Patterns of Retentive Failures in Dislodged Single Crowns

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ABSTRACT

Objective: The study aimed to ascertain the prevalence of retentive failure patterns of single crowns leading to de-cementation of the crowns and to estimate their average length of service.

Study Design: Cross-sectional study.

Place and Duration of Study: Department of Prosthodontics, Armed Forces Institute of Dentistry, Rawalpindi Pakistan, from May to Nov 2020.

Methodology: 80 patients were selected using the non-probability Consecutive sampling technique. Both male and female patients with only single-unit crowns were included. In addition, the material used for the fabrication of crowns, years of service and site of retentive failure were recorded.

Results: Female patients (41, 51.3%) reported more frequently than males (39, 48.8%). The majority of the dislodged crowns (41, 51.3%) concerned the mandibular posterior region. Almost half of the crowns (44, 55%) dislodged due to fracture occurring at the interface of restoration and the cement. 68.8% of crowns served for 1-3 years before dislodgement. Most of the dislodged restorations (30, 37.5%) were provided by general dentists.

Conclusion: Mandibular posterior crowns were the most prevalent crowns that were dislodged, and the estimated length of most of the crowns was up to 3 years. Therefore, the anatomy of the tooth being prepared must be considered before preparing the tooth so that retentive failure may be reduced, thus improving the overall length of service.

Keywords: Crowns; Dental Prosthesis Failure; Dental Prosthesis Retention.

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INTRODUCTION

A strategically planned and well-executed fixed prosthodontic restoration can maintain functional integrity and restore esthetics. Contrarily, a poorly fabricated prosthesis leads to irreparable mutilation of oral and dental tissues.[1] Longevity of fixed dental prostheses (FDPs), therefore, must be ensured since a great deal of time and cost is invested in the treatment and high expectations of patients are to be met.[2] Complications, however, do occur, which can compromise the longevity of FDPs. They can either be mechanical, biological or aesthetic.[3] Various studies have reported a higher incidence of mechanical complications leading to failure of fixed restorations.[4-6] Mechanical problems include, but are not limited to, de-cementation of crowns, loss of retention, marginal discrepancies, abutment fractures, porcelain fractures, fracture of metallic connectors etc.[4] Jamal *et al*,[5] advocated that open proximal contacts, loss of retention and ceramic fracture were the major causes leading to compromises in the way of the success of FDPs. Ghani *et al*,[2] published similar results, reporting that majority of the crowns faced complications due to de-cementation (24.8%). Similarly, Singh *et al*,[4] reported higher mechanical failure rates (59.9%) of FDPs in a group of 106 patients, out of which 11.7% accounted for the loss of retention. Lack of retention can be ascribed to several causes like improper tooth preparation with undue occlusal reduction, the excessive taper of opposing walls and shortened proximal walls.[7,8] Failure to comply with correct cementation techniques and lack of occlusal adjustments during lateral excursive and protrusive mandibular movements can also lead to retentive failures.[9]

Since a huge number of clinical failures of crowns are rooted in the occurrence of retentive complications, it is important to emphasize strict adherence to the principles of crown preparation and cementation. Basic tooth preparation guidelines like conservation of biological structure, retention and resistance forms and maintenance of marginal integrity must be followed.[10]

This study was undertaken to assess the patterns of retentive failures in single-unit crowns and estimate their average service length. To the authors' best knowledge, a study of such kind has not been carried out before. It will help to infer methods that aid in

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making the intaglio surfaces of crowns more retentive, enhancing the longevity of fixed dental prostheses and improving the standards of dental health services.

METHODOLOGY

This cross-sectional study was conducted at the department of Prosthodontics, Armed Forces Institute of Dentistry, Rawalpindi Pakistan, from May to November 2020. The sample size of 80 patients was selected using WHO Calculator, with a confidence interval of 95%, and anticipated population proportion of 30.4%,[11] and absolute precision of 10% (the calculated sample size was 58). The sampling technique utilized was non-probability Consecutive sampling technique. Informed consent was taken from patients selected in the study.

Inclusion Criteria: Patients of both gender, 25 to 50 years of age, with only a single unit of full coverage of all metal and metal-ceramic crowns were included in the study.

Exclusion Criteria: Patients having multi-unit fixed dental prosthesis, history of trauma, systemic illnesses, tooth fracture along with crown dislodgement, parafunctional habits, crown provided on the severely malaligned tooth, parafunctional habits and bruxism were excluded from the study.

In addition, detailed history, thorough clinical examination and radiographic evaluation were carried out. A well-structured proforma was used to collect the data, including demographic details like age and gender, the material used for the crown fabrication, years of service and site of retentive failure. Retentive failure patterns were classified based on the site of cement fracture and location of adhesion of residual cement as: Type-1: Through the luting agent layer (cement adhered to abutment tooth and crown both), Type-2: At the interface of restoration and the luting agent (cement adhered to abutment tooth only),Type-3: At the interface of luting agent and abutment tooth (cement adhered to the internal surface of the crown only).[12,13]

Statistical Package for Social Sciences (SPSS) version 21.0 was used for the data analysis. Descriptive statistics were calculated for both qualitative and quantitative variables. Frequency and percentages were calculated for variables like gender, type of failure, and crowns. For quantitative variables like age, mean + SD were calculated. The Chi-square test was used to determine the association between type of retentive failure and length of service of crowns. The *p*-value of < 0.05 was considered to be significant.

RESULTS

A total of 80 patients were selected with the mean age of 36.46 ± 5.904 years, out of which 39 (48.8%) were males and 41 (51.3%) were females. Porcelain-fused-to-metal crowns accounted for 91.3% of the sample population, whereas 8.8% crowns were all-metal. Out of 80 dislodged crowns, 41 (51.3%) belonged to the mandibular posterior quadrant, whereas 30 (37.5%) to the maxillary posterior quadrant. Table-I showed a detailed description of the site of dislodgement of crowns in the oral cavity.

Table-I: Frequency of dislodgement of crowns in relation to quadrants in the oral cavity.

Site of Dislodgement	n (%)
Maxillary Anterior	5 (6.3%)
Maxillary Posterior	30 (37.5%)
Mandibular Anterior	4 (5%)
Mandibular Posterior	41 (51.3%)
Total	80 (100%)

It was observed that almost half the retentive failures occurred at the interface of crown and cement layer (55%), leaving cement residues on the abutment tooth entirely. Figure-1 depicted the distribution of retentive failures.

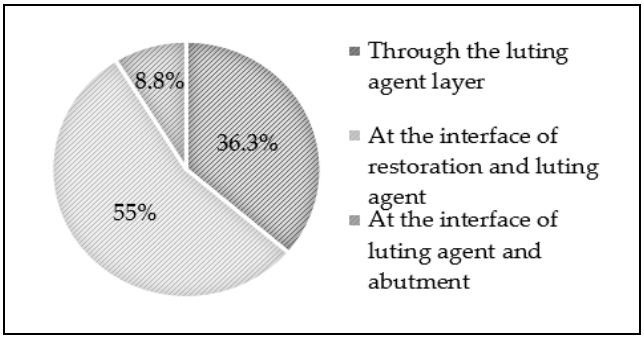

Figure-I: Distribution of retentive failures on the basis of location of cement fracture.

The results showed that the majority of the crowns received (55, 68.8%) had served for almost 1-3 years before dislodgement. In addition, most of the de-cemented crowns were provided to the patients by general dentists (30, 37.5%) and recent graduates doing house-job at the institute (29, 36.3%). Figure-2 illustrated the length of service of de-cemented crowns and the level of training clinicians who initially provided those crowns to the patients.

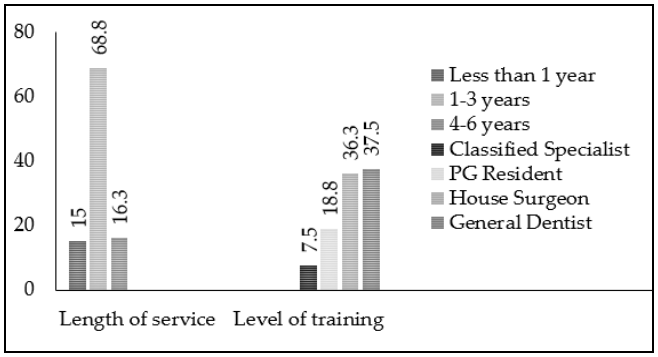

Figure-II: Length of service of crowns before de-cementation (in years) andlevel of training of treating clinicians.

The chi-square test was used to determine the association between type of retentive failure and length of service of crowns was highlighted in Table-II. A total of 29 (36.3%) crowns were de-cemented at the interface of crown and cement after having served for almost 1-3 years.

Table-II: Association between type of retentive failure and length of service of crowns.

Type of Retentive Failure	Length of Service (Years)			Total n (%)	*p*-value
	<1	1-3	4-6		
Through the luting agent layer	2	22	5	29 (36.25%)	0.160
At the interface of restoration and luting agent	7	29	8	44 (55%)	
At the interface of luting agent and abutment	3	4	0	7 (8.75%)	
Total	12	55	13	80 (100%)	

DISCUSSION

Periodic long-term follow-up of patients is extremely important for the evaluation of the success of any prosthesis. If the long-term success of fixed dental prostheses is desired, patients must be periodically recalled to assess the restorations and supporting tissues. Since the same is not possible for all cases in our set-up, evaluation for repair/replacement remains the only evaluation method for most individuals.

Literature showed that most of the articles published internationally and locally reported the reasons for failures and dislodgement of crowns.[2-6] This study, however, aimed at assessing the patterns of retentive failures of crowns and the level at which the cement fracture occurs.[11] It was noted that the majority of the crowns (91.3%) were of the porcelain-fused-to-metal type which is similar to the results of a study carried out by Collares *et al*,[12] in which 63.8% of crowns provided to the patients were metal-ceramic. This could be attributed to better aesthetic outcomes, strength, and patients' preferences.[5,10]

De-cementation of crowns occurred most frequently in the mandibular posterior region (51.3%). A study published by Ghani *et al*,[2] also showed that most of the de-cementations (48.1%) occurred in posterior restorations of the mandible. Contrasting results were published by Memon *et al*,[13] which revealed that 60.8% of dislodged FDPs concerned the maxillary arch, with the majority of the dislodgments in posterior areas of the mouth. The results of this study show that 55% of the retentive failures occurred at the junction of the crown and cement layer, leaving cement residues on the abutment teeth entirely. Similar results were shown in an in-vitro study by Noffsinger *et al*,[11] in which the most prevalent cement fractures occurred at the interface of cement and crowns while glass ionomer cement was used as the luting agent. These results are supported by the fact that GIC possesses reasonably good tensile strength and molecular bonding to the tooth structure.[14] These adhesive failures can occur when the internal surface of the crown is markedly smooth and can be rectified if the internal surface of the crown is either rendered roughened, grooved or laser sintered.[10,15,16]

It was observed that many crowns served for 1-3 years before getting dislodged. According to Ghani *et al*,[2] 50% of dislodged crowns were served for 1-5 years. Conversely, a longer mean service length of 6.9 years was observed with crowns by Singh *et al*,[4] before retentive failures occurred. According to the results of the present study, the majority of the crowns (37.5%) that presented for re-cementation were placed by general dentists. Porcelain-fused-to-metal FPDs showed good survival rates (15-20 years) when provided by dental specialists under ideal circumstances.[17,18]

Moreover, this makes evaluation and analysis of data on FPD survival, success and complications difficult due to the use of non-standardized patient populations treated by dentists with differing clinical expertise levels, including general dentists, post-graduate trainees, field specialists and dental specialists, other than Prosthodontists. This variation in clinical experience markedly affects the outcome. Therefore, for the provision of data to facilitate assessment and comparison of FDP success and complications, it is necessary to conduct a randomized controlled study of the adequate time period, selection of the controlled patient population, standardization of tooth preparation characteristics, use of standard laboratory fabrication

procedures by trained dental technicians and patient motivation towards standardized oral hygiene measures.

CONCLUSION

Within the limitations of this study, it is concluded that the mandibular posterior crown was the most prevalent dislodged crown, and the estimated length of most of the crowns was up to 3 years. Therefore, the anatomy of the tooth being prepared must be considered before preparing the tooth so that retentive failure may be reduced, thus improving the overall length of service.

Conflict of Interest: None.

Author's Contribution

MS: Manuscript drafting, critical revision, SA: Study design, data acquisition, manuscript drafting, IK: Data analysis, critical revision, AR: Study conception, critical revision, MK: Statistical analysis, results and discussion, MA: Results and critical revision.

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