Journal of Paediatric Surgeons of Bangladesh (2024) Vol. 15 (1 & 2)
Official Journal of the Association of Paediatric Surgeons of Bangladesh
https://doi.org/10.3329/jpsb.v15i1.89128

Journal of Paediatric Surgeons of Bangladesh

Original Article

Evaluation of free gingival changes after cementation of Nickel Chromium cast crown

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Abstract

Background: Full coverage crowns are commonly used to restore severely damaged teeth and improve function and durability. Nickel–chromium cast crowns are widely utilized due to their strength, durability and cost-effectiveness. However, crown placement may influence the health of surrounding gingival tissues. This study aimed to evaluate free gingival changes following cementation of nickel–chromium cast crowns.

Methods: This prospective observational study was conducted in the Department of Prosthodontics at Bangabandhu Sheikh Mujib Medical University and Beau-Dent, The Dental Specialist from June 2021 to July 2022. A total of 60 patients aged 25–30 years who required nickel–chromium cast crowns were included. Baseline gingival condition was recorded before crown cementation using the gingival index and clinical assessment of free gingiva.

Results: Among the participants, 53.3% were aged 25–27 years and 56.7% were male. Most crowns were placed on molar teeth (61.7%). The mean gingival index increased from 0.56 ± 0.23 before cementation to 0.91 ± 0.36 at 1 month and 1.17 ± 0.41 at 3 months. Initially, 78.3% of patients had normal gingiva, but this decreased to 38.3% after three months, while mild inflammation increased to 45.0% and moderate inflammation to 16.7%. Conclusion: Nickel–chromium cast crowns were associated with a gradual increase in gingival inflammatory changes following cementation. Proper crown design, accurate marginal adaptation and good oral hygiene are essential to maintain gingival health after crown placement.

Key words: Nickel–chromium crown, free gingiva, gingival index, crown cementation, prosthodontics.

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Introduction

Dental caries and structural damage of posterior teeth are common oral health problems that often require restorative and prosthodontic treatment [1]. When significant tooth structure is lost, full coverage crowns are frequently recommended to restore function, strength and esthetics. Among the various materials used in fixed prosthodontics, nickel–chromium (Ni–Cr) cast crowns remain widely used due to their high strength, durability, good marginal integrity and relatively low cost [2]. These characteristics make them a practical option for many patients seeking fixed dental restorations [3].

Despite their advantages, the placement of full coverage crowns may influence the health of surrounding periodontal tissues, particularly the free gingiva [4]. The success of a crown restoration depends not only on its mechanical properties and longevity but also on its compatibility with the adjacent gingival tissues. Improper crown margins, overcontouring, inadequate marginal adaptation, or plaque accumulation around the restoration may lead to gingival inflammation, bleeding, or other periodontal complications [5]. Therefore, maintaining gingival health

is an important consideration in prosthodontic treatment [6].

The free gingiva, which surrounds the cervical portion of the tooth, plays a vital role in protecting underlying periodontal structures [7]. Any alteration in this tissue following crown placement may indicate the biological response of the gingiva to the restorative material or the prosthetic procedure itself [8]. Gingival changes such as redness, swelling, bleeding on probing and increased gingival index scores have been reported in patients following crown cementation, especially when plaque control is inadequate or when crown margins extend too close to the gingival sulcus [9].

Nickel–chromium alloys are commonly used in cast crowns due to their mechanical strength and corrosion resistance [10]. However, some studies have suggested that metallic restorations may influence gingival tissue response, either through marginal irritation or plaque retention around the crown margins [4]. Proper clinical techniques, accurate marginal fit and good oral hygiene practices are essential to minimize these effects and maintain periodontal health after crown placement [11].

Evaluation of gingival changes following cementation of cast crowns is therefore important to assess the biological compatibility of the restoration and the quality of prosthodontic treatment [12]. Monitoring gingival condition before and after crown placement helps clinicians identify early signs of inflammation and implement preventive measures when necessary. Clinical indices such as the gingival index are commonly used to assess the degree of gingival inflammation and to compare gingival status over time [13].

Understanding the gingival response associated with nickel–chromium cast crowns can provide valuable information for improving restorative procedures and ensuring long-term periodontal health. Therefore, this study was conducted to evaluate the changes in free gingival condition following the cementation of nickel–chromium cast crowns in patients undergoing fixed prosthodontic treatment.

Methodology and Materials

This prospective observational study was conducted in the Department of Prosthodontics at Bangabandhu Sheikh Mujib Medical University and Beau-Dent, The Dental Specialist from June 2021 to July 2022 to evaluate free gingival changes following cementation of nickel–chromium cast crowns. A total of 60 patients requiring full coverage nickel–chromium cast crowns were included in the study. Patients aged between 25 and 30 years who required single posterior full coverage crowns and were willing to participate in the study were selected using purposive sampling technique.

All patients underwent thorough clinical examination before treatment. Baseline gingival condition around the prepared tooth was recorded prior to crown cementation using standard clinical parameters including gingival index and clinical observation of free gingival condition. Tooth preparation was performed following standard prosthodontic principles and impressions were taken using elastomeric impression materials. Nickel–chromium cast crowns were fabricated in the dental laboratory and cemented using conventional luting cement. Gingival status was re-evaluated at follow-up visits after cementation to assess any changes in the free gingiva.

Inclusion criteria included patients aged 25–30 years requiring a single nickel–chromium cast crown in premolar or molar teeth, patients with clinically healthy or mildly inflamed gingiva before crown placement and those who provided informed consent. Exclusion criteria included patients with systemic diseases affecting periodontal health, smokers, patients with poor oral hygiene, those with periodontal disease, previous prosthetic crowns in the same region and patients unwilling to participate in follow-up evaluation.

All collected data were recorded in a structured data sheet and analyzed using SPSS. Descriptive statistics including frequency, percentage, mean and standard deviation were calculated and presented in tables to evaluate changes in free gingival condition following crown cementation.

Results

Table I: Distribution of Patients by Age and Gender (n = 60)

Age Group (years)	Male n (%)	Female n (%)	Total n (%)
25–27	19 (31.7)	13 (21.7)	32 (53.3)
28–30	15 (25.0)	13 (21.7)	28 (46.7)
Total	34 (56.7)	26 (43.3)	60 (100)

Table I shows the distribution of patients according to age and gender. Among the total 60 participants included in the study, the majority belonged to the 25–27 years age group, comprising 32 patients (53.3%), while 28 patients (46.7%) were within the 28–30 years age group. Regarding gender distribution, male patients were slightly more predominant, accounting for 34 cases (56.7%), whereas female patients constituted 26 cases (43.3%). In the 25–27 years age group, 19 patients (31.7%) were male and 13 patients (21.7%) were female, while in the 28–30 years age group 15 patients (25.0%) were male and 13 patients (21.7%) were female.

Table II: Distribution of Teeth Receiving Nickel-Chromium Cast Crowns (n = 60)

Tooth Type	Number of Teeth	Percentage (%)
Premolar	23	38.3
Molar	37	61.7
Total	60	100

Table II presents the distribution of teeth that received nickel–chromium cast crowns among the study participants. Out of the 60 crowned teeth, the majority were molars, accounting for 37 teeth (61.7%), whereas premolars comprised 23 teeth (38.3%).

Table III: Mean Gingival Index Before and After Cementation of Crown (n = 60)

Time of Examination	Mean Gingival Index	Standard Deviation (SD)
Before Cementation	0.56	±0.23
1 Month After Cementation	0.91	±0.36
3 Months After Cementation	1.17	±0.41

Table III shows the mean gingival index of the study participants before and after cementation of the nickel–chromium cast crowns. The mean gingival index before cementation was 0.56 ± 0.23, indicating generally healthy gingival condition around the teeth prior to crown placement. However, the mean gingival index increased to 0.91 ± 0.36 at 1 month after cementation, suggesting a noticeable rise in gingival inflammation during the early post-cementation period. Furthermore, the mean gingival index continued to increase to 1.17 ± 0.41 at 3 months after cementation.

Table IV: Changes in Free Gingival Condition After Crown Cementation (n = 60)

Gingival Condition	Before Cementation n (%)	After 3 Months n (%)
Normal Gingiva	47 (78.3)	23 (38.3)
Mild Inflammation	11 (18.3)	27 (45.0)
Moderate Inflammation	2 (3.3)	10 (16.7)
Severe Inflammation	0 (0)	0 (0)
Total	60 (100)	60 (100)

Table IV presents the changes in free gingival condition before cementation and three months after crown cementation among the study participants. Before cementation, the majority of patients had normal gingiva (47 patients, 78.3%), while 11 patients (18.3%) showed mild inflammation and only 2 patients (3.3%) had moderate inflamma

tion. After three months of crown cementation, the proportion of patients with normal gingiva decreased to 23 cases (38.3%), while mild inflammation increased to 27 cases (45.0%). Additionally, moderate inflammation was observed in 10 patients (16.7%), whereas no cases of severe inflammation were reported during the study period.

Discussion

The present study evaluated the changes in free gingival condition following cementation of nickel–chromium cast crowns. Fixed prosthodontic restorations are widely used to restore function and structural integrity of damaged teeth; however, their influence on surrounding periodontal tissues remains an important clinical consideration. The findings of the present study demonstrated a gradual increase in gingival inflammation after crown cementation, which is consistent with observations reported in several previous studies.

In this study, the majority of participants were within the 25–27 years age group (53.3%) and male patients constituted 56.7% of the study population. Although age and gender were not the primary outcomes of this research, the predominance of young adult patients requiring crown restorations may reflect the higher occurrence of dental caries, tooth fracture and structural loss among this age group. Similar clinical patterns have been reported by Rahman et al., who evaluated oral hygiene status following crown placement and noted that posterior restorations are commonly required in adult patients due to extensive tooth damage and occlusal stress [14].

The distribution of crowned teeth in the present study showed that molars accounted for 61.7% of restorations, while premolars represented 38.3%. This finding indicates that posterior teeth, particularly molars, more frequently require full coverage restorations due to their heavy functional load and increased susceptibility to caries and structural breakdown. Similar observations have been reported by Moslehifard et al., who emphasized the importance of full-coverage prosthetic rehabilitation in severely damaged posterior teeth to restore proper occlusal function and stability [15].

One of the most important findings of the present study was the change in gingival health after crown cementation. The mean gingival index increased from 0.56 ± 0.23 before cementation to 0.91 ± 0.36 at 1 month and 1.17 ± 0.41 at 3 months, indicating a gradual increase in gingival inflammation around crowned teeth. These findings are consistent with the study of Saravanakumar et al., who reported that different crown materials and restorations may influence inflammatory responses in gingival tissues due to plaque accumulation and marginal irritation [16].

Similarly, Dimofte et al. reported that fixed dental prostheses may alter the periodontal environment if plaque

control is inadequate or if marginal adaptation is not optimal. They emphasized that improper crown contour and subgingival margins can contribute to gingival inflammation and periodontal changes [17]. The increase in gingival index values observed in the present study may therefore be related to plaque retention around crown margins or minor marginal discrepancies following cementation.

In the present study, evaluation of free gingival condition also revealed a noticeable shift in gingival status over time. Before crown cementation, 78.3% of patients had normal gingiva, while only 18.3% showed mild inflammation and 3.3% had moderate inflammation. However, after three months, the proportion of patients with normal gingiva decreased to 38.3%, while mild inflammation increased to 45.0% and moderate inflammation to 16.7%. These findings suggest that gingival tissues may become more susceptible to inflammatory changes after crown placement, particularly if plaque control is not maintained effectively.

Comparable findings were reported by Shetty, who observed that periodontal parameters may deteriorate slightly around fixed prosthetic restorations over time, particularly in cases where plaque accumulation occurs near crown margins [18]. In addition, Jamal et al. reported that long-term complications of metal-based crowns may include periodontal irritation and gingival inflammation, emphasizing the importance of proper crown design and oral hygiene maintenance [19].

The role of luting agents and marginal seal in maintaining gingival health has also been highlighted in previous studies. Handa et al. demonstrated that microleakage around crown margins may contribute to plaque retention and gingival irritation, while Wingo emphasized that the choice of dental cement can influence the longevity and biological compatibility of crown restorations [20,21]. Furthermore, Alvarez-Arenal et al. noted that appropriate selection of luting agents is essential to ensure proper marginal adaptation and minimize periodontal complications [22].

Limitations of The Study

This study had several limitations that should be considered while interpreting the findings. The sample size was relatively small (n = 60) and the study population was restricted to a narrow age group (25–30 years), which may limit the generalizability of the results to other age groups. In addition, the follow-up period was limited to three months, which may not fully reflect the long-term periodontal response to nickel–chromium cast crowns. Other factors such as oral hygiene practices, dietary habits and individual periodontal susceptibility could also influence gingival health but were not extensively evaluated in this study.

Conclusion

Within the limitations of this study, cementation of nickel–chromium cast crowns was associated with a noticeable increase in gingival inflammation over time. Although these crowns effectively restore damaged teeth, careful attention to crown margins, prosthetic design and consistent oral hygiene practices is essential to maintain healthy gingival tissues and prevent periodontal complications.

Financial support and sponsorship
No funding sources.

Conflicts of interest
There are no conflicts of interest.

References

1. KV RR. Comparison of the Bond Strength of Nickel Chromium and Titanium Castable Abutments with Ni-Cr Crowns Using GIC as Luting Cement an Invitro Study (Master's thesis, Rajiv Gandhi University of Health Sciences (India)). 2016
2. Anto N, Kumar GV. Comparison of retentive strength of glass ionomer cement, resin-modified glass ionomer cement and adhesive resin cement with nickel–chromium cast crown: An in vitro study. CODS-Journal of Dentistry. 2021 Jan 11;11(1):11-4.
3. Dăguci L, Dăguci C, Dumitrescu CI, Farcaşiu C, Tărlungeanu DI, Bătăiosu M, Dina MN, Mărgăritescu C, Ţuculină MJ andrei OC. Periodontal clinico-morphological changes in patients wearing old nickel–chromium and copper alloys bridges. Romanian Journal of Morphology and Embryology. 2020 Oct 6;61(2):449.
4. Subin EK. To Evaluate the Effect of Recasting Nickel-chromium Alloy with and Without Addition of New Alloy on the Marginal Accuracy of Complete Cast Crowns: An Invitro Study (Master's thesis, Rajiv Gandhi University of Health Sciences (India)).2018
5. Sadhana S. Comparitive Evaluation of The Marginal Gap of Two Different Commercially Available Ni-Cr Alloys By Ringless Casting Technique Using Conventional And Accelerated Casting Methods–An In-vitro Study (Master's thesis, Rajiv Gandhi University of Health Sciences (India)).2016
6. Kapoor S, Prabhu N, Balakrishnan D. Comparison of the effect of different surface treatments on the bond strength of different cements with nickel chromium metal alloy: An in vitro study. Journal of Clinical and Experimental Dentistry. 2017 Jul 1;9(7):e912.
7. Beltagy TM. Effect of multiple stainless steel crowns on salivary pH, nickel and chromium levels. Egyptian Dental Journal. 2020 Jan 1;66(1-January (Orthodontics, Pediatric & Preventive Dentistry)):1-6.
8. Ristic L, Dakovic D, Postic S, Lazic Z, Bacevic M, Vucevic D. Clinical characteristics of abutment teeth with gingival discoloration. Journal of Prosthodontics. 2019 Jan;28(1):e45-50.
9. Ponni MP. Assessment of Bite Force and Periodontal Health of Primary Molars Following Stainless Steel Crown Placement Using a Novel Modification of Hall

Technique: a Clinical Study (Master's thesis, Rajiv Gandhi University of Health Sciences (India)).2018

10. da Silva LJ, Leal MB, Valente ML, de Castro DT, Pagnano VO, Dos Reis AC, Bezzon OL. Effect of casting atmosphere on the marginal deficiency and misfit of Ni-Cr alloys with and without beryllium. The Journal of prosthetic dentistry. 2017 Jul 1;118(1):83-8.
11. Shivram MP. An Invitro Study to Evaluate the Marginal Fit and Bacterial Leakage of Complete Cast Crowns Obtained by Laser Sintering and Conventional Casting Technique (Master's thesis, Rajiv Gandhi University of Health Sciences (India)).2018
12. Abdalla HB, Clemente-Napimoga JT, Trindade-da-Silva CA, Alves LJ, Prats RD, Youssef A, Vieira dos Santos PC, Buarque e Silva WA andrade e Silva F, Napimoga MH. Occlusion heightened by metal crown cementation is aggressive for periodontal tissues. Journal of Prosthodontics. 2021 Feb;30(2):142-9.
13. Pasupuleti Y. Fit of Cobalt-Chromium Copings Fabricated Using Laser Sintered and Conventional Casting Techniques:-AN In-Vitro Study (Master's thesis, Rajiv Gandhi University of Health Sciences (India)).2018
14. Rahman MM, Biswas U, Abid M, Banik RK, Nurul M. Evaluation of Oral Hygiene Status After Cementation of Modified Crown on Mandibular Molar Tooth.
15. Moslehifard E, Nikzad S, Geraminpanah F, Mahboub F. Full-mouth rehabilitation of a patient with severely worn dentition and uneven occlusal plane: a clinical report. Journal of Prosthodontics on Complex Restorations. 2016 Sep 13:63-72.
16. Saravanakumar P, Mohamed K, Mani U, Grover M, Thangarajan ST. Effect of different crown materials on the interleukin-one beta content of gingival crevicular fluid in endodontically treated molars: An original research. Cureus. 2017 Jun 16;9(6).
17. Dimofte A, Dragomir LP, Popescu MR, Popescu DM, Gheorghe DN, Martu MA, Surlin P. Aspects of the Relationship Between Fixed Dental Prostheses and Periodontal Tissues. Romanian Journal of Medical and Dental Education. 2021 Jan;10(1).
18. Shetty K. Comparative Evaluation of Porcelain Fused to Metal (PFM) Material used for Fixed Partial Prosthesis Placed on Vital Non-vital Abutments on the Periodontal Status–A Two Year Retrospective Follow-up. Journal of Pharmaceutical Research International. 2020 Jan 1.
19. Jamal S, Ghafoor R, Khan FR, Zafar K. Five year evaluation of the complications observed in porcelain fused to metal (PFM) crowns placed at a university hospital. JPMA. The Journal of the Pakistan Medical Association. 2020;70(5):845.
20. Handa M, Marya P, Gupta V, Chopra S. Comparative evaluation of microleakage of metallic copings luted with three different commercially available luting cements: An: in vitro: study. The Journal of Indian Prosthodontic Society. 2021 Jan 1;21(1):57-65.
21. Wingo K. A review of dental cements. Journal of veterinary dentistry. 2018 Mar;35(1):18-27.
22. Alvarez-Arenal A, Gonzalez-Gonzalez I, deLlanos-Lanchares H, Brizuela-Velasco A, Ellacuria-Echebarria J. The selection criteria of temporary or permanent luting agents in implant-supported prostheses: in vitro study. The Journal of Advanced Prosthodontics. 2016 Apr 1;8(2):144-9.