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Clinical Responses of Gingival Tissues to Single Unit Full Coverage Crowns

Anjuman Ara Akhter[1]*, Md. Ali Afzal Khan[2], Alia Sultana[3], Zinat Nasreen[4]

[1]Professor, Department of Prosthodontics, Dental Unit, Islami Bank Medical College, Rajshahi, Bangladesh
[2]Associate Professor, Department of Prosthodontics, Update Dental College & Hospital, Dhaka, Bangladesh
[3]Ex Associate Professor, Department of Prosthodontics, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh
[4]Assistant Professor, Department of Pediatric Dentistry, Islami Bank Medical College, Rajshahi, Bangladesh

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***Corresponding author:** Anjuman Ara Akhter
Professor, Department of Prosthodontics, Dental Unit, Islami Bank Medical College, Rajshahi, Bangladesh

Abstract

Background: Full-coverage crowns are a common restorative treatment option; yet, their placement may influence gingival health and tissue response. This study aims to assess the changes in gum health around crowns after placement and at one-year follow-up. ***Methods:*** A prospective study was conducted in the Department of Prosthodontics, Faculty of Dentistry, Bangladesh Medical University, from January 2002 to December 2003. Thirty patients requiring full coverage crowns were included and followed. Clinical parameters like plaque adhesion, probing depth, gingival bleeding, gum recession, and metal margin exposure were recorded at 15 days and one year after cementation. Data analysis was done using SPSS version 26 with statistical significance at $p<0.05$. ***Results:*** In 30 patients (53.3% male, 46.6% female), no plaque was observed immediately following the placement of the crown, but 33.3% of them exhibited plaque deposition at one-year follow-up ($p=0.100$). Probing depth, which was 1-1.5 mm in 100% of cases at 15 days, rose to 66.66% with 1-1.5 mm depth and 33.33% with <2 mm depth at one year. Gum recession was not observed initially, but was present in 60% of cases at one year. Metal margin exposure was increased from 0% to 50% at one-year follow-up. ***Conclusion:*** The study confirms that gingival tissues accommodate by developing changes after full coverage crown placement, where greater plaque build-up, gum recession, and metal margin exposure were observed at one-year follow-up. Ongoing vigilance and upkeep are unavoidable if the long-term success of crown restorations is to be ensured.

Keywords: Gingival Recession, Full Coverage Crowns, Periodontal Health, Marginal Adaptation.

INTRODUCTION

Dental caries and dental trauma are two of the biggest problems in restorative dentistry, often requiring treatment plans of an extensive kind to restore both function and esthetics. Full-coverage crowns are a guaranteed prosthetic restoration of highly compromised teeth, particularly those with extensive loss of tooth structure, endodontic therapy, or severe attrition [1]. They provide mechanical protection as well as replacement of lost dental tissues, thereby restoring satisfactory occlusal function and esthetic appearance. But insertion of full coverage restorations includes the placement of foreign material within the oral cavity, and it can potentially influence the biological reaction of the adjacent periodontal tissues [2]. The correlation between restorative treatment and periodontal health has been at the center of major clinical interest and research focus. The periodontal tissues, such as gingiva, periodontal ligament, cementum, and alveolar bone, have a delicate harmony with the tooth structure and the surrounding oral environment. Once restorations are placed, particularly those that continue into the subgingival area, this biological balance can be destroyed [3]. Earlier research has proved that marginal contour and fit of restorations have a great impact on plaque accumulation, which is the major etiological agent in periodontal disease etiology [4]. Additionally, ill-fitting restoration margins may invade the biological width, an area encompassing the junctional epithelium and supracrestal connective tissue fibers, and lead to chronic inflammation and tissue damage [5]. Evidence in the literature is contradictory regarding the vigor of the gingival reaction to full coverage restorations. Literature indicates that there are a few studies that have noted well-contoured restorations with supragingival margins

maintaining periodontal health equal to that of natural teeth [6]. Conversely, subgingival restoration margins have been linked with increased gingival inflammation, increased probing depth, and potential loss of attachment [7]. The degree of reaction is influenced by a number of factors, including the quality of restoration, positioning of margin, oral hygiene status, and patient compliance with maintenance regimen [8]. Also, the type of restorative material, i.e., metal-ceramic, all-ceramic, or full metal crowns, may potentially influence tissue reaction differently [9]. This potential clinical trial was conducted to compare in a systematic manner the clinical responses of the gingival tissues following single-unit full coverage crown placement. The goal of this study is to assess the change in initial periodontal parameters like plaque formation, probing depth, bleeding on probing, recession of the gum, and metal margin exposure during the early healing period and at one-year follow-up. Interpretation of such reactions is critical for clinicians to optimally adjust crown structure, margin placement, and patient treatment protocol to minimize adverse periodontal effects and optimize the durability and outcome of the restoration.

METHODS

This prospective study was conducted in the Department of Prosthodontics, Faculty of Dentistry, Bangladesh Medical University (BMU) from January 2002 to December 2003. Ethical approval was obtained from the relevant authorities, and all participants were informed about the nature of the study. Verbal consent was taken from the guardians of patients under 18 years of age. The inclusion criteria included pulpless, endodontically treated teeth with extensive enamel and dentin loss, subgingival extension of the lesion, teeth used as retainers for fixed partial dentures, and vital teeth with severe attrition. Patients with root fractures below the cervical margin, supragingival margins of restoration, or poor periodontal and oral hygiene were excluded. After explaining the study in simple language, general and oral examinations were conducted using sterilized dental instruments under adequate lighting. The gingiva was gently dried and examined for color, texture, contour, and consistency. Parameters such as plaque adherence, marginal integrity of the crown, probing depth, gingival bleeding, gum recession, and metal margin exposure were evaluated. The width of the keratinized gingiva was measured by gently depressing the marginal gingiva with a periodontal probe. Observations were made on buccal, lingual, and proximal surfaces, with buccal areas examined for gum recession and lingual areas for probing depth and plaque. Clinical responses were recorded 15 days after cementation and again after one year. Data were analyzed using SPSS (Version 26), employing Z-tests and chi-square tests, with p-values <0.05 considered statistically significant.

RESULTS

Table 1 represents the demographic profile of 30 patients included in the study. The sample had a wide age range of 10 to 50 years, with the highest proportion in the 10-20 years age group (30%), followed by the 41-50 years age group (26.6%). The 21-30- and 31-40-years age groups represented 23.3% and 20%, respectively, of the sample. With regards to gender distribution, the study population was nearly evenly distributed, with 53.3% male (n=16) and 46.6% female (n=14).

Table 1: Distribution of the Study Population based on Demographic Profile (n=30)

Features	(n)	(%)
Age		
10-20 years	9	30%
21-30	7	23.3%
31-40	6	20%
41-50	8	26.6%
Sex		
Male	16	53.3%
Female	14	46.6%

Table 2 summarizes the occupation of the study population. The participants in the study have been categorized based on occupational group into four groups (A, B, C, and D). Group A, ostensibly professional jobs, comprised the largest group at 46.7% (n=14) of the sample. Group B accounted for 33.3% (n=10) of respondents, and Groups C and D each accounted for 10% (n=3) of the population.

Table 2: Distribution of occupation of the study population (n=30)

Group	Frequency	%	Cumulative Percent
A	14	46.7%	46.7%
B	10	33.3%	80%
C	3	10%	90%
D	3	10%	100%
Total	**30**	**100%**	

Table 3 depicts the change over time in the accumulation of plaque about crown restorations. No plaque was detected in any of the 30 patients at 15 days directly following crowns placement (0%), indicating successful initial cleaning of restorations. However, upon one-year follow-up examination, plaque was detected in 10 patients (33.3%), showing that biofilm deposition had occurred during the observation period. The 0.100 p-value indicates that there is no statistically significant variation between the two time periods, showing that whilst plaque accumulation was noticed, the individual variation was great.

Table 3: Plaque Adherence at 15 Days and One-Year Follow-Up (N=30)

Findings	On the 15th day		1-year follow-up		
	n	%	n	%	P- value
Present	0	0%	10	33.3%	
Absent	30	100%	20	66.66%	0.100 Ns

Table 4 provides the changes in periodontal probing depth, a vital indicator of gingival and periodontal status. On day 15 following cementation, all 30 patients (100%) showed a probing depth of 1-1.5 mm with a healthy periodontal tissue response post-restoration. On one-year follow-up, probing depth distribution was varied, with 20 patients (66.66%) maintaining 1-1.5 mm depth and 10 patients (33.33%) showing <2 mm probing depth. The p-value of 0.100 indicates that there is no statistically significant difference between periods.

Table 4: Probing Depth Observations at 15 Days and One-Year Follow-Up (N=30)

Duration	1-1.5 mm depth		<2 mm depth1		p-value
	n	%	n	%	
After 15 days	30	20	0	0	
After 1 year	100	66.66%	10	33.33%	0.100 Ns

Two critical clinical findings, gum recession and metal margin exposure, are denoted in Table 5, and both have implications for esthetic and functional outcomes. Neither gum recession nor metal margin exposure was seen in any patient at 15 days (0%). But at one-year follow-up, dramatic changes were observed: gum recession in 18 patients (60%) and metal margin exposure in 15 patients (50%). These findings indicate significant gingival remodeling and resorption in the first year following crown placement that can compromise esthetics as well as the marginal seal of the restoration. The resulting high incidence of such changes emphasizes the significance of precise margin placement and consideration of such esthetic or all-ceramic restorations in visible areas.

Table 5: Incidence of Gum Recession and Metal Margin Exposure at 15 Days and One-Year Follow-Up (N=30)

Observation	Gum recession				Metal margin exposure			
	After 15 days		1-year follow-up		After 15 days		1-year follow-up	
	n	%	n	%	n	%	n	%
Present	0	0	18	60	0	0	15	50
Absent	30	100%	12	40%	30	100%	15	50%

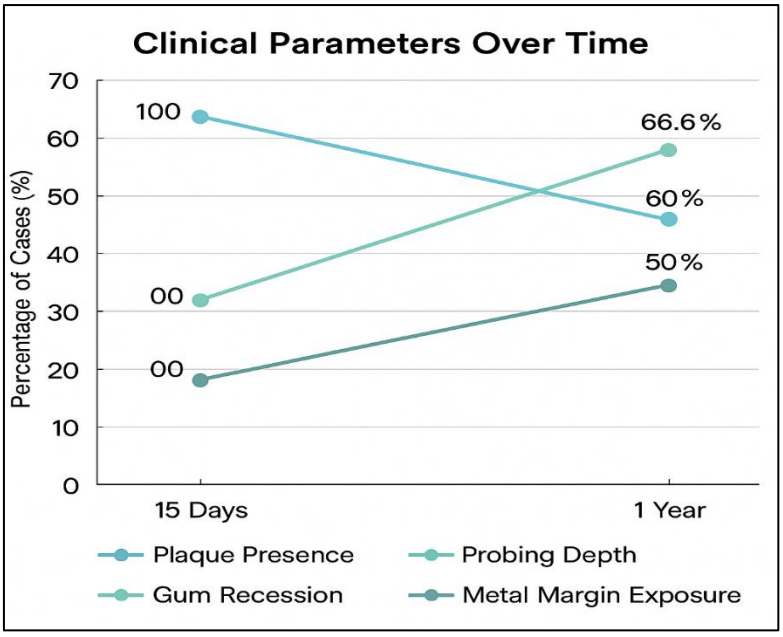

Figure 1: Clinical Parameters Over Time Following Full-Coverage Crown Placement. This line chart demonstrates the temporal changes in gingival health parameters measured at 15 days and one year after crown cementation. While initial responses were healthy and stable, the one-year follow-up revealed increased plaque presence (33.3%), gingival recession (60%), and metal margin exposure (50%), along with slight variation in probing depth (66.6% ≤ 1.5 mm, 33.3% < 2 mm). The figure visually highlights a gradual biological adaptation of gingival tissues to the prosthetic restoration over time, emphasizing the importance of margin design and regular maintenance for long-term periodontal health

DISCUSSION

This potential clinical trial evaluated periodontal tissue adaptation to single-unit full-coverage crowns over a one-year observation period with measurement of plaque accumulation, probing depth, recession, and metal margin exposure. The results indicated that gingival tissues underwent significant adaptive alterations after the placement of crowns, indicating dynamic biological interaction between restorations and surrounding periodontal structures. Temporal trend of plaque accumulation revealed a chronic increase with time. None of the patients at 15 days after cementation showed plaque, possibly for the initial smoothness of the newly cemented crowns, the remnant antimicrobial action of cement, and professional polishing [10]. But at one-year follow-up, 33.3% of the patients showed visible deposits of plaque, indicating creeping colonization by biofilm in spite of a seemingly smooth surface. The lack of statistical significance (p=0.100) indicates variability between subjects attributed to variables such as oral hygiene habits, salivary morphology, diet, and margin design of restorations. The discovery agrees with earlier evidence in favor of the fact that the retention of plaque is the fundamental mechanism underlying restorations and periodontal loss [11,12]. Probing depth analysis revealed clinically significant but statistically nonsignificant change (p=0.100). Though two-thirds (66.66%) of the patients recorded healthy probing depths of 1–1.5 mm at one year, approximately one-third experienced slight increments (<2 mm), indicating gingival remodeling. This suggests that the periodontal tissues are accommodated without radical inflammatory responses, as has been documented by Knoernschild et al., where tissue stability is often within one year after crown placement [13]. These results emphasize the observation that well-contoured subgingival margins were well tolerated if oral hygiene was sufficiently maintained. Recession of the gum and exposure of metal margins were the most significant findings, increasing from 0% initially to 60% and 50%, respectively, at one year. Gingival recession, which is apical migration of the gingival margin, can be caused by various contributing factors, such as mechanical trauma occurring with tooth preparation, encroachment upon biological width, and physiologic tissue remodeling [14]. The frequency of recession is high and implies that margin depth and preparation method are of paramount importance in determining tissue reaction. Metal margin exposure, observed in half of the cases, presents esthetic difficulties, particularly in anterior areas, and is mostly related to the concomitant presence of gingival recession and subgingival margin design. This underlines the need for case-based treatment planning and correct material choice, with an all-ceramic restoration to be preferred for anterior teeth where esthetics are the priority [15]. The type of gingival changes observed can be attributed to several clinical factors. Some of the selected teeth had subgingival extensions of lesions or were fixed partial denture retainers and demanded deep margins. Although subgingival margins ensure greater retention and marginal seal, they are perpetual irritants to gingival

tissues that may lead to localized inflammation and tissue remodeling [16]. Interference with the biologic width, the physiologic width necessary to support periodontal attachment, may also have led to soft tissue resorption. Additionally, endodontically treated teeth, which were a major part of the sample, have less proprioceptive feedback and therefore are more likely to experience over-preparation trauma without patient signs of discomfort. Compliance with oral hygiene by the patient was an important factor in minimizing adverse periodontal effects.

Limitations of the Study

This study was limited by its small patient sample of 30 patients and the lack of a control group against which to compare different margin placement depths or restorative materials. Single-center study design may limit generalizability to more heterogeneous populations.

CONCLUSION

This study demonstrates that gingival tissues exhibit a response to significant adaptive changes in the first year following full coverage crown placement, characterized by increased plaque deposit, probing depth in some patients, extensive gum recession (60%), and metal margin exposure (50%). While post-cementation reactions for the short term were minimal, the vast tissue remodeling evidenced at one-year follow-up emphasizes the importance of careful treatment planning, accurate crown construction, and strict patient monitoring. Long-term periodontal health following crown placement requires the management of comprehensive measures, including proper margin placement, optimal restoration design, excellent marginal fit, and repeated patient compliance with oral hygiene measures and professional maintenance protocols.

Recommendations

Future studies should employ larger, multicenter sample populations with longer follow-up periods extending beyond one year to assess tissue stability and long-term crown success. Investigation of specific variables such as margin placement depth, restoration material type (metal-ceramic versus all-ceramic), and patient-specific factors (smoking, diabetes, oral hygiene compliance) using randomized controlled designs would provide evidence-based guidance for optimizing crown design principles and improving clinical outcomes in prosthetic dentistry.

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