



مجله علوم طبی غالب (MJ)

صفحه اصلی مجله: <https://www.mj.ghalib.edu.af>

ISSN

P: 3105-0786

E: 3006-094X

OPEN ACCESS

<https://doi.org/10.58342/MJ.V.3.I.2.15>

ناشر: پوهنتون / دانش گاه غالب - هرات

شیوع پروتزه‌های ثابت و اختلالات آن در رادیوگرافی‌های اپوی جی شهر هرات افغانستان

سال ۱۴۰۲-۱۴۰۳



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چکیده

اطلاعات مقاله

نوع مقاله:

پژوهشی

صفحات: ۲۷۳-۲۵۹

تاریخ دریافت:

۱۴۰۵ / ۰۲ / ۰۳

تاریخ پذیرش:

۱۴۰۵ / ۰۶ / ۲۹

تاریخ نشر:

۱۴۰۵ / ۰۷ / ۰۱

زمینه و هدف: پروتزه‌های ثابت دندانی که شامل روکش‌ها و بریج‌های دندانی می‌باشد بصورت گسترده برای بازسازی عملکرد و زیبایی در میرضانی با نواحی بی‌دندانی قسمی به‌شکل گسترده مورد استفاده قرار می‌گیرد. درحالی‌که تعداد زیادی از مقالات بین المللی که شیوع و اختلالات این نوع پروتزها را بررسی کرده، در دسترس می‌باشد اما در افغانستان چنین اطلاعاتی جمع‌آوری نشده و در دسترس قرار ندارد. بررسی شیوع و اختلالات پروتزهای ثابت در هرات، دیدگاه ارزشمندی در مورد نیازهای سلامت دهان فراهم میکند.

روش: این مطالعه توصیفی-مقطعی، ۸۰۰ تصویر رادیوگرافی پانورامیک (OPG) را که به‌طور تصادفی از میان ۱۰۸۴۲ تصویر ثبت‌شده در مرکز رادیوگرافی رازی طی سال‌های ۱۴۰۲-۱۴۰۳ انتخاب شده بود، مورد تحلیل قرار داد. معیارهای ورود شامل بیماران ۲۰ ساله و بالاتر با داده‌های دموگرافیک کامل و کیفیت تصویر رادیوگرافی قابل قبول بود. داده‌ها با استفاده از نرم‌افزار SPSS نسخه ۲۶ پردازش شدند و با استفاده از آزمون χ^2 square رابطه بین سن و موجودیت پروتز، همچنان رابطه بین کانتی لیور و پوسیدگی ثانوی ارزیابی شد. تمرکز بر وجود روکش‌های دندانی، پوسیدگی ثانویه، رادیولوسنسی اپیکال و پروتزه‌های کانتی لیور بود.

یافته‌ها: در میان جمعیت مورد مطالعه، ۴۵٫۲۵٪ حداقل یک پروتز ثابت داشتند (با درنظر داشت CI ۹۵ درصد)، در حالی که ۵۴٫۷۵٪ بدون پروتز ثابت بودند. پوسیدگی ثانویه زیر پروتزه‌های ثابت در ۲۵٫۸۷٪ موارد مشاهده شد که بیشتر بیماران تنها یک ضایعه داشتند. رادیولوسنسی اپیکال در ۱۳٫۵۰٪ افراد تشخیص داده شد. پروتزه‌های کانتی لیور نسبتاً نادر

بودند و در ۱۱,۲۵٪ شرکت کنندگان دیده شدند که اغلب محدود به یک واحد بودند. آزمون Chi-Square نشان داد که رابطه نزدیک بین سن و داشتن پروتز وجود دارد، همچنان نتایج آزمون مذکور مشخص نمود بین داشتن پروتز کانتی لیور و داشتن کریس ثانوی در دندان های پایه رابطه نزدیک است.

نتیجه گیری: یافته ها نشان می دهد پروتزهای ثابت در هرات شایع هستند و به طور کلی عملکرد مناسبی دارند، به طوری که میزان عوارض با گزارش های بین المللی قابل مقایسه است. اگرچه بیشتر پروتزها بدون مشکل عمده عمل می کنند، بخشی از بیماران دچار پوسیدگی یا ضایعات پری آپیکال شدند که اهمیت طراحی صحیح پروتز، مهارت بالینی و آموزش بیماران را برجسته می سازد. توصیه می شود مطالعات گسترده تر و چند مرکزی انجام شود تا درک جامع تری از نتایج پروتزی در افغانستان حاصل گردد.

کلیدواژه ها: شیوع، پروتز های ثابت قسمی، رادیوگرافی پانورامیک.

ارجاع به این مقاله: احمدی، م. ر، عرفان ع، هاشمی ض، حسینی س، م. شیوع پروتزهای ثابت و اختلالات آن در رادیوگرافی های اوپی جی شهر هرات افغانستان سال ۱۴۰۲-۱۴۰۳. *مجله علوم طبی غالب*. [اینترنت]. ۱۴۰۵ / ۰۷/۰۱. [تاریخ برداشت]: ۱۳(۱): ۲۷۳-۲۵۹.

<https://doi.org/10.58342/MJ.V.3.I.2.15>

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Prevalence of fixed partial dentures & their complications in OPG radiographs from Herat, Afghanistan (2023-2024)



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Article Info

ABSTRACT

Article type:

Research Article

pp: 259-273

Received:

23/04/2026

Accepted:

20/09/2026

Published:

23/09/2026

Background and Objective: Fixed dental prostheses (FDPs), including crowns and bridges, are widely used to restore function and aesthetics in partially edentulous patients. While international studies have documented their prevalence and complications, there is limited epidemiological data from Afghanistan. Understanding the distribution and performance of FDPs in Herat provides valuable insight into local oral health needs and aligns regional findings with global standards.

Method: This descriptive cross-sectional study analyzed 800 panoramic radiographs (OPGs) randomly selected from 10,842 images recorded at the Razi Radiography Center between 2023–2024. Inclusion criteria required patients aged 20 years or older with complete demographic data and acceptable image quality. Data were processed using SPSS version 26 and Chi-square tests were applied to assess the relationship between age and the presence of fixed prostheses, as well as between cantilever and secondary caries in abutments, focusing on the presence of restorations, secondary caries, apical radiolucency, and cantilever prostheses.

Result: Among the study population, 45.25% had at least one fixed prosthesis (95% CI : 42-49). Individuals aged 30 years had the highest presence among participant. Secondary caries beneath FDPs were present in 25.87% of cases, with most patients exhibiting only one lesion. Apical radiolucency was detected in 13.50% of individuals. Cantilever restorations were relatively uncommon, observed in 11.25% of participants, with most cases limited to a single unit. The Chi-square test revealed a statistically significant association between the presence of FPDs and the age of patients and also between presence of cantilever prosthesis and the secondary caries of abutments tooth.

Conclusion: The findings indicate that FDPs are prevalent in Herat and

generally perform well, with complication rates comparable to international reports. While most restorations function without major issues, a subset of patients experienced caries or periapical pathology, underscoring the importance of proper prosthesis design, clinical expertise, and patient education. Broader multicenter studies are recommended to provide a more comprehensive understanding of prosthetic outcomes in Afghanistan.

Keywords: Prevalence, Fixed partial denture, OPG radiography.

Cite this article: Ahmadi M. R, Erfan O, Hashemi Z, Hossaini S. M. Prevalence of fixed partial dentures & their complications in OPG radiographs from Herat, Afghanistan (2023-2024). *Ghalib Medical Journal*. [Internet]. Publication date. 23.09.2026; 3 (2): 259-273: <https://doi.org/10.58342/MJ.V.3.I.2.15>



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1. Introduction

Prosthodontics techniques varied, but all patients were routinely treated with a series of specific clinical procedures ^[1]. Replacement of missing teeth in partially edentulous arch involves various treatment options like removable, fixed prosthesis or fixed partial dentures (FPDs), implants and tooth implant supported bridge ^[2-4]. Fixed dental prostheses particularly single crowns and dental bridges are among the most widely used restorative treatments in modern dentistry. They play a major role in helping patients regain proper chewing function, enhance smile aesthetics, and maintain structural stability in the oral cavity. The most commonly reported complications with fixed dental prostheses (FDPs) have been caries, loss of vitality, periodontal disease recurrence, loss of retention, tooth fracture, and material fracture ^[5-11]. However, their success is closely tied to many factors, such as oral hygiene, professional maintenance, socioeconomic conditions, and access to high-quality dental services ^[10-13].

Panoramic radiographs have become a cornerstone in evaluating prosthetic treatments. Their ability to capture the full maxillofacial region in a single image makes them especially valuable for identifying issues that might otherwise go unnoticed in clinical examinations. These radiographs help assess the condition of abutment teeth, the presence of secondary caries, periodontal bone support, periapical pathology, and possible technical failures in prosthetic constructions ^[14,15]. Studies carried out in countries such as Turkey and Finland demonstrate how panoramic surveys contribute to a clearer understanding of national oral health patterns. For instance, reviewed more than 3,000 radiographs to identify population-wide trends in prosthetic and dental health ^[12]. Similarly, found significant geographic differences within Finland regarding how crowns and fixed dentures were among older adults ^[13].

In contrast to such extensive international research, there remains a notable lack of epidemiological data on fixed prostheses in Herat and in Afghanistan more broadly. Rapid population growth, limited access to routine dental care, and varying levels of oral health awareness contribute to unique challenges in the region. While many patients receive fixed prosthetic treatments, there is little published evidence documenting how prevalent these restorations are, what complications occur most frequently, or how well they withstand functional demands over time. These knowledge gaps make it difficult for dentists, educators, and health authorities to design effective treatment strategies or preventive programs ^[16].

Conducting a panoramic radiographic study in Herat in the year 1403 offers a unique opportunity to fill this gap. By examining real-world radiographic data, clinicians can identify patterns such as the rate of abutment caries, periodontal breakdown, root canal failures associated with crowned teeth, technical deficiencies in prosthetic fabrication, and the overall distribution of different

types of fixed prostheses. Such information is not only academically valuable but also directly relevant to improving everyday clinical outcomes^[17-18].

Ultimately, studying the prevalence and complications of fixed prostheses in Herat contributes to a deeper understanding of the region's dental health landscape. It also aligns local research with international standards, providing a foundation for future comparative studies between Afghan populations and those of other countries^[19-20].

2. Research Methodology

2.1. Study Setting

This study was conducted using a descriptive cross-sectional design based on recorded data from the Razi Radiography Center. The collected information was obtained from patients who visited the center during the period 1402–1403 (2023–2024).

2.2. Target Population

The target population of this study consisted of 10,842 OPG images from the Razi Radiology Center that contained teeth, had a recorded age of 20 years or older, were of acceptable quality, and included complete demographic information. OPG images that were taken outside the Razi Radiology Center, did not contain teeth, had a recorded age below 20 years, were of poor quality (artifact, severe distortion and incomplete visualization), or lacked clear and complete demographic information were excluded from the study.

2.3. Dependent variables

Presence of FPDs, secondary caries of abutment teeth, apical radiolucency of abutment teeth and cantilever prostheses.

2.4. Study Population

The study population consisted of 800 OPG images. Based on the inclusion criteria, 10,842 OPG images were initially identified and categorized by gender into two subgroups: 5,086 males and 5,738 females. In the next stage, to increase accuracy and reduce sampling bias, an independent sample of equal size was selected from both gender groups. For this purpose, the Raosoft sample size calculator was used. Considering a 95% confidence interval, 95% confidence level, 50% response distribution, and a target population of 10,842, the program determined a sample size of 800 images by using $n = \frac{z^2 \cdot p \cdot (1-p)}{e^2}$ formula which z is confidence level, p is response distribution and e is margin of error. Subsequently, using a simple random number generator, 800 samples were randomly selected from the 10,842 OPG images.

2.5. Data Analysis

The data obtained in this study were analyzed using SPSS version 26 and Chi-square tests were applied to assess the relationship between age and the presence of fixed prostheses, as well as between cantilever and secondary caries in abutments.

2.6. Ethical Considerations

In this study, no intervention was performed on patients who visited the Razi Radiology Center, and only data related to the presence of fixed prostheses were evaluated. The collected data were used solely for scientific and research purposes and were not shared with unrelated individuals or institutions. Furthermore, the results of the study are reported in an aggregated and statistical form, and no reference is made to the individual identity of patients. It should also be noted that the research proposal was submitted to the Ethics Committee of Herat University and received the necessary ethical approval prior to the implementation of the study.

3. Findings/Results

3.1. Age

The age distribution of the participants ranged from 20 to 70 years. The highest proportion was observed among individuals aged 30 years (8.25%), followed by those aged 40 years (7.25%). The distribution was relatively concentrated between 20 and 50 years, while the proportion of participants generally decreased among older age groups, particularly after 50 years. Overall, the findings indicate a predominantly young-to-middle-aged study population. The individuals included in this study were 20 years of older.

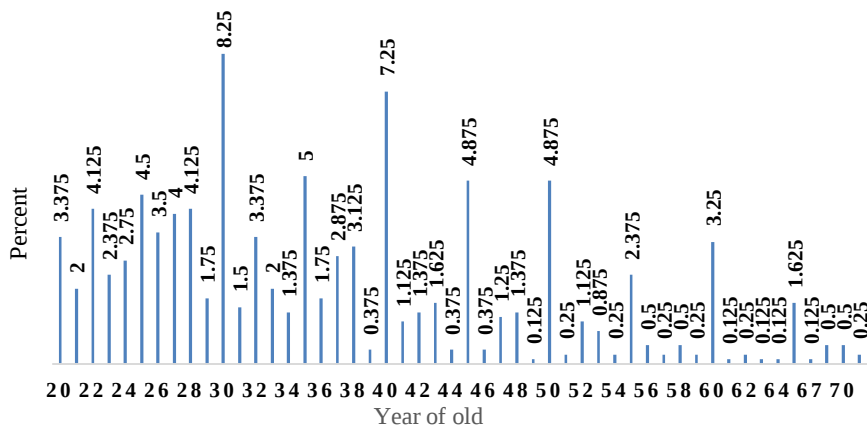


Figure 1. Age of the persons

We found mean 36.66 and std.deviation 12 for this variable.

3.2. Presence of Restoration

The results of the frequency distribution of restoration status in our sample of 800 individuals show that the majority of participants (54.75%) had no type of restoration, while 45.25% of the individuals had at least one restoration.

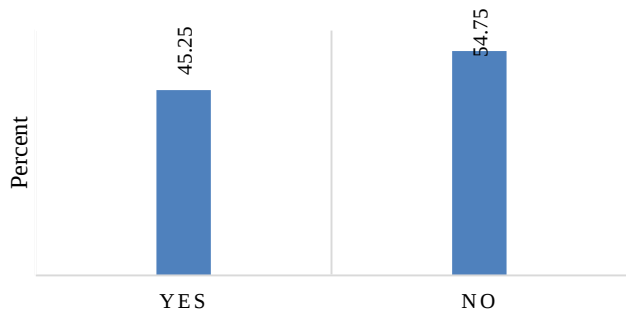


Figure 2. prevalence of fixed partial dentures

3.3. Presence of Secondary Caries

The results of the frequency distribution of the presence of secondary caries in our sample of 800 individuals show that the majority of participants (74.13%) had no secondary caries beneath fixed prostheses in their oral cavity.

The highest percentage of secondary caries beneath fixed prostheses was observed in (7.63%) of the studied individuals, each presenting one secondary carious lesion. The lowest percentage was found in (0.13%) of the study participants (one individual), who had nine secondary carious lesions beneath fixed prostheses.

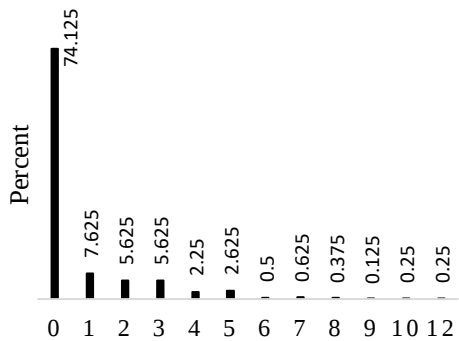


Table 3. secondary caries beneath the fixed partial dentures

We found mean 0.75 and std.deviation 1.64 for this variable.

3.4. Prevalence of Apical Radiolucency in Teeth with Fixed Prostheses

The results of the frequency distribution regarding the presence of apical radiolucency in teeth with fixed prostheses in our sample of 800 individuals showed that the majority of participants (86.50%) had no apical radiolucency in teeth supporting fixed prostheses in the oral cavity. The highest percentage of apical radiolucency among teeth with fixed prostheses was observed in 7.25% of the studied individuals, who presented with one apical radiolucent lesion. The lowest percentage was observed in 0.13% of the participants (3 individuals), who exhibited 7, 8, or 10 apical radiolucent lesions.

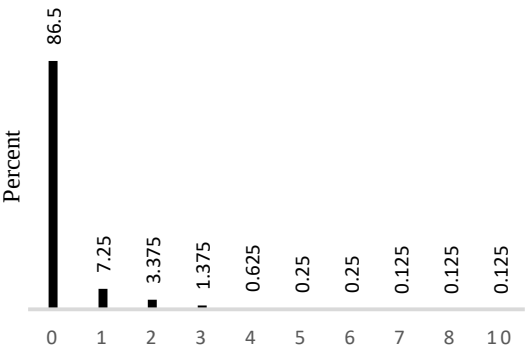


Table 4. Show the periapical radiolucency in teeth with fixed partial dentures

We found mean 0.26 and std.deviation 0.8 for this variable.

3.5. Prevalence of Cantilever Restorations

The results of the frequency distribution regarding the presence of cantilever restorations in our sample of 800 individuals showed that the majority of participants (88.75%) had no cantilever restorations in their oral cavity. The highest percentage of cantilever restorations was observed in 5.50% of the studied individuals, who had one unit of cantilever restoration. The lowest percentage was found in 0.13% of the participants (two individuals), who presented with 7 and 11 units of cantilever restorations.

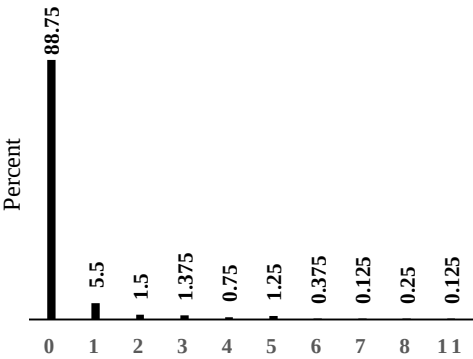


Table 5. Show number of cantilevers per person

We found mean 0.28 and std.deviation 1.09 for this variable.

3.6. Chi-square test

The Chi-square test revealed a statistically significant association between the presence of FPDs and the age of patients (Pearson $\chi^2 = 92.875$, $df = 49$, $p < 0.001$). This indicates that these two variables are strongly related in the studied population.

Table 1. Chi-Square Test Results for the Association Between FPDs and Patient Age

Test Statistic	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	92.875 ^a	49	< .001
Likelihood Ratio	102.751	49	< .001
Linear-by-Linear Association	29.461	1	< .001
N of Valid Cases	800		

Note. ^a 46 cells (46.0%) have expected count less than 5. The minimum expected count is .45.

Also we made another Chi-square test that revealed a clear and statistically significant link between presence of cantilever prosthesis and the secondary caries of abutments tooth (Pearson $\chi^2 = 876.581$, $df = 99$, $p < 0.001$). The results

highlight that cantilever plays an important role in the distribution of secondary caries within the examined group.

Table 2. Chi-Square Test Results for the Association Between Cantilever Prosthesis and Secondary Caries

Test Statistic	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	876.581 ^a	99	< .001
Likelihood Ratio	190.660	99	< .001
Linear-by-Linear Association	154.597	1	< .001
N of Valid Cases	800		

Note. ^a 110 cells (91.7%) have expected count less than 5. The minimum expected count is .00.

4. Discussion

This study provides a clear picture of the use of fixed dental prostheses (FDPs) and their associated complications among patients in Herat, Afghanistan. Overall, the findings suggest that while restorative treatments are fairly common, most FDPs function without major biological complications, which is reassuring and aligns with observations from international studies.

In the present study, 45.25% of participants had at least one type of fixed partial restoration. This is very close to what Bekiroglu N et al. reported, where 48.3% of individuals had fixed or indirect restorations ^[10]. This similarity suggests that, despite differences in healthcare systems, the uptake of restorative care in Herat is within the expected global range. However, the fact that more than half of the participants (54.75%) had no restorations may still point to unmet treatment needs or barriers to accessing dental services.

When looking at secondary caries, the majority of patients in this study (74.13%) did not show any lesions beneath fixed prostheses, meaning that 25.87% were affected. This figure falls well within the range reported in previous studies. For example, in turkey country Türker N et al. (2019) found secondary caries in 21.6% of cases, while Yamanel K et al. (2009) reported a slightly lower rate of 17.8%. On the other hand, in Finland Näpänkangas R et al. (2011) observed higher levels, around 28.0%, particularly over longer follow-up periods ^[11-13]. Taken together, these comparisons suggest that the rate observed in this study is neither unusually high nor low, but rather reflects

typical clinical outcomes. It also highlights how factors such as oral hygiene, marginal fit, and duration of prosthesis use can influence the development of secondary caries.

A similar pattern was observed for apical radiolucency. In this study, 86.50% of participants showed no periapical pathology, leaving 13.50% with detectable lesions. This is very close to the findings of Konishi M et al. (2021), who reported a prevalence of 12.4%, and Şain A et al. (2020), who found 15.2%^[14, 15]. The consistency across studies suggests that most abutment teeth remain healthy when proper clinical procedures are followed. At the same time, the presence of apical pathology in a small proportion of cases serves as a reminder that endodontic quality, coronal sealing, and occlusal forces remain critical factors for long-term success.

The use of cantilever restorations in this study was relatively limited (11.25%), which also reflects current clinical practice. Almohefer S et al. (2024) reported a very similar figure of 10.8%, indicating that clinicians tend to use this design cautiously^[16]. This is not surprising, given the well-known biomechanical challenges associated with cantilever FDPs. The low prevalence observed here may, in fact, contribute to the generally favorable outcomes seen in this population.

Overall, what stands out is how closely the findings of this study match those reported internationally. Across all measured variables restoration prevalence, secondary caries, apical radiolucency, and cantilever use the results fall within previously reported ranges. This suggests that, despite potential limitations in resources, the clinical performance of FDPs in this setting is comparable to global standards.

The findings of this study should be interpreted within the specific socioeconomic and healthcare context of Herat and Afghanistan. The relatively high prevalence of fixed prostheses may reflect patients' preference for aesthetic and functional rehabilitation, while limited access to advanced options such as implants constrains treatment choices. On the other hand, the notable presence of secondary caries and periapical lesions can partly be explained by economic challenges; many patients are unable to afford regular follow-up visits, and post-treatment maintenance services are not consistently available. In addition, limited public awareness of oral hygiene contributes to complications that are less frequently observed in countries with stronger healthcare systems.

That said, some limitations should be considered. Because the study is cross-sectional, it cannot capture how complications develop over time. In addition, relying mainly on radiographic findings may underestimate early or clinically subtle problems. Factors such as the age of the prostheses, materials used, and patients' oral hygiene habits were also not fully explored and could influence the outcomes.

It is also important to consider the influence of healthcare infrastructure and professional training. Dental clinics in Herat often lack advanced equipment and standardized maintenance protocols, which may affect the long-term success of prosthetic treatments. Variability in clinical expertise and the absence of a structured referral system further increase the risk of poorly designed or inadequately executed prostheses. These local factors help explain why a proportion of patients experienced complications such as secondary caries or apical radiolucency, even though the overall complication rates remain comparable to international reports.

In conclusion, fixed dental prostheses in this population appear to perform well, with complication rates similar to those reported in other parts of the world. Continued attention to good clinical practice, regular follow-up, and patient education will be important to maintain and further improve these outcomes.

5. Conclusion and Recommendations

This study demonstrates that the use of fixed prostheses among patients and visitors to dental clinics and treatment centers is considerably prevalent. More than half of the individuals did not have fixed prostheses, while approximately 45% had at least one type of prosthetic restoration, indicating widespread utilization and strong patient interest in crowns and prosthetic treatments. Furthermore, the study highlights the significant role dentists play in prescribing this notable number of prostheses.

The findings revealed that most patients did not present with secondary caries beneath their prosthetic restorations, and periapical lesions were reported at a relatively low rate, suggesting that the quality of treatments is generally acceptable. Nevertheless, a proportion of patients did experience complications, which can be attributed to inadequate prosthesis design, insufficient clinical expertise, failure to adhere to biomechanical principles, poor oral hygiene practices by patients, and lack of regular follow-up after receiving prostheses. The occurrence of cantilever prostheses is noteworthy, as such designs may contribute to periapical lesions and secondary caries.

This research underscores the importance of adhering to scientific principles in the design and execution of fixed prostheses. Failure to observe these principles often leads to prosthetic failure and serious, sometimes irreversible, damage to teeth, including periapical radiolucencies of abutment teeth.

Conducted for the first time in Afghanistan, this study revealed that a significant proportion of patients and dental clinic visitors utilize fixed prostheses. The presence of complications calls for serious attention from dental practitioners, and it is recommended that future studies be conducted with larger sample sizes across multiple centers to provide a more comprehensive picture of the prosthetic status of patients.

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