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Original Article

Evaluation of Crown Removal Using Two Devices Manual Back Action vs Spring Loaded Press Type Crown Removers, A Randomized Clinical Trial

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CLINICAL SIGNIFICANCE

The manual back-action crown remover offers clinicians reliable method to preserve tooth structure and allow restoration reuse, reducing procedural risks and costs, while automated devices may expedite removal but carry higher risk of damage.

ABSTRACT

Objectives: While manual back-action devices rely on tactile feedback and controlled force, automated spring-loaded press-type removers offer ease of operation but may exert less predictable forces. This study aimed to compare the success rate, efficiency, and incidence of unexpected events between manual back-action and spring-loaded press-type crown removers.

Materials and Methods: In this randomized clinical trial, 140 crowns and bridges (70 per group) requiring removal were assigned to either a manual back-action remover (Group 1) or a spring-loaded press-type remover (Group 2). All procedures were performed by a single experienced endodontist under local anesthesia. Primary outcome was successful intact removal; secondary outcomes included procedure time and adverse events (catastrophic vs. non-catastrophic failures). Statistical comparisons were made using chi-square tests and independent t-tests.

Results: Overall success was high in both groups (Group 1: 87% [61/70]; Group 2: 91% [64/70]; $p > 0.05$) . Mean removal time did not differ significantly (Group 1: 6 ± 5 min; Group 2: 5 ± 3 min; $p > 0.05$) . However, the manual back-action group experienced significantly fewer unexpected events (20% vs. 47%; $p = 0.046$), including lower rates of coronal tooth fractures (4% vs. 11%) and crown chipping (4% vs. 24%) . Reuse of restorations was higher after manual removal (80% vs. 56%; $p = 0.002$).

Conclusion: Both devices are effective for crown and bridge removal, achieving comparable success rates and procedure times. The manual back-action remover, however, yields a significantly lower incidence of adverse events and greater preservation of restorations. Clinicians should consider manual removal when conservation of tooth structure and prosthesis reuse are priorities.

1. Introduction

The increasing prevalence of periodontal diseases, dental caries, and tooth loss continues to impact global oral health, affecting nearly half of the world's population.[1,2] Dental crowns and bridges are routinely used to restore function and aesthetics in both root canal-treated and edentulous cases, providing strength, longevity, and improved patient satisfaction.[3,4] The long-term success of such restorations depends on adequate sealing and adaptation, which are essential to prevent bacterial infiltration and reinfection of the underlying tooth structure.[5,6]

Despite advances in restorative materials and techniques, dental crowns and bridges are not permanent. Clinical studies indicate that the mean lifespan of crowns is approximately 10 years, with six-year survival rates around 88%.[9,10] Over time, several clinical scenarios may necessitate the removal of these restorations, including endodontic retreatment, development of secondary caries, marginal adaptation issues, chipping or fracture of the ceramic layer, and periodontal complications such as gingival recession or bone loss.[7,8] In some cases, removal is required to facilitate accurate diagnosis and treatment planning, particularly when the underlying condition of the abutment tooth is uncertain or compromised.[11,12]

Traditionally, dental restorations can be removed using either destructive or conservative methods. Destructive techniques involve sectioning and irreversibly damaging the restoration, thus preventing any possibility of reuse and increasing treatment time and cost for the patient.[15] In contrast, conservative approaches aim to dislodge the crown or bridge while preserving its structural integrity, enabling possible recementation and reducing both patient morbidity and financial burden.[15,16] The choice of removal technique is influenced by factors such as abutment design, periodontal status, type of restorative material, and the presence of posts or cores[13,14]

A wide range of conservative removal devices have been developed to facilitate atraumatic crown and bridge removal. However, despite their frequent use in clinical practice, there is a lack of well-designed comparative studies evaluating the effectiveness and safety of these devices. A preliminary search of the literature reveals no randomized clinical trials directly comparing commonly used conservative removal tools.

The primary aim of this randomized clinical trial is to compare the success rates of two conservative crown and bridge removal devices: the manual back-action remover and the spring-loaded press-type remover. Success is defined as the removal of crowns or bridges in toto (i.e., intact and without irreparable damage). The secondary objective is to evaluate and compare the incidence of procedural complications and adverse events occurring during and after the removal process with each device.

2. Materials and Methods

2.1. Trial design

The study design is a randomized clinical trial and was conducted following approval by the Institutional ethical committee board (CSICDSR/IEC/0282/2023) at CSI College of Dental Sciences and Research. The trial was registered at Clinical Trial Registry India (CTRI/2023/12/060538). The current study was performed between January 2023 to December 2023.

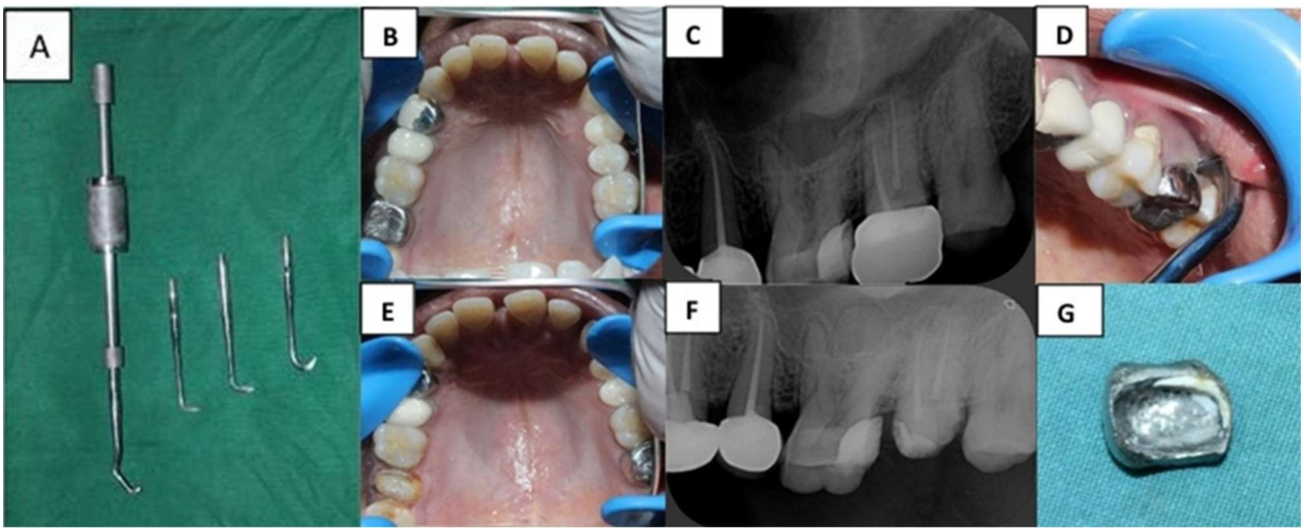

Fig. 1. Treatment using Manual back action crown remover

2.2. Sample size calculation

Sample size was determined through G Power software version 3.1.9.2 with effect size of 0.37 with alpha error 0.05 and power 0.95 gives a total sample size of 140 crowns and bridges.

2.3. Participants, eligibility criteria

The study included both root canal treated and vital teeth that had been restored with single-unit crowns, as well as crowns or bridges comprising up to three units. Eligible restorations included metal crowns, metal-ceramic crowns, Emax crowns, zirconia crowns, and ceramic-faced crowns. Teeth with severe periodontal compromise and restorations involving more than three units (i.e., large bridges) were excluded from the study.

2.4. Interventions

A comprehensive medical evaluation was conducted for all participants, and each patient was informed about the potential risks and benefits prior to the procedure.[18] Pre-operative radiographs were taken to assess the periodontal status of the tooth, including the presence of periapical radiolucency, bone loss, and the quality of obturation. Pre-treatment clinical photographs were obtained using a DSLR camera under standardized lighting conditions.

The subjects were randomly assigned to one of two groups using the lottery method. One group underwent crown removal using a manual back-action crown remover, while the other group was treated with a spring-loaded press-type crown remover. All procedures were performed by a single experienced endodontist.[17] All procedures were performed under local anesthesia (1:80,000 Lignocaine hydrochloride with adrenaline; Lignox, Warren Pharmaceuticals, India).

In Group 1 (manual back-action), 70 crowns and bridges (58 single-unit crowns and 12 joint crowns) were attempted for removal. The tip of the crown remover was secured to the margins of the crowns and bridges with the thumb of the left hand, while the other hand supported the weight of the remover attached to the shaft. Each stroke was generated manually by gently sliding the weight along the hammer shaft to deliver short and rapid impact forces, thereby aiding in the dislodgement of the crowns and bridges (Fig. 1).

In Group 2 (spring-loaded press-type), 70 crowns and bridges (56 single-unit crowns and 14 joint crowns) were attempted for removal. This device was operated single-handedly; the tip of the crown remover engaged the margins of the crowns and bridges, and with a simple press of the handle, the device automatically generated the necessary force for crown dislodgement (Fig. 2).

Success in this study was defined as the complete removal of crowns and bridges with minimal damage to both the restorations and the underlying tooth structure. Following each successful

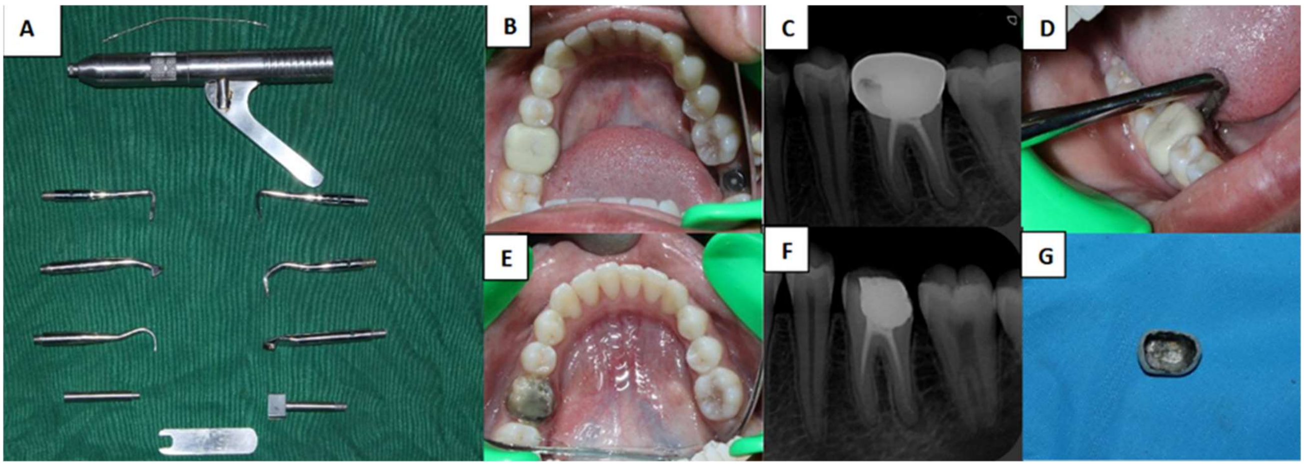

Fig. 2. Treatment using spring press type crown remover.

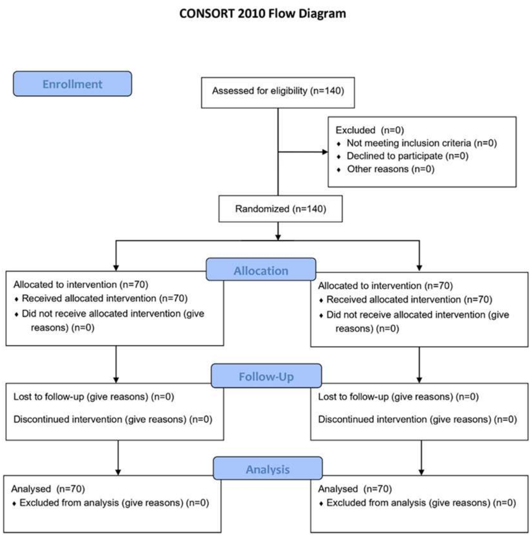

Fig. 3. Pirate flowchart

removal, post-operative radiographs and clinical photographs were taken to assess the remaining tooth structure and the crown-to-root ratio. Further evaluation was performed to determine if the crowns could be re-luted, provided that the margin fit was satisfactory.

Failure was defined as an unsuccessful attempt to remove crowns and bridges with the assigned device, necessitating removal by sectioning using a diamond or tungsten carbide bur or metal cutting bur. A catastrophic failure was defined as a coronal fracture of the tooth resulting in extensive damage and requiring a change in treatment plan with more complex and costly interventions. A non-catastrophic failure referred to marginal breakdown of the restoration, crown chipping, or crown fracture causing only minimal tooth damage, usually requiring minor adjustments without the need for complex intervention.

2.5. Primary and secondary outcome

The primary outcome of this study was the success rate of crown and bridge removal using the manual back-action crown remover compared to the spring-loaded press-type crown remover. Success was defined as the complete removal of the crown or bridge with minimal damage to the restoration and the underlying tooth structure.

The secondary outcome was the evaluation of any unexpected events or complications that occurred during or after the crown removal procedures. These included both catastrophic and non-catastrophic failures, as well as any adverse effects observed postoperatively.

2.6. Statistical analysis

Statistical analysis was performed using IBM SPSS software version 23 (IBM Corp., USA) to evaluate the overall success rate of crown removal, the time required to complete the procedure, and the unexpected event during and after crown removal between the two groups were compared using the chi-square test.

Table 1. Success rates of crown removal using two devices

Instrument	Successful	Unsuccessful	Total
Manual back action	61 (87.1%)	9 (12.9%)	70
Spring-loaded automatic	64 (91.4%)	6 (8.6%)	70
Total	125 (89.3%)	15 (10.7%)	140
p-value	0.672		

3. Results

The average age of the patients in this study was 40 ± 13 years. A total of 140 crowns and bridges were evaluated, including 114 single crowns and 26 splinted (joint) crowns. The distribution by type was as follows: 27 metal crowns, 95 metal-ceramic crowns, 10 zirconia crowns, 5 ceramic-facing crowns, and 3 E-Max crowns. The study included 54 male and 73 female patients, with each gender group receiving 70 crowns and bridges (Fig. 3).

The success rate of crown removal was evaluated, yielding an overall success rate of 89% (124 out of 140 crowns and bridges; 103 single crowns and 21 joint crowns). In Group 1 (Manual back-action), 61 out of 70 crowns and bridges were successfully removed (52 single crowns and 9 joint crowns), corresponding to a success rate of 87%. In Group 2 (Spring-loaded press type), 63 out of 70 crowns and bridges were successfully removed (51 single crowns and 12 joint crowns), resulting in a 91% success rate. However, the difference in success rates between the groups was not statistically significant ($p > 0.05$) (Table 1).

The time required for successful crown removal was compared between the two groups. In Group 1 (Manual back-action), the mean duration for removing crowns and bridges was approximately 6 ± 5 minutes (61 cases), whereas in Group 2 (Spring-loaded press type), the mean duration was 5 ± 3 minutes (63 cases). Although the difference was not statistically significant, the manual back-action group required more time for crown removal compared to the spring-loaded press type group.

A total of 48 unexpected events occurred during and after crown removal. In Group 1 (Manual back-action), there were 14 unexpected events: 5 restoration fractures, 2 crown fractures, 1 tooth luxation, 3 coronal tooth fractures, and 3 instances of chipping of crowns and bridges. In Group 2 (Spring-loaded press type), there were 33 unexpected events: 8 restoration fractures, 8 coronal tooth fractures, and 17 instances of chipping of crowns and bridges (Table 2). There was a statistically significant difference in the incidence of unexpected events between the two groups ($P = 0.046$). The highest incidence of coronal tooth fractures was observed in premolar cases, affecting both maxillary and mandibular premolars (n=8). In this study, catastrophic failures occurred more frequently in single-unit crowns compared to joint crowns.

The reuse of crowns and bridges after removal was achieved in 56 cases (51 single crowns and 5 joint crowns) in Group 1 (manual

Table 2. Unexpected events during and after crown removal by instrument

Event	Manual back-action type — n (%)	Spring-loaded press type — n (%)	P-Value
Catastrophic Failures			
Coronal fracture of tooth	3 (21.4%)	8 (24.2%)	
Subtotal — catastrophic failures	3 (21.4%)	8 (24.2%)	
Non-Catastrophic Failures			
Restoration failure	5 (35.7%)	8 (24.2%)	**0.046**
Crown fracture	2 (14.3%)	0 (0.0%)	
Crown chipping	3 (21.4%)	17 (51.5%)	
Tooth luxation	1 (7.1%)	0 (0.0%)	
Subtotal — non-catastrophic failures	11 (78.6%)	25 (75.8%)	
Total (all unexpected events)	14 (100.0%)	33 (100.0%)	

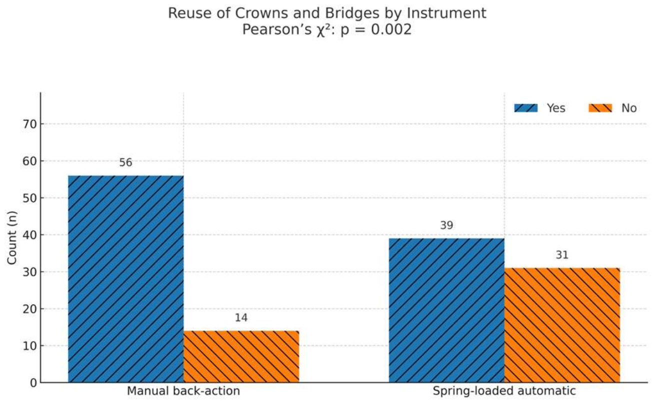

Fig. 4. Reuse of crown and bridges

back-action crown remover), and in 39 cases (36 single crowns and 3 joint crowns) in Group 2 (spring-loaded press type crown remover). This difference was statistically significant (P = 0.002) (Fig. 4).

4. Discussion

Crown failure can result from a variety of factors, including endodontic failure, secondary caries, periodontal disease, excessive bridge span, ceramic fractures, and loosening.[18] Successful crown removal requires meticulous planning to minimize the risk of injury to the underlying tissues. In addition to the traditional cutting method, several alternative techniques have been developed to facilitate crown removal while preserving tooth structure.[19]

The primary objective of this study was to compare the success rates of two crown removal devices: the manual back-action remover and the spring-loaded press type remover. Both devices demonstrated effective performance, with no statistically significant difference in overall success rates between the manual back-action group and the spring-loaded press type group.

In the present study, several unexpected events were encountered during crown and bridge removal, including chipping of the crown, crown fracture, and tooth luxation. In addition, restoration fracture and coronal tooth fracture were observed after the removal of crowns and bridges. The causes of these events are likely related to factors such as the grip of the devices and the amount of force or stress exerted on the tooth structure. While a firm grip is necessary to loosen crowns and bridges.[20] It may inadvertently contribute to crown chipping and fracture. Misdirected or excessive forces can damage the underlying tooth or core [21], and excessive force or stress may lead to restoration fracture, coronal tooth fracture, or even tooth luxation.[22]

In this study, a higher number of unexpected events were observed in the spring-loaded press type group, likely due to the stronger gripping force and greater uncontrolled pressure exerted by the automatic device, resulting in increased stress on the tooth structure. Furthermore, premolar teeth were more frequently associated with coronal fractures during removal with both types of crown removers, probably due to their smaller size and reduced ability to withstand traction forces during crown removal.[23] Tooth luxation occurred during manual back-action crown removal, which was attributed to moderately compromised periodontal health. Therefore, it is advisable to use both devices with caution, especially in cases with moderate or severe periodontal compromise.

Although the manual back-action crown remover was associated with fewer adverse events, it presented challenges in achieving a firm grip on the crown, which often made dislodgement more time-consuming. In contrast, the spring-loaded press type group provided greater stability and a more secure hold at multiple points. However, barriers such as limited access can also affect treatment outcomes.[24] Crown removal in posterior regions, such as second molars, is particularly difficult in patients with limited mouth opening. Restricted access and limited visibility hinder proper instrument positioning and angulation, thereby increasing the risk of slippage and prolonging the procedure when using the manual back-action device. These findings suggest that while both techniques are effective, the press type method offers practical advantages in terms of ease of handling and operator comfort in challenging access situations. Notably, during this study, the spring-loaded press-type crown remover device required replacement midway, as the spring action force gradually diminished, rendering the device ineffective. In contrast, the manual back-action remover remained functional throughout the study and did not require replacement.

One of the main objectives in crown removal is to adopt a conservative approach that preserves the underlying tooth structure and minimizes unnecessary damage to crowns and bridges, thereby facilitating their potential reusability. Intactly removed crowns and bridges can be reused as provisional restorations during the fabrication of new prostheses.[22] In the present study, a higher number of coronal tooth fractures was observed in the spring-loaded press type group, likely due to the uncontrolled forces exerted by this device, which can make it difficult for the operator to precisely sense and control the amount of force applied during crown and bridge removal. Additionally, crown chipping is a critical factor affecting the reusability of prostheses. The results of this study showed that the spring-loaded press type crown remover resulted in a higher incidence of crown chipping, which hindered the reusability of crowns, compared to the manual back-action crown remover. This may be attributed to the manual device's ability to apply controlled and gradual force based on the operator's tactile feedback.[13]

Although the overall success rate and the time required for removal of crowns and bridges were similar between the two devices, the extent of damage to both the tooth and the crown differed significantly. The automatic (spring-loaded press type) crown remover was found to be more destructive than the manual method, causing greater damage to both the tooth structure and the existing crown. In contrast, the manual technique allowed for more controlled and gradual removal. Therefore, the manual back-action approach is particularly advantageous in preserving the original restoration, reducing additional costs, and minimizing the need for a new prosthesis.[25]

The primary limitation of this study is its single-center design with all procedures performed by one operator, which may restrict the applicability of our findings to other clinical settings and experience levels. The relatively small sample size and the necessity to replace the spring-loaded press device midway—due to mechanical power degradation—could have introduced variability and limit the consistency of the performance data.

5. Conclusion

Both the manual back-action and spring-loaded press-type crown removers achieved similarly high success rates and comparable procedure durations. However, the manual technique consistently produced less damage to both the tooth structure and the existing restoration, underscoring its value when preservation of the prosthesis and underlying dentition is paramount. The automated device, while offering user-convenience and streamlined operation, carries a greater risk of coronal fractures and restoration damage. Clinicians should therefore select the crown removal method that best balances operative efficiency with the need for restorative conservation. Ongoing refinement of device mechanics and the development of standardized training protocols may further improve clinical outcomes and broaden the applicability of automated removal systems.

References

1. Rajasekaran JJ, Krishnamurthy HK, Bosco J, Jayaraman V, Krishna K, Wang T, Bei K. Oral microbiome: a review of its impact on oral and systemic health. *Microorganisms*. 2024; 12(9):1797
2. Perrone BR, Bottesini VC, Duarte DA. Minimal intervention dentistry: What is its clinical application and effectiveness in different continents? –A scoping review. *J Conserv Dent Endod*. 2024; 27(2):134-139.
3. Benisha RE, Piriyanga R, Sherwood IA, Ramanathan IS, Abirami AA. Comparing metal onlay and full crown in root canal treated molars with single proximal defect - An 18-month clinical study. *J Conserv Dent Endod*. 2025; 28(5):468-473.
4. Patel J, Shah NC, Dedania M, Choudhary D, Bharti N, Jain A. Comparative clinical evaluation of correct anatomic contour and tight contact in Class II direct composite restoration using two newer contact forming instruments. *J Conserv Dent Endod*. 2024; 27(11):1135-1140.
5. Anand M, Karthikeyan K, Sekar M. Current trend of restoration of endodontically treated teeth with extensive subgingival caries: A case series. *J Conserv Dent Endod*. 2022; 25(2):202-205.
6. Heling I, Gorfil C, Slutzky H, Kopolovic K, Zalkind M, Slutzky-Goldberg I. Endodontic failure caused by inadequate restorative procedures: review and treatment recommendations. *J Prosthet Dent*. 2002; 87(6):674-678.
7. Algadhi AA, Aljuman AS, Hummadi AM, Alqunfuthi NI, Al Moaleem MM. Crown or Not to Crown Root Canal Treated Teeth: Minireview. *Biosc Biotech Res Comm*. 2021; 14(2): 594-599.
8. Goodacre CJ, Bernal G, Rungcharassaeng K, Kan JY. Clinical complications in fixed Prosthodontics. *J Prosthet Dent*. 2003; 90(1):31-41.
9. Schwartz NL, Whitsett LD, Berry TG, Stewart JL. Unserviceable crowns and fixed partial dentures: life-span and causes for loss of serviceability. *J Am Dent Assoc*. 1970; 81(6):1395-1401.
10. Raedel M, Priess HW, Bohm S, Walter MH. Six-year survival of single crowns - A massive data analysis. *J Dent*. 2020; 101:103459.
11. Parreira FR, O'Connor RP, Hutter JW. Cast prosthesis removal using ultrasonics and a thermoplastic resin adhesive. *J Endod*. 1994; 20(3):141–143.
12. Addy LD, Bartley A, Hayes SJ. Crown and bridge disassembly--when, why and how. *Dent Update*. 2007; 34(3):140-150.
13. Biswas M, Mazumdar D, Gengadharani B, Saha KK, Saha B, Saha D. Comparative evaluation of fracture resistance of endodontically treated teeth with wedge shaped non-carious cervical lesions using different types of esthetic post: An in vitro study. *J Conserv Dent Endod*. 2025; 28(3):285-289.
14. Janardanan K, Varkey VK, Lovely M, Anuroopa A. Coronal disassembly systems and techniques: An overview. *J Interdiscip Dent*. 2014; 4(1):33.
15. Raghavan R, Shajahan PA, Gibi MV. Crown Removers: A Review. *Int J Innov Sci Res Technol*. 2022;7(4):751–755.
16. Vasileva R. Techniques for fixed dental restorations removal – classification, decision on the correct approach, advantages and disadvantages. *J IMAB*. 2021;27(1):3510–3517
17. Corah NL, Gale EN, Illig SJ. Assessment of a dental anxiety scale. *J Am Dent Assoc*. 1978; 97(5):816-819.
18. Zavanelli AC, Mazaro JV, NÓbrega PI, FalcÓn-antenucc RM, Zavanelli RA. Data collection about failures in fixed partial dentures: 1-year monitoring. *RGO-Rev Gaúch Odontol*. 2018; 66(3):250-256.
19. Alhaddad AJ, Abuzinadah SH, Alkhalifah T. Recent techniques for removal of indirect restorations: classification and minimally invasive approach. *Ann Med Health Sci Res*. 2021; 11(6):31-36
20. Larsson A, Manuh J, Chrcanovic BR. Risk factors associated with failure and technical complications of implant-supported single crowns: *A retrospective study. Medicina*. 2023; 59(9):1603.
21. Varghese VS, Uppin V, Pujar M, Kurian N, Barad N. Crown removal approaches: regaining entry to the pulp chamber. *Indian J Appl Res*. 2016; 6(3):245-248.
22. Sharma A, Rahul GR, Poduval ST, Shetty K. Removal of failed crown and bridge. *J Clin Exp Dent*. 2012; 4(3):167-172.
23. Ozkir SE, Unal SM, Yurekli E, Güven S. Effects of crown retrieval on implants and the surrounding bone: a finite element analysis. *J Adv prosthodont*. 2016; 8(2):131-136.
24. da Rosa SV, Moysés SJ, Theis LC, Soares RC, Moysés ST, Werneck RI, Rocha JS. Barriers in access to dental services hindering the treatment of people with disabilities: a systematic review. *Int J Dent*. 2020; 2020:1-17.
25. Bajunaid SO. Review of techniques for the intact removal of a permanently cemented restoration. *Gen Dent*. 2017; 65(5):48-53.

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CRediT Author Statement

A. K. : Conceptualization, Methodology, Software, Formal analysis, Investigation, Resources, Writing - Original Draft, Visualization, Project administration, G. D. : Software, Writing - Original Draft, Visualization, S. P. : Validation, Investigation, Data Curation, A. S. : Conceptualization, Methodology, Software, Validation, Formal analysis, Writing - Review & Editing, Visualization, Supervision, Project administration, A. A. : Validation, Investigation, Data Curation

Data Availability Statement

Data can be shared on genuine request to corresponding author.

Ethics Approval

Clinical Trial Registry India with CTRI number (https://www.ctri.nic.in) CTRI/2023/12/060538. following approval by the Institutional ethical committee board (CSICDSR/IEC/0282/2023).

Conflict of Interest

The authors declare that there are no conflict of interest and not have any financial interest in the companies whose materials are included in this article.

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