

## Frequency of Horizontal Crown Fracture in Endodontically Treated Posterior Teeth Restored with Amalgam

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### ABSTRACT

**Objective:** To evaluate the frequency of horizontal crown fracture in endodontically treated posterior teeth restored with amalgam when compared to other restorative materials.

**Study Design:** Cross sectional comparative study.

**Place and Duration of study:** Operative Department, Armed Forces Institute of Dentistry, Rawalpindi Pakistan, from Jan to Dec 2019.

**Methodology:** Patients reporting to Operative Department, Armed Forces Institute of Dentistry, were studied for the frequency of horizontal crown fractured endodontically treated teeth restored with amalgam and other restorative materials. History, clinical examination, mobility and trans-illumination test were used to diagnose horizontal crown fracture. Fracture of one or more cusps of endodontically treated posterior teeth involving enamel and dentin was taken as Horizontal crown fracture.

**Results:** A high percentage of patients with amalgam restoration after endodontic treatment of posterior teeth experienced horizontal crown fracture as compared to composite and glass ionomer cement. Out of 54 patients included in the study, 42(77.8%) patients were having amalgam restorations while 6(11.1%) patients were having composite and other 6(11.1%) were restored with glass ionomer cement material.

**Conclusion:** Patients with endodontically treated posterior teeth restored with amalgam presented with a high percentage of horizontal crown fracture as compared to other restorative materials and there is a need to provide full coverage restoration of endodontically treated tooth as soon as possible to enhance its survival.

**Keywords:** Amalgam, Cuspal coverage restoration, Horizontal crown fracture.

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### INTRODUCTION

Survival of the tooth and restoration is of paramount importance to patient and dentist after endodontic treatment. Small amalgam filling has higher success than Mesio-Occluso-Distal (MOD) or multi surface amalgam restorations.<sup>1</sup> Studies have shown that endodontically treated teeth restored with amalgam and having an MOD cavity had the highest failure rate when compared with other restorative material like adhesive bonding systems.<sup>2</sup> Mincik *et al.* in a study concluded that for long term success of endodontically treated teeth direct restorative material of choice is cuspal coverage composite restoration, as it increases the fracture resistance of the tooth.<sup>3</sup> In contrast some studies have shown the resistance to fracture of a MOD cavity in endodontically treated teeth after thermal and mechanical loading was significantly less in teeth restored with amalgam in comparison with restoration with fibre reinforced composite or ceramic inlay.<sup>4</sup>

A variety of techniques are used for increasing the

resistance to fracture such as conservative cavity preparation, truss access cavity preparation (directly accessing the mesial and distal canal orifice and leaving the intervening dentine intact) and ninja also known as ultra conservative cavity preparation have been used and has shown positive results.<sup>5</sup> Coverage with cast gold partial coverage crowns after endodontic treatment has yielded better results with highest fracture resistance as compared to amalgam.<sup>6</sup> In a study carried out on endodontically treated teeth restored with only intracoronal restoration has a mean survival rate of 9.5 years, whereas with crowns and adhesive restorations survived 14.3 years on average, so it is recommended that a cuspal coverage restoration should be provided as soon as possible.<sup>7</sup>

The current study was planned to see the frequency of horizontal crown fracture in endodontically treated posterior teeth restored with amalgam when compared to other restorative materials.

### METHODOLOGY

The cross sectional comparative study was conducted at Operative Department, Armed Forces

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Institute of Dentistry, Rawalpindi Pakistan, from January to December 2019 after approval of ethical committee (ltr no. 905/Trg-ABP1K2). All the patients reporting to OPD of Opera-tive Department, AFID were considered for the study.

**Inclusion Criteria:** Patients of either gender with age range from 18-50 years presenting with the complaint of fracture of endodontically treated posterior teeth were included in the study.

**Exclusion Criteria:** Medically compromised or pregnant ladies, periodontally compromised teeth and teeth having more than one year after endodontic treatment were excluded.

Clinical examination of the patients with the chief complaint of tooth fracture after endodontic treatment restored with amalgam included mobility of the tooth fragment and recognition of fracture line in a horizontal direction was detected with a probe. Fracture of one or more cusps of endodontically treated posterior teeth involving enamel and dentin were taken as Horizontal crown fracture. Mobility of the fragments was confirmatory for the presence of fracture. Radiographic examination with IOPA (intraoral periapical radiograph) was carried out to confirm that the tooth is endodontically treated.

Total Sample size of 54 was calculated using open-Epi calculator with power of the test kept at 80% with the ratio of exposed to unexposed as 1. odds ratio was 13. A value of 13.1% and 1.9% were incorporated into the sample size calculator.<sup>8</sup>

Data was evaluated by SPSS version 20. Quantitative variables like age Mean+S.D was calculated. While for qualitative variables like gender frequencies and Percentage was calculated. Chi square test was used to compare fracture among restorative materials and  $p$ -value $\leq$ 0.05 was considered significant.

**RESULTS**

Out of 54 cases studied, 42(77.8%) patients were having amalgam restoration while 6(11.1%) were restored with composite and 6(11.1%) with glass ionomer restoration. When amalgam was compared to composite and glass ionomer cement,  $p$ -value was calculated as 0.003 which is  $<$ 0.05 and statistically significant. As the data clearly shows that a high percentage of patients with amalgam restoration after endodontic treatment experienced horizontal crown fracture while for composite and Glass ionomer restoration the distribution was the same. (Table-I) Out of 54 patients

examined, 43(79.06%) patients were male while 11 (20.04%) patients were females (Table-II).

**Table-I: Distribution of materials in terms of fracture (n=54)**

Restorative Materials	Frequency (Percentage) n=54(100%)	p-value
Amalgam	42(77.8%)	0.003
Composite	06(11.1%)	
Glass ionomer	06(11.1%)	

**Table-II: Age and Gender distribution (n=54)**

		Total Number	Mean $\pm$ SD
<b>Age</b>			
Minimum Age	28.00	-	46.53 $\pm$ 8.40
Maximum Age	66.00		
<b>Gender</b>			
Male n(%)	43(79.06%)	54	-
Female n(%)	11(20.04%)		

**DISCUSSION**

Preparation of access cavity for endodontic treatment is of great importance and plays a role in providing resistance to fracture after completion of endodontic treatment. The more conservative the cavity, the more resistant it is to fracture. Furthermore the type of restorative material is equally important as cavities restored with amalgam are more prone to fracture as compared to composite filling or complete coverage restoration.<sup>9</sup> Adhesive approach is now becoming more popular as it increases the longevity of endodontically treated teeth. Preference is now given to fibre post and core rather than cast posts and the remaining tooth structure is considered one the most important determinant for survival of endodontically treated teeth.<sup>10</sup>

Although there is a long standing concept that contracted endodontic cavities (CECs) provide more resistance to fracture as compared to traditional endodontic cavities (TECs),but study has shown that there is no significant difference between the two types of cavity preparations.<sup>11</sup> Teeth that are restored with composite or amalgam after endodontic treatment has a higher chance (2.29 times more) of fracture than those covered with crowns, also the timing of crown placement is important, teeth with crown placed after four months of endodontic treatment has a three times more chance of fracture than those with crown placed within 4 months.<sup>12</sup> In a cochrane review, the comparison of single crown versus conventional filling was studied and results showed that composite plus post restored with crown yields better results than conventional restoration alone.<sup>13</sup> Composite resin is considered as an ideal material for core build up and resin

modified GIC is an intermediate material for non-stress bearing areas and bio-dentine is not recommended to be used as a core material. Also the fracture associated with composite and RMGIC is favorable whereas with bio-dentine the fracture is unfavorable.<sup>14</sup> Composite filling whether applied with direct or indirect technique has no impact on the fracture resistance but a difference is found when compared with the control group.<sup>15</sup>

There are a multitude of factors associated with cracked teeth like more than 40 years of age, upper first permanent molar followed by lower first molar and then lower second molar already restored tooth endodontic treatment, use of non adhesive restorative materials such as amalgam filling or inlays all these are associated with an increase incidence of vertical root fracture or cuspal fracture.<sup>8</sup> One of the techniques for enhancing the resistance to fracture of an endodontically treated tooth is the use of intra canal orifice barrier using GIC or flowable composite resin and studies has concluded that it significantly improves the fracture resistance and increase the survivability of the tooth.<sup>16</sup> Endodontic retreatment is also a factor considered to decrease the fracture resistance of a tooth but studies have shown that it reduces the strength of the tooth to a certain extent but further studies are required to ascertain this relationship and also of various techniques of endodontic treatment and their effect on tooth structure.<sup>17</sup> Various cuspal coverage restoration techniques were studied and it was concluded that cuspal coverage with amalgam lining superimposed with a composite filling has significantly increased strength than composite filling alone.<sup>18</sup> Baba and Goodacre in a study highlighted the benefits of composite resin in posterior teeth with conservative opening when compared to other restorative materials.<sup>19</sup> Belli and others in a review of direct restorative materials for root treated teeth concluded that amalgam is not a good material for the final restoration of root filled teeth, because it does not make bond and there is more tooth structure loss during cavity preparation and restoration may deform under stresses leading to the fracture of root filled tooth. They further added that direct composite resin is an excellent treatment option with conservation of tooth structure for restoration of root filled teeth as compared to amalgam. They recommended glass ionomer cement for restoration of small cavities.<sup>20</sup> These findings are in accordance with our study. Further research is required to evaluate the effects of cavity design cuspal coverage, role of isola-

tion and selection of material to restore endodontically treated teeth for long term success.

## CONCLUSION

Endodontically treated teeth are at an increased risk of fracture if restored with amalgam, so a cuspal coverage restoration with composite is more preferable as it enhances the fracture resistance and longevity of the tooth

## FUTURE WORK

Recent studies carried out to find the relationship between fracture resistance and endodontically treated teeth are limited and further long term studies are required to find more reliable results and give guidelines for restoration of endodontically treated teeth.

**Conflict of Interest:** None.

## Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

PJAK & SMH: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

AY & FB: Data acquisition, data analysis, approval of the final version to be published.

MW & NB: Critical review, concept, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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