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Assessment of Patient Satisfaction and The Reasons for Crowns and Fixed Partial Denture Failure, a Clinical Study

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Abstract

Aims. This study aimed to assess the satisfaction levels of patients who had fixed dental prostheses for rehabilitation and analyze the aspects, including biological, mechanical, and aesthetic, that contribute to the failure of these prostheses. **Material and Methods.** Cross-sectional observational research was undertaken in the Department of Prosthodontics, College of Dentistry, University of Basrah, Iraq, from September 2022 to May 2023. The study included a cohort of 130 patients, both males and females, who received treatment with fixed dental prostheses. The participants who were selected answered a series of questionnaires on their concerns about the fixed prosthesis, and a clinical examination involving radiographic assessments of the prosthesis was conducted. The reason for failure was documented, and data were organized for descriptive analysis of the components assessed through chi-square and Fisher's exact test. **Results.** Based on clinical and radiographic assessment, it was determined that 103 out of the total number of individuals assessed experienced some form of failure. 44.6% of the cases exhibited biological problems, 31% exhibited mechanical failures, and 24.2% exhibited aesthetic problems. Dental caries accounted for most biological failures (32.6%), whereas prosthesis loosening was the primary mechanical cause of failure (56.2%). Poor marginal fit was identified as the leading aesthetic reason for failure (48%). A strong correlation was seen between the level of satisfaction and mechanical failure (p=0.017). **Conclusion.** Most patients expressed satisfaction following the observation period. Dental decay was the most prevalent biological component leading to failure, whereas loss of retention was the primary mechanical cause. In comparison to other aspects affecting aesthetics, poor marginal fit had a more significant role.

Keywords: Survival rate, Fixed dental prosthesis, Abutment failure, Technique complication, Patient satisfaction.

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Introduction

Numerous treatment options, including dental implantology, conventional fixed prostheses, and removable prostheses, can be used to replace lost teeth in a partially edentulous arch [1]. Fixed prosthodontics refers to the use of artificial alternatives to replace or restore teeth that cannot be easily removed by the patient [2]. Dental fixed crowns and bridges are securely linked to the remaining teeth [3]. Fixed crowns are utilized for the purpose of restoring teeth that have been broken or have big amalgam or composite resin restorations. They can restore functionality and greatly enhance aesthetics. Due to the growing trend among middle-aged and older individuals to maintain a significant proportion of their

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natural teeth, rehabilitation with fixed dental prostheses is well accepted and sought by patients [4]. The increased demand for crowns and fixed dental prostheses also increased the frequency of failure associated with such prostheses [5]. All-ceramic fixed prostheses are often utilized in clinical dentistry due to the introduction and availability of several ceramic materials for clinical application [6]. If the treatment planning for fixed dental prostheses is done improperly, there is a higher chance of premature failure and irreparable harm to the teeth and supporting tissues [7]. These restorations may fail, resulting in the development of new cavities or the loss of the teeth that support them [8]. Typically, complications arise because of or during fixed dental prosthesis therapy operations. Failure can be attributed to three primary factors: biological, mechanical, and aesthetic [9]. The effectiveness of rehabilitation treatment may be assessed by patient satisfaction, comfort, and the durability of the prosthesis. It is necessary to do clinical follow-up investigations on patients who have received artificial crowns and fixed dental prostheses to identify any complications [6]. To accurately diagnose, plan treatment, and execute procedures for fixed dental prostheses, it is crucial for the dentist to have a comprehensive understanding of the factors that lead to dissatisfaction or contribute to failures. Special attention should be given to the most common failure factors to ensure that the patient's expectations are met [10]. The quality of prostheses is determined by both immediate and late failures. Immediate failures are often caused by a lack of criteria during the manufacturing stages, resulting in errors in the form and color of the prosthesis. Late failures, on the other hand, are typically related to factors such as caries, periodontal disease, endodontic complications, or technical issues like abutment fractures, loss of retention, and ceramic fracture [11,12].

This study aimed to evaluate the satisfaction of patients rehabilitated with fixed dental prostheses and observe the incidence of prosthesis failures among patients treated with these types of restorations. It also aimed to give special attention to the most frequent failure factors so that a detailed diagnosis and treatment plan meeting the patient’s needs could be concluded.

Materials and Methods

A cross-sectional study was carried out on the patients previously treated with fixed prostheses who visited the prosthodontic clinics of the College of Dentistry, University of Basrah. The study protocol underwent a thorough evaluation and received official approval from the college Institutional Review Board and Research Ethics, and Scientific Committee, then it was registered under the number BCD-3-002-22-9. The study had a total of 130 participants, consisting of 78 females and 52 males. All participants were above the age of 18 and willingly accepted to take part in the study by signing a written consent form. The questionnaire pro forma was utilized to gather the information. The survey comprised socio-demographic inquiries, including gender, age, treatment satisfaction, post-cementation hygiene care, and type of complications identified by clinical and radiographic evaluation. Each participant underwent a comprehensive clinical evaluation while seated upright in an illuminated environment in the dentist's chair. A sole examiner positioned in front of the patient conducted visual and tactile intra-oral examinations of both the teeth and the periodontium around the prosthesis. This was done using a sterile dental explorer, periodontal

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probe, and mouth mirror, ensuring the highest level of examination precision. Tapping of the abutment with the mirror/probe instrument end at the occlusal or incisal aspect and palpation of the gingiva were carried out to identify pain adjacent to the abutment and pus discharge. Following the clinical examination, periapical radiographs were conducted using a radiographic digital sensor, positioner, and X-ray portable machine (Eighteeth Company, China). For each evaluation, a uniform time of exposure was used with a long cone paralleling approach and a predetermined source-film distance of 25 cm. The periapical radiograph can detect biological failures like proximal caries (Figure 1), periapical lesions, periodontal problems, and bone loss. Secondary caries can also be identified by a thorough examination of the borders of the prosthesis and tooth surfaces using a dental explorer. Mechanical failures such as loss of retention, connector failure, abutment tooth fracture (Figure 2), and porcelain fracture were observed. Aesthetic failures such as poor shade matching, poor contour, poor marginal fitness, and subpontic tissue shrinkage were also identified.

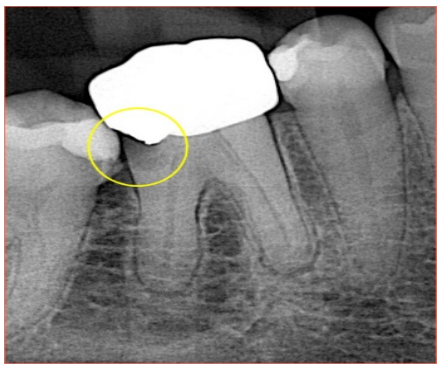

Figure 1. Interproximal caries.

Figure 2. Abutment fracture.

The exclusion criterion encompassed patients who declined to respond to the questionnaire and undergo examination. Additionally, patients with cantilever-type fixed prostheses were also excluded. The study data were inputted into a computer and organized for statistical analysis using SPSS software (version 20). The connection between variables was verified using Chi-square and Fisher's exact test. A p-value below 0.05 was deemed statistically significant.

Results

The sample comprised 130 patients, 78 females (60%) and 52 men (40%). The average age of the patients was 43, with a standard deviation of 11.8. The research included patients as young as 21 and as old as 68.

Figure 3 illustrates the distribution of failures across three categories: biological failures, mechanical failures, and aesthetic failures. Biological failures constitute the highest proportion, accounting for 44.6% of all failures. Mechanical failures account for 31% of failures, while aesthetic failures constitute 24.2%.

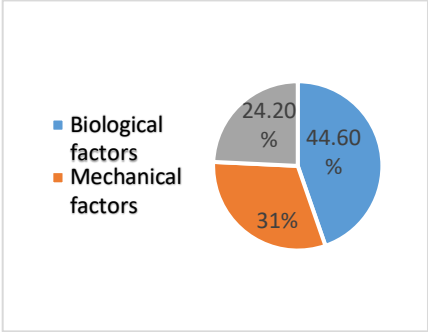

Figure 3. Fixed partial denture failure distribution.

According to Table 1, about 60.8% of the fixed prostheses were crowns, while short-span three-unit bridges made up 26.9%, four-unit bridges about 3.8%, five-unit bridges about 5.4%, six-unit bridges about 1.5%, and long-span seven- and eight-unit bridges accounted for 0.8% each. This study found an elevated percentage of problems related to

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single crowns or short-span three-unit fixed partial dentures, namely 33% and 36.8%, respectively. In contrast, there was a minimal occurrence of complications with long-span bridges, such as 2.9% for seven-unit bridges and 3.8% for eight-unit bridges.

Table 1. Failure rate related to the number of units of fixed restorations.

Fixed partial denture units	No. of cases	%	No. of compli cations	%
Single crown	79	60.8	34	33
Three units bridge	35	26.9	38	36.8
Four units bridge	5	3.8	7	6.7
Five units bridge	7	5.4	13	12.6
Six units bridge	2	1.5	4	3.8
Seven units bridge	1	0.8	3	2.9
Eight units bridge	1	0.8	4	3.8
Total	130	100	103	100

Table 2 shows that 57.7% of interviewees had no problems with prosthesis hygiene, 30% did not practice regular hygiene, and 12.3% never performed oral hygiene due to some difficulties.

Table 2. Oral hygiene maintenance among subjects.

Oral hygiene maintenance	Subjects	%
Always	75	57.7
Sometimes	39	30
Never	16	12.3
Total	130	100

Table 3 lists 46 biological failures, as some patients had numerous occurrences. Secondary caries accounted for 15 instances (32.6%), followed by endodontic involvement in 10 cases (21.7%), periodontal involvement in 9 cases (19.5%), pulp degeneration in 6 cases (13%), gingival recession in 4 cases (8.6%), and crown perforation in 2 cases (4.3%).

Table 3. Frequency distribution of biological failures

Biological failures	No. of cases	%
Secondary caries	15	32.6
Endodontic involvement	10	21.7
Periodontal involvement	9	19.5
Pulp degeneration	6	13
Gingival recession	4	8.6
Perforation	2	4.3
Subpontic inflammation	0	0
Total	46	100

As indicated in Table 4, 32 instances experienced mechanical malfunctions in their fixed restorations. Three mechanical failures were recorded, with the most prevalent being prosthesis loosening, which occurred in 18 instances (56.2%). This was followed by abutment fracture in 8 cases (25%) and ceramic fracture in 6 cases (18.7%).

Table 4. Frequency distribution of mechanical failure.

Mechanical failures	No. of cases	%
Retention loss	18	56.2
Abutment fracture	8	25
Ceramic fracture	6	18.7
Connector failure	0	0
Total	32	100

Table 5 recorded twenty-five instances of aesthetic failures. The most prevalent problem occurring in 12 cases (48%) was a poor marginal fit. This was followed by poor shade matching in 7 cases (28%), poor contour of the prosthesis in 4 cases (16%), and 2 cases (8%) of subpontic tissue shrinking.

Table 5. Frequency distribution of aesthetic failures.

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Aesthetic failures	No.	%
Poor marginal fit	12	48
Poor shade	7	28
Poor contour	4	16
Subpontic tissue shrinkage	2	8
Total	25	100

Table 6 displays the correlation between variables, with the inclusion of the chi-square and Fisher exact tests. When participants were surveyed about their degree of satisfaction with the prosthetic therapy they got, 48 patients expressed dissatisfaction (36%) whereas 82 expressed satisfactions (63%). Based on the sample median, the age range was categorized into two groups: 43 years or under and over 43 years.

Biological, mechanical, and aesthetic failures were categorized as either existing or absent. A statistically significant correlation was found between the level of satisfaction and the occurrence of mechanical failures (p=0.017). The connections between the other factors, namely gender (p=0.941), age range (p=0.221), biological failures (p=0.532), and aesthetic failure (p=0.074), were not found to be statistically significant.

Table 6. The correlation of satisfaction with gender, age, biological, mechanical, and aesthetic factors.

Variables	Satisfaction		Dissatisfaction		Total		P-value
Gender	No.	%	No.	%	No.	%	0.941
Female	49	62.8	29	37.2	78	100	
Male	33	63.5	19	36.5	52	100	
Total	82	63	48	36	130	100	
Age range	No.	%	No.	%	No.	%	0.221
≤ 43 years	45	68.1	21	31.8	66	100	
> 43 years	37	57.8	27	42.1	64	100	
Biological Failure	No.	%	No.	%	No.	%	0.532
Present	23	62.1	14	37.8	37	100	
Absent	59	63.4	34	36.5	93	100	
Mechanical failure	No.	%	No.	%	No.	%	0.017
Present	10	40	15	60	25	100	
Absent	72	68.5	33	31.5	105	100	
Aesthetic failure	No.	%	No.	%	No.	%	0.074
Present	11	47.8	12	52.1	23	100	
Absent	71	66.3	36	33.6	107	100	

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Discussion

Crowns and bridges restorations are expensive and generate high patient expectations. Despite thorough and precise attention to detail, instances of failures and patient dissatisfaction are frequently observed, therefore, it is important to do clinical follow-up studies on patients who received these restorations are mandatory to find complications [13, 14]. Among the 130 participants included in this trial, 103 experienced problems; Sheikh et al. (2021) identified a total of 142 patients who had concerns related to the fixed prosthesis [9]. The results of our study showed a high incidence of complications in single crown or short-span fixed partial dentures, this is in opposition to recent clinical studies that found an increase in complication rates with each additional pontic in fixed partial dentures [15]. The reason for this difference could be that most prostheses assessed in our study were either single-crown or short-span prostheses, which is consistent with the findings of Alenezi et al. [16]. Regular follow-up appointments with patients are essential for assessing the durability of fixed partial dentures, which are influenced by several factors, including the standard of oral hygiene maintained by the patient [17]. Although the statistical analysis did not reveal any significant results (p=0.941), it was found that women expressed greater satisfaction with the prosthesis than men, in contrast, previous studies have reported different outcomes when participants were asked about their degree of satisfaction with the prosthesis [18]. In addition to that, this study demonstrates a lack of a link between age and satisfaction (p=0.221). However, it is interesting that younger patients achieved a greater percentage of satisfaction (68.1%). Subjects who expressed satisfaction had a lower chance of failure, in contrast to those who were dissatisfied, Zavanelli et al. also reported similar findings [19]. Biological factors accounted for most failures, followed by mechanical and aesthetic factors; this aligns with the results provided by Datta et al. [20] and in contrast to the discovery made by Alghafees et al. [21]. According to research done by different authors, caries has been identified as an essential biological cause for failure, the secondary caries are directly influenced by the patient's cleanliness practices and the marginal fitness of the prosthesis. According to Alsterstal et al. (2021) the endodontic-treated abutment had a low percentage of periapical lesions; this might be attributed to the fact that the endodontic treatment was primarily performed by professionals [22]. The periodontal involvement factor accounts for 19.5% of biological failures, this might be explained by the prosthesis impeding the normal stimulation of the supporting structures [23]. The advancement of periodontal disease may also be influenced by deficiencies in oral health, smoking, and hereditary factors [24]. A strong association was seen between the amount of satisfaction and the occurrence of mechanical failure (p= 0.017). The main factor contributing to mechanical failure in the research was the loss of retention (56.2%), it may be attributed to the failure of cementation and excessive taper preparation of the abutment tooth [25]. Previous authors have also reported similar findings about retention loss. [11] The second factor contributing to mechanical failure is abutment fracture, endodontic treatment of the abutment might decrease the resistance of the teeth to fractures [26]. Moreover, several studies identified ceramic fracture as the most prevalent mechanical problem, while in this study porcelain fracture was about 18.7% [16]. Ceramic chipping may be due to critical load or bruxism [27, 28].

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Minor chipping did not influence fixed partial denture function, but substantial chipping caused prosthesis failure [29]. Among all the aesthetic failure factors, the poor marginal fit was about 48%. From a technological standpoint, a strong marginal fit is crucial for ensuring the long-term durability of fixed prostheses [30]. The poor shade match was deemed undesirable, and its impact was diminished when compared to other criteria contributing to aesthetic failure; these findings contradict the conclusions of Chandranaik et al., [1]. Aesthetic defects can also be attributed to improper sizing and shaping of teeth, these deficiencies can lead to issues such as food being stuck due to an inaccurate prosthesis contour [25].

Conclusion

The most important factor affecting the level of satisfaction was mechanical defects; the major mechanical failure identified was the loss of crown and bridge retention. In addition to that, several biological failures were observed, mainly secondary caries. Finally, aesthetic defects were mostly attributed to inadequate marginal fit.

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