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Research Article

Clinical Evaluation of Factors Leading to Provisional Crown Failure

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Abstract: ***Background:*** Provisional crowns are essential in fixed prosthodontics, serving to protect prepared teeth and maintain functionality while ensuring aesthetics during treatment. The purpose of this study was to evaluate the clinical factors contributing to their failure, aiming to improve reliability and patient outcomes. ***Aim of the study:*** The aim of the study was to identify and evaluate clinical factors contributing to the failure of provisional crowns. ***Methods:*** This retrospective observational study took place in the Department of Prosthodontics at BSMMU and beau-dent, Dhaka, Bangladesh, from January to December 2013, involving 120 patients who underwent provisional crown placement. Participants provided informed consent, and data collected included demographics, tooth type, crown material, and operator experience. Failures (debonding, fracture, marginal leakage) were monitored over six months, considering factors like bruxism and margin fit. Outcomes were analyzed using SPSS version 22.0. ***Results:*** A total of 120 patients were included in the study, with a mean age of 54.3 years and a gender distribution of 56.67% male and 43.33% female. The most common failure type was debonding, occurring in 8.33% of the cases. Bruxism was present in 91.30% of the failure cases. Bruxism showed a significant association with failures (p=0.011). The bar chart for bruxism highlights its impact, showing that 91.30% of the failure group had bruxism compared to 63.92% in the success group. ***Conclusion:*** The study highlights that bruxism, poor margin fit, use of Bis-acryl resin, and operator experience of fewer than five years are significant factors contributing to the failure of provisional crowns.
Keywords: Provisional Crowns, Crown Failure, Debonding, Marginal Leakage, Fixed Prosthodontics.

INTRODUCTION

Provisional crowns and fixed partial dentures (FPDs) are essential components of fixed prosthodontics, serving as temporary solutions between tooth preparation and the placement of definitive restorations.[1,2] Their usage duration varies based on treatment needs, ranging from a few days for single crowns to several months in cases like periodontal therapy, implant restoration, or diagnostic purposes.[3] These interim restorations provide critical functions, such as protecting exposed dentine, preventing sensitivity, preserving tooth position, and ensuring satisfactory aesthetics.[4] They also play a key role in maintaining gingival health, shielding the pulp from thermal and chemical irritants, and sustaining interocclusal and intra-arch relationships.[5] Furthermore, they must withstand functional loads, endure masticatory forces, and exhibit an aesthetic quality that closely resembles the final restoration.

Despite their critical role, provisional crowns often encounter challenges, including failures like debonding, fractures, and marginal leakage. Such issues can result in patient discomfort, functional difficulties, unintended tooth movement, and aesthetic dissatisfaction, frequently necessitating costly and time-intensive repairs.[6] Research indicates that a notable proportion of provisional crowns fail within weeks of placement, primarily due to material weaknesses and adhesive degradation.[7] These setbacks can extend treatment timelines, elevate expenses, and diminish patient satisfaction, emphasizing the importance of using durable materials and employing accurate fabrication techniques to enhance the reliability of provisional restorations.

Failures in provisional crowns result from a combination of patient-specific, material-related, and operator-dependent factors. The mechanical properties of provisional materials, such as fracture toughness and compressive strength, are crucial for withstanding masticatory forces, typically ranging from 300–500 N.[8] Fracture toughness reflects a material's ability to resist crack propagation from microscopic defects, while compressive strength determines its capacity to endure applied loads. Additionally, surface hardness and material density influence durability and wear resistance. Despite advancements like CAD/CAM-manufactured crowns with enhanced materials, challenges remain, particularly in clinical scenarios where significant masticatory forces increase failure risks, especially for long-span restorations compared to

shorter spans.[10] Notably, there is a scarcity of literature on flexural strength and elastic modulus under simulated in vivo conditions, underscoring the need for targeted research to improve material performance and clinical outcomes.[11]

Understanding the factors contributing to provisional crown failure is essential for improving clinical outcomes, as these restorations play a crucial role in protecting prepared teeth and maintaining function during treatment. Previous studies have highlighted patient-specific factors like bruxism, material properties such as Bis-acryl resin, and operator-related factors, including experience level, as key contributors to failure. However, the interaction of these variables and their relative impact remains inadequately explored, particularly in real-world settings. By addressing these gaps, this study aims to guide the development of improved materials, techniques, and clinical protocols, ultimately reducing failure rates and enhancing patient care. The study's purpose was to determine and assess the clinical factors that contribute to provisional crown failure.

Objective

- The aim of the study was to identify and evaluate clinical factors contributing to the failure of provisional crowns.

Methodology and Materials

This retrospective observational study was conducted in the Department of Prosthodontics at Bangabandhu Sheikh Mujib Medical University (BSMMU) and beau-dent, Dhaka, Bangladesh, from January 2013 to December 2013. A total of 120 patients who underwent provisional crown placement were included in the study.

Inclusion Criteria:

- Patients aged 18 years and above.
- Patients receiving provisional crowns for restorative dental procedures.
- Patients without systemic diseases affecting dental health.

Exclusion Criteria:

- Patients with temporomandibular joint (TMJ) disorders.
- Patients who had previously experienced failure of provisional crowns.
- Patients with poor oral hygiene or active periodontal disease.

Informed consent was obtained from all participants to ensure confidentiality and voluntary participation. Clinical data, including demographic information (age, gender) and the type of tooth receiving provisional crowns (molars, premolars, anterior teeth), were recorded. Additionally, the material used for the crowns (e.g., Bis-acryl resin) and the operator's experience level (<5 years vs. >5 years) were documented. The provisional crown failures were classified into three types: debonding, fracture, and marginal leakage, and these outcomes were monitored over a six-month period post-placement. Factors such as bruxism, margin fit, material used, and operator experience were considered as potential contributors to failure. Data were compiled and analyzed using SPSS version 22.0, employing descriptive statistics to summarize the participants' demographics and clinical characteristics. Frequencies and percentages of failure types were calculated. To compare the factors linked with failure and success, a chi-square test was performed, with a p-value of < 0.05 deemed statistically significant.

RESULTS

Table 1: Demographic and Clinical Characteristics of Patients with Provisional Crown Placement (n=120)

Variables		Frequency (n)	Percentage (%)
Age (In years)	30 – 44	34	28.33%
	45 – 64	65	54.17%
	≥ 65	21	17.50%
	Mean ± SD	54.3 ± 12.6	
Gender	Male	68	56.67%
	Female	52	43.33%
Tooth type for provisional crowns	Molars	65	54.17%
	Premolars	35	29.17%
	Anterior teeth	20	16.67%

Table 1 presents the demographic and clinical characteristics of the study participants who underwent provisional crown placement. A total of 120 patients were included in the study. The age distribution shows that 34 patients (28.33%) were between 30–44 years, 65 patients (54.17%) were between 45–64 years, and 21 patients (17.5%) were 65 years or older. The mean age of the sample was 54.3 years with a standard deviation of 12.6 years. Regarding gender, 68 patients (56.67%) were male, while 52 patients (43.33%) were female. As for the tooth type for provisional crowns, 65 crowns (54.17%) were placed on molars, 35 crowns (29.17%) were placed on premolars, and 20 crowns (16.67%) were placed on anterior teeth.

Table 2: Types of Failures and Their Proportions in Provisional Crown Cases (n=23)

Type of Failure	Number of Cases (n)	Percentage (%)
Total Failures	23	18.75%
-Debonding	10	8.33%
-Fracture	8	6.67%
-Marginal Leakage	5	4.17%

A total of 23 failure events were recorded. The most common failure type was debonding, occurring in 10 cases (8.33%), followed by fracture in 8 cases (6.67%), and marginal leakage in 5 cases (4.17%). The total failure rate was 18.75%, indicating that a significant proportion of provisional crowns experienced failure during the study period.

Table 3: Factors Contributing to Provisional Crown Failure (n=23)

Variable	Frequency (n)	Percentage (%)
Bruxism (Yes)	21	91.30
Material (Bis-acryl resin)	18	78.26
Margin Fit (Poor)	20	86.96
Operator Experience (<5 yrs)	15	65.22

Among the 23 recorded failure events in provisional crowns, bruxism was the most frequently associated factor, present in 21 cases (91.30%). Poor margin fit was identified in 20 cases (86.96%), while Bis-acryl resin was used in 18 cases (78.26%). Operator experience of less than five years was noted in 15 cases (65.22%).

Table 4: Comparison of Failure and Success Factors in Provisional Crown Cases (n=120)

Variable	Failure Group (n=23)	Percentage (%)	Success Group (n=97)	Percentage (%)	p-value
Bruxism (Yes)	21	91.30	62	63.92	0.011
Material (Bis-acryl resin)	18	78.26	50	51.55	0.004
Margin Fit (Poor)	20	86.96	40	41.24	<0.001
Operator Experience (<5 yrs)	15	65.22	30	30.93	<0.001

Table 4 highlights the comparative analysis of key factors influencing provisional crown outcomes between failure (n=23) and success groups (n=97). Bruxism was significantly associated with failures, occurring in 91.30% of cases compared to 63.92% in the success group (p=0.011). The use of Bis-acryl resin was observed in 78.26% of failure cases and 51.55% of success cases (p=0.004), suggesting its potential role in crown durability. Poor margin fit was notably prevalent in the failure group (86.96%) versus 41.24% in the success group (p<0.001). Additionally, operator experience of fewer than five years was more frequent in failure cases (65.22%) compared to 30.93% in successful outcomes (p<0.001).

DISCUSSION

This study investigates the clinical factors contributing to the failure of provisional crowns, a common aspect of restorative dental procedures. Provisional crowns, often used to maintain tooth function and aesthetics during the period before a final restoration, are susceptible to failure due to various factors. The results emphasize the importance of understanding both patient-specific conditions, such as bruxism, and procedural factors, including margin fit and operator experience. The high failure rates observed underscore the need for improved clinical practices, such as better material choices and enhanced operator training, to reduce failure rates and improve long-term outcomes for patients undergoing restorative dental treatments. The findings also provide insights into the challenges faced in provisional crown success, underscoring the multifactorial nature of crown failures in dental practice.

In this study, the majority of patients undergoing provisional crown placement were male (56.67%), and most crowns were placed on molars (54.17%). These findings align with those of Palinkas et al.[11], who observed higher failure rates among male patients, attributed to stronger bite forces and a higher prevalence of bruxism. Increased occlusal forces in men can create greater mechanical stresses on crowns, contributing to their failure.[12] Similarly, Hyde et al.[13], emphasized that molars are more prone to crown failure due to their exposure to significant occlusal pressures. These patterns underscore the need for patient-specific considerations, such as selecting durable materials and optimizing design, particularly for male patients and molar restorations.

In this study, the total failure rate of 18.75% closely mirrors findings by Hyde et al., emphasizing the challenges of provisional crown durability in clinical

and educational settings. Debonding (8.33%) emerged as the most common failure type, aligning with Hyde et al.'s[13] observations of luting cement and operator technique as critical factors. Fractures (6.67%) underscore the need for robust material selection, particularly under high occlusal forces, while marginal leakage (4.17%) highlights the significance of precise marginal adaptation. These findings reinforce the importance of durable materials, advanced operator training, and optimized techniques to improve outcomes for provisional restorations.

In this study, failure of provisional crowns was significantly influenced by factors such as bruxism, poor margin fit, operator experience, and material choice. Bruxism, present in 91.30% of failures, highlights the need for managing occlusal forces to prevent structural compromise. Bis-acryl resin was used in 78.26% of failure cases, suggesting its limitations in high-stress environments despite its convenience and aesthetics. Poor margin fit, observed in 86.96% of failures, underscores the critical importance of precise preparation and cementation techniques to prevent marginal leakage and related complications. Additionally, 65.22% of failures were associated with operators having less than five years of experience, emphasizing the role of skill and expertise in achieving successful outcomes. These findings collectively stress the importance of tailored material selection, advanced operator training, and meticulous procedural techniques to reduce failure rates and improve the durability of provisional crowns.

In this study, bruxism was significantly associated with provisional crown failure ($p = 0.011$), aligning with previous finding that bruxism impacts implant failure, implant fracture, and marginal bone loss negatively.[14] Material type (Bis-acryl resin) also showed a significant association with failure ($p = 0.004$), similar to another study highlighting the prevalence of technical complications such as ceramic chipping.[15] Poor margin fit was another critical factor ($p < 0.001$), echoing issues related to the lack of precise fit leading to complications.[15] Additionally, operator experience ($p < 0.001$) was significant, consistent with the variability in clinical practices noted due to different professionals' involvement.[16,17] These results reinforce the importance of managing bruxism, selecting appropriate materials, ensuring precise margin fit, and maintaining high standards of clinical practice to improve the success rates of provisional crowns.

These results highlight the multifactorial nature of provisional crown failures, emphasizing the need for comprehensive clinical strategies. Focusing on patient-specific factors and improving procedural techniques can significantly enhance the durability and success of provisional crowns.

Limitations of the study

This study had some limitations:

- The sample was not randomly selected.
- The study's limited geographic scope may introduce sample bias, potentially affecting the broader applicability of the findings.
- The absence of long-term outcome data, which may affect the ability to fully assess the durability and performance of provisional crowns.

CONCLUSION

This study provides a comprehensive evaluation of factors leading to the failure of provisional crowns. The results indicate that debonding, fractures, and marginal leakage are the most common types of failures, with a total failure rate of 18.75%. Bruxism, poor margin fit, use of Bis-acryl resin, and operator experience of fewer than five years are significantly associated with higher failure rates. Notably, bruxism is present in 91.30% of failure cases, highlighting its critical impact on crown durability. These findings underscore the importance of addressing these factors in clinical practice to improve the longevity and success of provisional crowns.

REFERENCES

1. Haselton DR, Diaz-Arnold AM, Vargas MA. Flexural strength of provisional crown and fixed partial denture resins. The Journal of prosthetic dentistry. 2002 Feb 1;87(2):225-8.
2. Strassler HE. Fixed prosthodontics provisional materials: making the right selection. Compendium of Continuing Education in Dentistry (15488578). 2013 Jan 1;34(1).
3. Vally Z, Sykes LM, Aspeling ME, Van de Merwe J, Ballyram R. In vitro comparison of the compressive strengths of seven different provisional crown materials. South African Dental Journal. 2013 Mar 1;68(2):64-7.
4. Burke FT, Murray MC, Shortall AC. Trends in indirect dentistry: 6. Provisional restorations, more than just a temporary. Dental update. 2005 Oct 2;32(8):443-52.
5. Larato DC. The effect of crown margin extension on gingival inflammation. Journal-Southern California Dental Association. 1969 Nov 1;37(11):476-8.
6. Ireland MF, Dixon DL, Breeding LC, Ramp MH. In vitro mechanical property comparison of four resins used for fabrication of provisional fixed restorations. The Journal of prosthetic dentistry. 1998 Aug 1;80(2):158-62.
7. Hyde JD, Arbon JD, Bader JD, Kanoy BE, Shugars DA. Patterns of retreatment in a dental school urgent care clinic. J Dent Res. 2006;85.
8. Balkenhol M, Köhler H, Orbach K, Wöstmann B. Fracture toughness of cross-linked and non-cross-linked temporary crown and fixed partial denture materials. dental materials. 2009 Jul 1;25(7):917-28.

9. Perry RD, Magnuson B. Provisional materials: key components of interim fixed restorations. Compend Contin Educ Dent. 2012 Jan 1;33(1).
10. Poonacha V, Poonacha S, Salagundi B, Rupesh PL, Raghavan R. In vitro comparison of flexural strength and elastic modulus of three provisional crown materials used in fixed prosthodontics. Journal of clinical and experimental dentistry. 2013 Dec 1;5(5):e212.
11. Palinkas M, Nassar MS, Cecílio FA, Siéssere S, Semprini M, Machado-de-Sousa JP, Hallak JE, Regalo SC. Age and gender influence on maximal bite force and masticatory muscles thickness. Arch Oral Biol. 2010 Oct;55(10):797-802.
12. Bonakdarchian M, Askari N, Askari M. Effect of face form on maximal molar bite force with natural dentition. Arch Oral Biol. 2009 Mar;54(3):201-4.
13. Hyde JD, Bader JA, Shugars DA. Provisional crown failures in dental school predoctoral clinics. Journal of dental education. 2007 Nov;71(11):1414-9.
14. Binon PP. The effect of implant/abutment hexagonal misfit on screw joint stability. Int J Prosthodont. 1996 Mar-Apr;9(2):149-60.
15. Schwarz MS. Mechanical complications of dental implants. Clin Oral Implants Res. 2000;11 Suppl 1:156-8.
16. Galante J. Stress-free prosthesis: a goal in implant dentistry. J Prosthet Dent. 1994;72:232.
17. Binon P. Screw joints, components, and other intimate relationships. J Prosthet Dent. 1994;72:625.