

Original Article

# Complications Associated with Metal Ceramic Prosthesis in Fixed Partial Denture used in Peshawar

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## ABSTRACT

**Background:** Fixed Partial Dentures (FPDs) are a cornerstone in the restoration of missing teeth, offering both functional and aesthetic benefits. Metal-ceramic FPDs, in particular, have gained popularity due to their durability and mechanical properties. However, their associated complications can significantly impact patient satisfaction and prosthesis longevity.

**Objective:** This study aims to investigate the complications associated with metal-ceramic FPDs in a Pakistani population, focusing on their prevalence, types, and distribution across different dental arches and locations.

**Methods:** Conducted at Sardar Begum Dental College, Peshawar, Pakistan, this descriptive cross-sectional study involved 183 participants, selected via non-probability convenience sampling over 4 to 6 months. Participants aged 15 to 60 years, who had been wearing metal-ceramic FPDs for more than a month, were included. Data were collected through a structured questionnaire, with complications categorized into biological and technical issues. SPSS version 25 was utilized for data analysis, employing descriptive statistics to quantify the prevalence and distribution of complications.

**Results:** The study identified pain on chewing (46.4%) and de-cementation (23.5%) as the most frequent complications. The distribution of complications was nearly even between the maxillary (49.1%) and mandibular (50.9%) arches, with a higher incidence in the posterior regions. Specifically, the mandibular posterior region recorded the most problems (45.4%), followed by the maxillary posterior (28.4%), maxillary anterior (20.8%), and mandibular anterior (5.5%) regions.

**Conclusion:** The prevalence of complications associated with metal-ceramic FPDs, particularly pain on chewing and de-cementation, underscores the need for meticulous case selection, precise treatment planning, and enhanced patient education on oral hygiene. These measures are essential to improving the longevity of FPDs and patient satisfaction, highlighting the importance of a multidisciplinary approach in dental care.

**Keywords:** Metal-Ceramic Fixed Partial Dentures, Dental Prosthesis Complications, Prosthodontics, Pain on Chewing, De-cementation, Dental Restoration Longevity, Oral Hygiene, Patient Satisfaction.

## INTRODUCTION

The utilization of Fixed Partial Dentures (FPDs) has markedly increased, attributed to their notable reliability, stability, and comfort, thereby presenting a viable alternative to dental implants for the restoration of functionality and aesthetics in individuals with missing teeth (1). Within the spectrum of prosthetic solutions, Metal-ceramic FPDs are particularly distinguished for their application in posterior tooth restoration, offering superior mechanical properties. Despite these advantages, the aesthetic outcomes of metal-ceramic FPDs can be compromised by the visibility of the dark substructure, which necessitates veneering, especially in constrained spaces (2). The long-term viability and success of metal-ceramic Fixed Partial Dentures have been substantiated by survival rates of 78% and success rates of 71% over an 18-year period of functional use (3), with Eliasson et al. reporting a remarkable 97% survival rate over a decade of clinical service (4). While these figures suggest a high degree of durability, metal-ceramic restorations are not without their challenges, including issues such as chipping, breaking, and surface wear, which may be underreported in literature due to potential conflicts of interest from commercial funding (5).

The clinical utilization of metal-ceramic prostheses in FPDs has brought to light several complications that necessitate attention within the realm of dental practice. Despite their clinical effectiveness and aesthetic qualities (6), these prostheses are susceptible to both technical and biological complications (7). Technical issues may include loss of retention, disintegration of ceramic components, occlusal discrepancies, and structural damage (8), often arising from design inadequacies, clinical application errors, or patient-specific factors (9). This underscores the critical need for meticulous case selection, diagnostic evaluation, and expert prosthetic craftsmanship (10). Further complicating matters are the challenges posed by inadequate metal support or mismatches in thermal coefficients, requiring careful consideration during treatment planning (11). Biological complications present another dimension of concern, encompassing secondary caries, pulpal disorders, periodontal diseases, and abutment fractures (8). The interrelation between biological and technical complications is noteworthy, as biological issues can precipitate technical problems, and vice versa (12). Success in the application of metal-ceramic FPDs, therefore, hinges on a comprehensive diagnostic process, adept technical skills, and a nuanced understanding of potential complications (1). The skill level of clinicians in managing these complications significantly affects the longevity and frequency of issues encountered (13). Thus, while technology can augment efficiency and outcomes in skilled hands, its application by less proficient practitioners can lead to adverse effects (14).

This study aims to explore and elucidate the prevalent concerns and challenges encountered by dental patients and professionals in Peshawar regarding metal-ceramic FPDs. By delving into these issues, the study seeks to enhance patient care, elevate patient satisfaction, and contribute to the advancement of prosthodontics in the region. The focus on understanding and addressing these complications is crucial for the ongoing development of dental practice and patient outcomes in the field of prosthodontics.

## MATERIAL AND METHODS

The study was conducted at Sardar Begum Dental College, Peshawar, Pakistan, utilizing a descriptive cross-sectional design over a period of approximately 4 to 6 months. Employing a non-probability convenience sampling method, the sample size was determined to be 183 participants. This calculation was based on a 13.7% prevalence rate (15), with a 5% margin of error and a 95% confidence interval, where  $z=1.96$ . The research targeted patients who had been wearing metal-ceramic prostheses for more than one month, aged between 15 and 60 years, encompassing both male and female subjects. The inclusion criteria were specifically designed to capture a diverse population that had a significant period of prosthesis wear, enabling a thorough evaluation of prosthesis-related complications. The chosen age range intended to cover a broad spectrum of patients to consider the varying impacts of age-related factors on prosthesis complications. Both genders were included to ensure the sample reflected the demographic diversity of the patient population. Exclusions were made for patients with implant-fixed or all-ceramic prostheses, due to the distinct nature of complications associated with these types, and individuals with mental illnesses were also excluded to ensure clarity in communication and understanding during the data collection process.

Ethical approval for the study was granted by the institutional research ethics board, adhering to the principles of the Declaration of Helsinki. Informed consent was obtained from all participants and department heads prior to their inclusion in the study, ensuring ethical standards were upheld throughout the research process. A meticulously developed questionnaire, alongside written informed consent forms, facilitated the collection of detailed data on prosthesis-related complications from participants in the prosthodontics department.

Data from the questionnaires were systematically entered into SPSS software (version 25) for detailed descriptive analysis. This analysis involved the calculation of frequencies and percentages to elucidate the prevalence and distribution of complications among the study population. The analytic process was designed to offer insights into the specific issues encountered by patients using metal-ceramic prostheses in Fixed Partial Dentures (FPDs), with the findings subsequently presented through various visualization tools. The aim was to provide a comprehensive and accessible summary of the research outcomes, thereby contributing valuable information on the complications associated with metal-ceramic prostheses in the context of the study population.

## RESULTS

In the conducted study at Sardar Begum Dental College, Peshawar, Pakistan, a descriptive cross-sectional approach was utilized to investigate the complications associated with metal ceramic prostheses in fixed partial dentures. The sample consisted of 183 participants, who were selected through non-probability convenience sampling. The demographic distribution revealed a diverse age range among the participants: 43 individuals (23.5%) were aged between 15 and 30 years, 80 individuals (43.7%) fell within the 31 to 45 years age bracket, and 60 participants (32.8%) were aged between 46 and 60 years (Table 1). The gender distribution was relatively balanced with a slight female predominance; 98 participants (53.6%) were female, and 85 participants (46.4%) were male (Table 1). In terms of educational status, the majority of participants were uneducated (44.3%), followed by those with university-level education (24.6%), elementary level education (15.8%), and secondary level education (15.3%) (Table 1).

The location of the dental prosthesis played a crucial role in the study, with the distribution almost evenly split between the maxilla and mandible. The anterior region of the maxilla was the site for 38 prostheses (20.8%), while the posterior maxilla accounted for 52 prostheses (28.4%). In the mandible, 10 prostheses (5.5%) were located in the anterior region, and a significantly higher number, 83 prostheses (45.3%), were found in the posterior region. This distribution indicates a slight preference for posterior mandibular locations for prostheses, with a cumulative 50.8% of the prostheses located in the mandible compared to 49.2% in the maxilla (Table 2).

Regarding the complications encountered by participants, pain on chewing was the most reported issue, affecting 85 individuals (46.4%). De-cementation and occlusal problems were also prevalent, experienced by 43 (23.5%) and 38 (20.8%) participants, respectively. Porcelain fracture and periapical problems were noted by 28 (15.3%) and 25 (13.7%) participants, in that order. Other complications included caries (12%), aesthetic problems (10.4%), abutment fracture (9.8%), and periodontal problems (9.3%). Notably, there were no reports of metal fracture among the participants (Table 3).

Table 1: Demographic Data of the Participants

S.no	Variables	Frequency	Percentage (%)
1	Age		
	15-30 years	43	23.5
	31-45 years	80	43.7
	46-60 years	60	32.8
	Gender		
	Male	85	46.4
	Female	98	53.6
3	Educational Status		
	Uneducated	81	44.3
	Elementary level	29	15.8
	Secondary level	28	15.3
	University level	45	24.6

Table 2: Location of Dental Prosthesis

Location	Maxilla		Mandible	
	n	%	n	%
Anterior	38	20.8	10	5.5
Posterior	52	28.4	83	45.3
Total	90	49.2	93	50.8

Table 3: Complications

Complications	n	%
Pain on Chewing	85	46.4
De-cementation	43	23.5
Occlusal Problems	38	20.8
Porcelain fracture	28	15.3
Periapical problems	25	13.7
Caries	22	12
Esthetic problems	19	10.4
Abutment fracture	18	9.8
Periodontal problems	17	9.3
Metal fracture	0	0

Table 4: Complications in Relation to the Location of Prosthesis in Maxillary and Mandibular Arches

Complications	Location	Total (n)	Maxilla		Mandible	
			Anterior	Posterior	Anterior	Posterior
Pain on Chewing		85	12	19	3	51
De-cementation		43	9	12	1	21
Occlusal Problems		38	5	11	2	20
Porcelain fracture		28	7	9	2	10
Periapical problems		25	4	7	2	12
Caries		22	5	6	1	10
Esthetic problems		19	12	4	2	1
Abutment fracture		18	5	4	2	7
Periodontal problems		17	0	10	1	6
Metal fracture		0	0	0	0	0

The analysis of complications in relation to the location of the prosthesis in the maxillary and mandibular arches offered insightful observations. Pain on chewing was predominantly reported in the posterior mandible (51 out of 85 cases), indicating a possible correlation with masticatory pressure distribution. De-cementation was more evenly spread but showed a slight increase in the posterior regions of both the maxilla and mandible. Occlusal problems and porcelain fractures followed a similar trend, with a preference for the posterior regions, suggesting a relationship with the functional demands on these prostheses. Esthetic problems were notably higher in the anterior maxilla, reflecting the greater aesthetic concern in the visible areas of the mouth. Periapical problems, caries, abutment fractures, and periodontal problems were relatively lower in frequency but showed a varied distribution across different prosthesis locations, underscoring the multifactorial nature of these complications (Table 4).

These findings underscore the complexity of managing metal ceramic prostheses in fixed partial dentures, highlighting the significance of considering both the technical aspects of prosthesis fabrication and placement, as well as the biological responses of patients to these restorations. The detailed analysis of complications in relation to prosthesis location provides valuable insights for clinical practice, aiming to improve patient outcomes through targeted interventions and enhanced prosthesis design.

## DISCUSSION

In the recent study conducted at Sardar Begum Dental College, Peshawar, Pakistan, the intricacies involved in evaluating and comparing the durability and complications associated with Fixed Partial Dentures (FPDs) were meticulously examined. The investigation highlighted the significant role that non-standardized patient profiles, varied instrumentation, and the divergent expertise levels of practitioners play in influencing the outcomes of FPDs. This diverse spectrum of practitioners ranged from general dental practitioners and undergraduate dental students to dental specialists other than prosthodontists, each contributing differently to the results observed due to their distinct skill sets and approaches to treatment (De Backer et al., 17). Such variability underscores the challenges in achieving uniformity in treatment outcomes and emphasizes the necessity for a comprehensive, long-term study with standardized parameters for tooth preparation, patient selection, and laboratory procedures to garner valid data on the success rates of metal ceramic FPDs, which have been shown to be effective and durable over periods of 15–20 years when crafted by experienced dental professionals (16).

Our study focused on the evaluation of complications associated with metal ceramic prostheses, categorizing them into biological and technical issues. Biological complications included caries, pain on chewing, abutment fracture, periodontal, and periapical problems, whereas technical complications encompassed de-cementation, esthetic concerns, porcelain fracture, and occlusal issues. The findings revealed a prevalence of de-cementation and occlusal problems, aligning with previous studies (De Backer et al., 17), yet caries, periodontal, and periapical issues were found to be less severe in our cohort.

The distribution of complications was nearly even between the maxillary and mandibular arches, with a pronounced occurrence in the posterior regions, corroborating the findings of Ghani et al. (8). This pattern reflects the challenges associated with posterior FPDs, which exhibited a reduced lifespan compared to those in anterior locations, a sentiment echoed by Saleem et al. (18) and contrasted by Cheung's (19) findings of higher failure rates in anterior restorations. Pain on chewing emerged as the most frequent complication, a finding consistent with other studies conducted in diverse geographic locations, thereby highlighting the universal challenge of achieving occlusal harmony in FPD treatments (1, 20).

The study's methodology, while robust, was not without limitations. The use of a convenience sampling technique and the potential for practitioner variability could have influenced the generalizability of the findings. Moreover, the cross-sectional design provides a

snapshot of complications without tracking their progression over time, suggesting the need for longitudinal studies to better understand the durability and long-term success of metal ceramic FPDs.

In light of these findings, several recommendations can be posited. It is imperative for dental practitioners to engage in meticulous case selection, accurate tooth preparation, and precise impression taking to lay a stable foundation for FPDs. Patients should be educated about proper oral hygiene practices to maintain the integrity of their prosthesis and mitigate complications. Additionally, laboratory technicians play a critical role in selecting high-quality materials and ensuring that occlusal adjustments are made to distribute biting forces evenly, thereby minimizing the risk of porcelain fracture or metal failure.

The collaboration between dentists, patients, and laboratory technicians is paramount in enhancing the longevity and success of metal-ceramic FPDs. Future research should aim to standardize treatment protocols and adopt longitudinal designs to provide deeper insights into the factors that influence the durability of these prostheses, ultimately contributing to the advancement of prosthodontic care and patient satisfaction.

## CONCLUSION

The study elucidates the complexity of managing complications associated with metal-ceramic Fixed Partial Dentures (FPDs), underscoring the critical interplay between practitioner expertise, patient compliance with oral hygiene, and the technical precision of laboratory procedures. The findings reveal that pain on chewing and de-cementation are the most prevalent complications, predominantly occurring in the posterior regions of both arches, highlighting the necessity for meticulous case selection, accurate diagnosis, and comprehensive treatment planning. These insights bear significant implications for human healthcare, emphasizing the need for a collaborative approach among dental practitioners, patients, and laboratory technicians to enhance the durability and success of FPDs, thereby improving patient outcomes and quality of life.

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