

Frequency of Iatrogenic Damage to Adjacent Teeth During Abutment Preparation by Residents and House Officers at a Dental College of Peshawar Khyber Pakhtunkhwa

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Abstract

Background: Iatrogenic damage in the process of crown preparation is related to the skill of the operator, and the awareness of the damage patterns can enhance the training and minimize the errors.

Objective: The objective of study was to evaluate the frequency, degree and type of unintentional damage occurred to adjacent teeth during abutment preparation performed by House Officers and Residents.

Materials and Methods: The study was cross-sectional nature (July 2024-July 2025) and it assessed 161 dental casts in Rehman college of dentistry through visual examination and magnification. The information about the degree and type of damage was put on a structured proforma and processed using SPSS 23. Calculations were made of means, standard deviations, frequencies and percentages and the chi-square test was used to determine the relationship between operator experience and damage ($p < 0.05$).

Results: House Officers experienced greater overall degree of damage on average ($M = 1.86$) compared to Residents ($M = 0.81$). according to the study's coding scheme, where 1 = nick, 2 = abrasion and 3 = no damage. The most common types of damage were abrasions (42.9%) followed by nicks (36.0%), while 21.1% of cases showed no damage. A statistically significant association was observed between operator level and type of damage ($p < 0.001$), with house officers having higher frequencies of abrasion and nicks, whereas Residents showed greater portion of cases with no damage.

Conclusion: House Officers were more damaging to procedures than the Residents. The majority of damages were minor such as abrasions and nicks. The experience of operators also had a great impact on the patterns of damage, and it is necessary to have better supervision and formal clinical education.

Keywords: Abutment Preparation, Iatrogenic Damage, Dental Casts, Clinical Competence.

Introduction

For all procedures carried out intraorally conservation of oral hard and soft tissues is considered a fundamental principle for all but this at time may be challenging during many procedures involving occluso-proximal cavity preparations, orthodontic stripping particularly in case of abutment preparation during crown and fixed prosthesis.¹ Procedure of preparing tooth to be crowned is dependent on not only on the available time, self-control and the experience of operator but there is mostly occurring complex clinical situations and environment.² In today's dental practice water-cooled rotary instruments have many problems in visibility due to aerosol and mist formation.² These unwanted adjacent teeth damage during abutment preparation is in the form of nicks, abrasions, furrows, roughness, grooving of enamel surface.³ This compromises the health of adjacent affected teeth and increase susceptibility to plaque accumulation and

increase risk of caries initiation and propagation. This can cause sensitivity to different stimuli and in advanced cases compromises the periodontal health.⁴ Advanced danger to upper posterior teeth was due to difficult physical and visual accessibility of those teeth. It is important to provide patients with an adequate prosthesis while maintaining the integrity of adjacent surfaces.⁵

In the past literature mostly of the studies are about proximal cavity preparation and orthodontic reduction procedures. However, fewer studies available reveal high incidence of damage during tooth preparation. A study conducted by Long and Smith illustrated the effect of contact area morphology on crown preparation this study used 45 extracted teeth grouped in 7 set each containing 5 teeth in the form of quadrant silicone impressions were made before and after the preparation and there is 100% damage and concluded that preparation of teeth with easier access to contact area was less prone to cause damage to adjacent teeth.⁶

In a study recently conducted by Badar et al concluded that high prevalence of damage to proximal surface of adjacent teeth 78% on mesial surface of tooth 60.5% on distal surface of tooth was observed (32.6% belonging to mild category involving only abrasions and the incidence of damage was found to be little higher 73.3% in consultants.⁷ Muhammad Sartaj Khan et al found that degree of damage observed by naked eye is least frequent.⁸ Many factors can contribute to potential iatrogenic damage to adjacent teeth. However, it appears that the factors are mainly related to performing operators and their experiences in performing successful procedures therefore, it was essential shedding lighter on such

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phenomenon to increase awareness among dentists and enhance the potential outcomes.^{9,10}

The rationale of this study is to evaluate the frequency of degree and type of the iatrogenic damage to adjacent teeth by residents and house officers as to decrease the future financial burden and the time of patients due to undesirable effect caused by iatrogenic damage during abutment preparation that leads to additional treatment needs and to detect the degree and type of damage in this regard and to find an association if any, between damage and variable.¹

Materials and Methods

This cross sectional study was conducted at Rehman College of dentistry from July 2024 to July 2025, followed by ethical approval for this study was obtained from Institutional Review Board (IRB) of Rehman College of Dentistry (Reference No.RCD-09-23-151) Dated 13 September 2023. After a thorough literature search, we calculated a sample size of 161 using the Open epi calculator, keeping the margin of error at 6%, a confidence level at 95%, power of test 80%.¹¹ Practitioners were grouped in to categories based on their experience this include house officers and residents. A maximum number of participants (161) during the study period were recruited. Non-probability convenient sampling technique was taken.

Those casts were included for with at least one tooth present anteriorly or posteriorly, with no caries and restoration at adjacent proximal surface. Proximal caries and restoration at adjacent teeth were excluded. Mishandled casts or casts with manipulative defects such as having porosities, distortion caused by premature removal of cast or improper storage of impression, foreign material in the mold such as blood or saliva where also excluded. Casts were examined with naked eye and magnifying glass. It is made sure that no manipulation or changes were made to the cast to ascertain that any damage to adjacent teeth were due to accidental touching with burs. To precisely measure the defects, the data was recorded in pre structured proforma regarding the degree and type of damage by residents and house officer with the type of damage categorized as: 1 = nick, 2 = abrasion, 3 = no damage. Data regarding dental groups were obtained from records sent to the laboratory by practitioners in laboratory request forms.

The data were analyzed using SPSS (version 23). Mean \pm standard deviations were calculated for degree of damage and frequencies \pm percentages were calculated for type of damage. Data were presented in tabular form. The Chi Square test was applied for inter group comparison of degree and type of damage to adjacent proximal surfaces during abutment preparation by residents and house officer at 95% confidence Interval and P value less than 0.05.

Results

A total of 161 cases were analyzed. The mean degree of damage was higher among House Officers (M = 1.86, SD = 0.91) compared to Residents (M = 0.81, SD = 0.71), indicating that House Officers caused greater overall damage during procedures. Regarding the type of damage the distribution differed significantly between the two groups ($p < 0.001$). In all cases, abrasion was the most prevalent form of damage (42.9%), next came nicks, and none was damaged in 21.1% of instances. A statistically significant association was observed between the operator's level and the type of damage ($p < 0.001$). House Officers caused a greater number of abrasions ($n = 49$) and nicks ($n = 33$), whereas Residents had fewer such damages and a higher number of cases with no damage ($n = 36$). This indicates that Residents produced fewer and less

severe damages compared to House Officers.

Out of 161 valid cases, the most frequently observed degree of damage was that visible only under magnification (37.9%), followed by slight damage visible to the naked eye (26.3%), and no damage (21.1%). Obvious damage was the least common (14.4%). The mean degree of damage (M = 1.34, SD = 0.97) suggests that most cases involved only mild to moderate damage. A statistically significant association was found between operator clinical experience and degree of damage ($p < 0.001$).

Table 1: Comparison of Degree Damage Between House Officers and Residents (N = 161)

Variable	House Officers (Mean + Standard Deviation)	Residents (Mean + Standard Deviation)	P-Value
Mean Degree of Damage	1.86 \pm 0.91	0.81 \pm 0.71	< 0.001
Frequency of Degree of Damage			
Variable	House Officers Frequency (%)	Residents Frequency (%)	P-Value
No Damage	13 (21.1%)	21 (13.0%)	< 0.001
Slight Damage (visible to naked eye)	21 (26.3%)	21 (13.0%)	< 0.001
Damage under magnification	31 (37.9%)	30 (18.6%)	< 0.001
Obvious Damage	10 (14.4%)	13 (8.1%)	< 0.001

Table 2: Comparison of type of Damage Between House Officers and Residents (N = 161)

Frequency of Degree of Damage			
Variable	House Officers Frequency (%)	Residents Frequency (%)	P-Value
Nick	49 (42.9%)	20 (12.4%)	< 0.001
Abrasion	33 (36.0%)	25 (15.5%)	< 0.001
No Damage	13 (21.1%)	36 (22.4%)	< 0.001

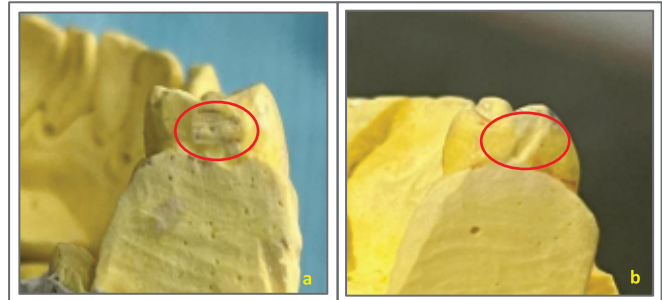


Figure 1: Type of Damage to the teeth (a) Abrasion (b) Nick

Discussion

The present study aimed to assess and compare iatrogenic damage to adjacent teeth caused by House Officers and Residents during crown preparation procedures. The results showed that House Officers caused significantly greater damage, both in terms of degree and type, compared to Residents. In contrast, Residents demonstrated better control and technique, resulting in a higher number of cases with no observable damage. These findings highlight the important role of clinical experience and technical skill in minimizing unintentional damage to adjacent teeth. Accidental damage to adjacent teeth is a well-recognized complication during restorative procedures and has been reported extensively in literature.^{3,12,7,8} In accordance with previous studies, our results demonstrated that superficial defects such as abrasions were the most commonly observed form of damage, followed by enamel nicks.¹²⁻¹⁴ Abrasion has been repeatedly identified as the predominant type of iatrogenic injury due to close proximity of adjacent structures, operator skill limitations, and use of rotary instruments in constrained spaces.^{4,18} Similar to our study, Khan et al. reported a high incidence of abrasion and nicking during abutment tooth preparation, particularly among less experienced practitioners.¹⁵ Moonpnar and Faulkner, 1991 also evaluated the damage to the tooth surface of adjacent teeth

and found 74% of the inspected surfaces.³

In the present study, the overall mean degree of damage score was 1.34, indicating that the majority of iatrogenic injuries were mild in nature and primarily visible only under magnification. Abrasion constituted the most frequently observed type of damage (42.9%), followed by enamel nicks (36%), while no damage occurred in 21.1% of cases. The comparison between the two operator groups revealed a statistically significant association ($p < 0.001$), with House Officers causing more frequent and severe defects than Residents. These findings clearly highlight the influence of operator skill level on the extent and nature of iatrogenic damage during crown preparation, reinforcing the importance of advanced training and controlled hand instrumentation.

These findings are in line with the findings of Moopnar and Faulkner who also found that there was significant difference in frequency of iatrogenic damage on the distal surfaces depending on the experience of the clinicians involved in the study.³ This is, however, very different with the study by Medeiros and Seddon,¹² who examined the adjacent tooth damage when preparing Class II cavity. They stated that the undergraduate students were more wary and only 23% of them were damaged, whereas qualified operators had an incidence of 64%. This indicates that the operator experience and iatrogenic damage relationship might be procedure-specific (e.g., crown preparation vs. Class II cavity) or dependent on the differences in clinical settings and levels of supervision. According to Khan et al. there was 71% proximal surface injury, of which 11% was apparent to the unaided eye and 39% was visible with a magnifying lens. House officers did the most harm, according to their study, which highlighted the impact of the practitioner's experience.¹¹

Similarly, High rates of iatrogenic damage during restorative operations were noted by Basudan et al. who emphasized the role that rough materials and hypersensitivity play in causing injury.¹⁶

According to a study of Khan et al. house officers or interns may do more approximate harm than seasoned professionals, such as consultants with postgraduate training. Adjacent tooth

surfaces were damaged to varied degrees in nearly 66% of instances. The results of the study are consistent with findings from earlier investigations,^{3,8,17} where damage was shown to be as high as 73%. Over time, consultant prosthodontics has gained more clinical experience, which could be explained by this difference in observation. On the other hand, research indicated that more experienced practitioners had more damage to the surfaces of nearby teeth.¹⁸ Protective methods greatly reduce the chance of harm, as SBE et al. showed that using a guided preparation procedure with protective strips reduced damage to just 15% of specimens. The finding that appropriate technique selection plays a critical role in limiting iatrogenic damage was reinforced by these investigations, which highlighted the significance of establishing protective barriers to maintain tooth integrity during restorative treatments. The efficacy of protective methods in clinical practice is demonstrated by the consistent findings across several investigations.¹⁹

Conclusion

This study revealed that clinical experience influenced procedural performance with House Officers performing worse on procedural damage than Residents. The majority of the damage was small and the most frequent ones were abrasion and nicks. This strong correlation between the level of operator and the type of damage highlights the necessity of the increase of supervision, systematic training, and practical development of skills. These results reinforce the value of specific educational strategies to enhance the accuracy of the procedure, patient safety and clinical competence of less experienced professionals.

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Author Contributions

1. **Hira Raza:** Conceptualization of the study, original draft writing, data Collection and funding.
2. **Jodat Askari:** Supervision, study design and critical Review.
3. **Mohid Hayat Awan:** Literature Review
4. **Sajid Ali:** Data Analysis and Funding
5. **Aeras Aslam:** Literature Review and Data Collection
6. **Sharafat Abdullah:** Data Interpretation