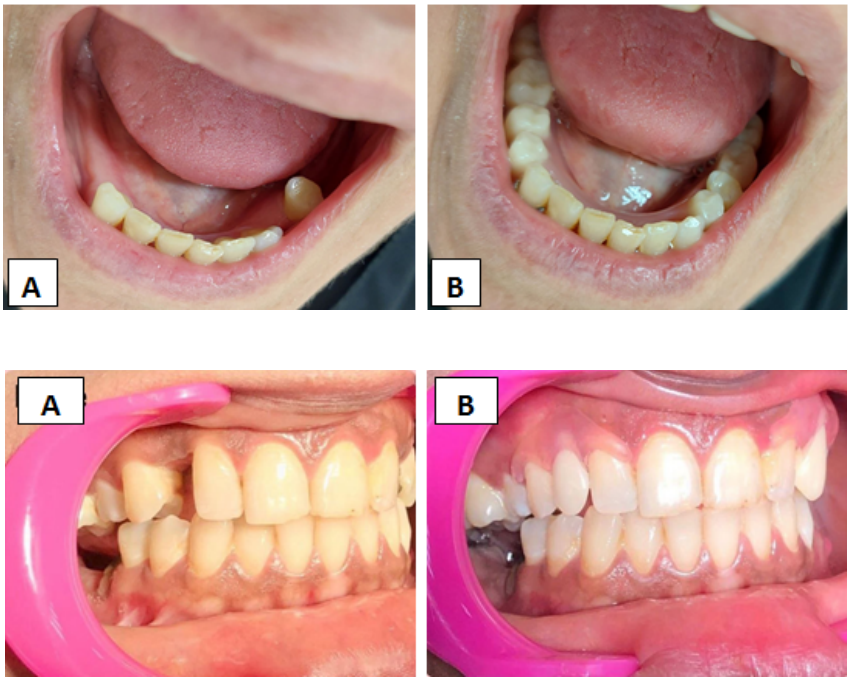

Figure 1. Representative treated cases with removable partial acrylic dentures showing the color of denture, color and size of the artificial teeth (A) before the treatment and (B) after wearing their dentures.

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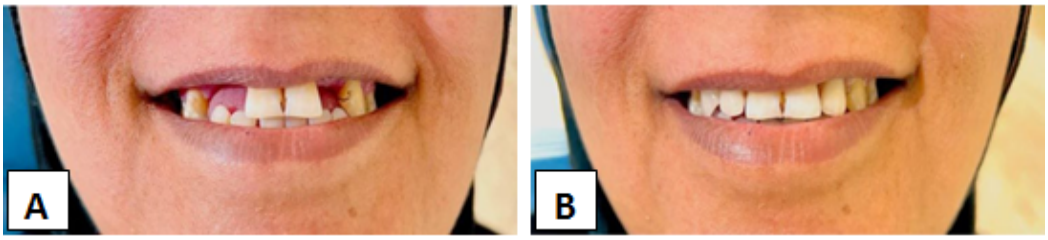
Figure 2. Illustrative treated cases with complete dentures showing patient's appearance after wearing their dentures and its positive effect on the appearance, so that the patient appears younger in age, (A) before the treatment and (B) after wearing their dentures.



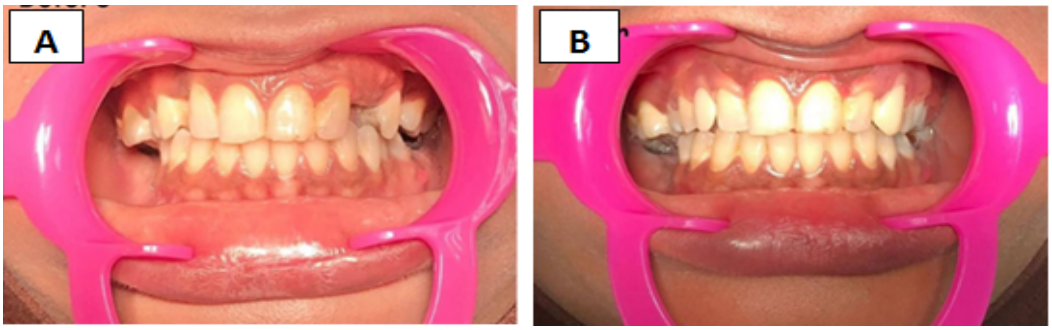


Figure 3. Representative cases treated with removable partial acrylic dentures (A) before the treatment and (B) after wearing their dentures.

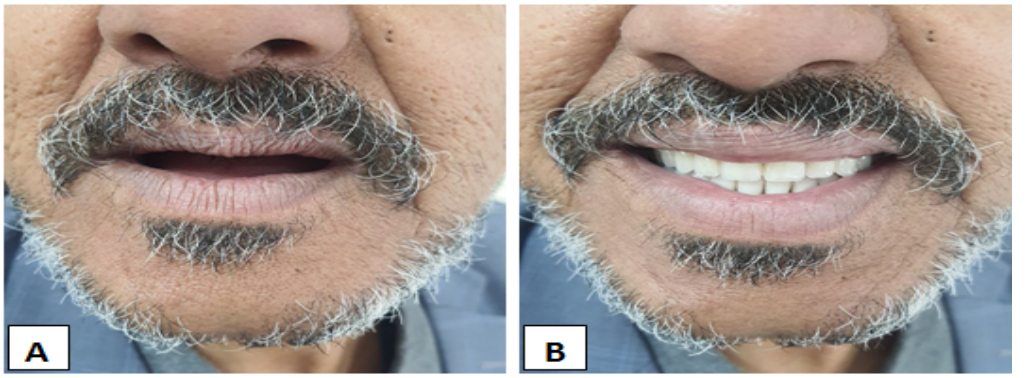


Figure 4. Representative treated cases with complete dentures, (A) before the treatment and (B) after wearing their dentures.

Discussion

The demographic distribution of our study sample offers valuable insights into patient satisfaction with removable partial and complete acrylic dentures. As expected, our study population skewed towards older adults, with 81.51% being over 50 years old, consistent with previous findings [20]. This age distribution aligns with the higher prevalence of tooth loss and denture needs among older demographics [21]. However, the absence of participants under 30 highlights a potential limitation requiring further investigation. Younger individuals often prioritize the superior aesthetics, comfort, and functionality offered by fixed solutions or dental implants, impacting their acceptance of removable options [22,23].

The significant gender disparity, with 72.6% males compared to 27.4% females, suggests that men might be more accepting of removable dentures. This difference could stem from varying priorities regarding

aesthetics and self-perception. Research indicates that women tend to place a higher value on the appearance of dental prostheses, influencing their satisfaction levels and potentially leading them to favor fixed solutions like implants [24-26]. Socio-economic factors also likely play a role, as men might prioritize the cost-effectiveness of removable dentures over the aesthetic advantages of more expensive alternatives [25,26].

The low educational attainment among our participants (75.34% uneducated) is noteworthy. This aligns with studies demonstrating a link between lower educational levels and higher rates of missing teeth and removable prosthetic use [22,26,28]. This pattern may be compounded by the generally lower educational attainment among older populations in Iraq. Educational level can significantly influence a patient's ability to understand post-procedure care, manage expectations, and adhere to maintenance routines, ultimately affecting their satisfaction with dentures. These findings underscore the need for tailored patient education and support based on individual needs and educational backgrounds.

Most patients found their denture teeth size "acceptable" (91.1%). This suggests that dentures were generally well-tailored to oral dimensions, potentially contributing to comfort. The low percentages of "very large" (5.5%) or "very small" (0.7%) teeth indicate that significant size discrepancies were infrequent, likely due to the presence of remaining natural teeth used as a reference for artificial tooth selection and the opportunity for patients to evaluate aesthetics during trial appointments [29]. While color satisfaction was generally acceptable, there is room for improvement as a considerable proportion of participants did not rate the color of their dentures or teeth as "very good."

Our analysis revealed a significant difference in upper denture retention between RPDs and CDs. This is unsurprising, as RPDs utilize clasps anchored to remaining teeth for stability [30-32]. Conversely, CD retention relies solely on the denture base's fit against the mucosa, influenced by factors such as saliva, soft tissue contours, and the rate of bone resorption, which tends to be more pronounced in completely edentulous jaws [33-38]. While advancements in materials and techniques like CAD/CAM have improved CD fit and comfort, they still typically offer less retention compared to RPDs [39].

Interestingly, no significant difference in lower denture retention was observed. This might be attributed to the anatomical and functional challenges inherent to the mandibular arch, which impact both RPDs and CDs. Factors such as limited ridge support, tongue movement, and floor of the mouth dynamics can dislodge both types of dentures [17,40-42].

The non-significant difference in perceived facial appearance between RPD and CD wearers aligns with Čelebić and Knezović-Zlatarić's research [43]. This suggests that both denture types effectively restore facial aesthetics by compensating for missing teeth and supporting facial structures [25]. The use of heat-cured acrylic resin, which blends well with oral tissues, likely contributed to the acceptable aesthetic outcomes for both denture types [12].

As expected, RPD wearers reported significantly better speech clarity compared to CD wearers. This difference likely stems from the complete palatal coverage of CDs, potentially interfering with tongue movements crucial for speech, particularly for producing certain consonant sounds [44,45]. Overextended

upper denture bases can further exacerbate speech difficulties by impeding lip movement [17,46].

The significant difference in chewing ability between RPD and CD wearers can be attributed to several factors. The superior stability and retention of RPDs during chewing motions, due to their anchorage to natural teeth, are key [46-49]. Additionally, the sensory input from periodontal mechanoreceptors in remaining natural teeth plays a crucial role in controlling jaw movements during chewing, a benefit absent in CD wearers [50,51]. Denture instability during chewing is a common complaint among CD wearers, leading to compensatory tongue and cheek movements that compromise their masticatory efficiency [17,48,52,53].

The significant difference in overall comfort favoring RPDs aligns with the findings on retention, speech, and chewing ability. The non-significant difference in reported mouth ulcers could be attributed to the emphasis on meticulous denture fabrication and regular adjustments for both denture types. The lack of difference in the acceptance of denture construction steps reinforces that both RPDs and CDs necessitate similar procedures to ensure optimal fit, comfort, and function.

This study indicates a general acceptance of both RPDs and CDs among our patient population, with a predominance of older males. However, RPDs appear to offer greater satisfaction, particularly regarding retention, speech, chewing, and overall comfort. These findings underscore the need for continued research and advancements in denture design, fabrication techniques, and patient education to further improve the experiences of individuals relying on removable prostheses.

Conclusions

Considering the shortcomings of this study, it was concluded that most of the patients who were included in the study were partially edentulous patients and more than those completely edentulous. Generally, there was acceptance and satisfaction from patients with their deferent types of the constructed removable acrylic studied dentures, and the percentage of males was higher than that of the females and the percentage of elderly patients was higher, but the level of education was low. In general, there was more acceptance and satisfaction among those who wear partial dentures than those who wear complete dentures in terms of retention, ability to chew, speak, and comfort, but there was no significant difference in terms of aesthetics (including face appearance after wearing denture, teeth size and the color of denture and teeth), the appearance of ulcers, and the steps of denture construction.

Acknowledgments

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data created and examined during the current study can be available upon reasonable request.

Funding

None.

Regulatory Statement

Every procedure used in the study complied with the 1964 Helsinki Declaration and its later 2013 revisions, Ethical approval was obtained from the University of Kufa/ College of Medicine/ Medical Ethics Committee (MEC-38) on 14/5/2024.

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