Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Index Copernicus value = 82.06

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Knowledge on outcome and survival of Endodontically treated cracked posterior permanent teeth among Endodontists: A qualitative research

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ABSTRACT:
Aim: The purpose of the study is to evaluate the success and survival rate of endodontically treated cracked posterior teeth and to assess the preoperative factors that affect teeth survival. **Methodology of study:** A questionnaire survey was conducted amongst 45 endodontists. Questions were asked regarding their experience of handling the failure of endodontically treated posterior teeth which experienced fracture either vertical or horizontal before restoration of teeth. **Results:** Teeth which had associated periodontal pockets had significant reduction in survival rates even after endodontic treatment according to various endodontists (56%). Teeth which had not been restored with a full crown coverage after endodontic treatment even after a significant time lapse, exhibited shorted survival as compared to those cases where the restoration was done in a timely manner after endodontically treated teeth according to participating endodontists in the survey (78.4%). **Conclusions:** Root canal treatment in cracked posterior teeth can be considered a suitable a suitable treatment option. The presence of an associated periodontal pocket results in a lower survival rate.
Key words Tooth fractures, non-vital teeth.

Received: 22 February, 2020 Accepted: 13 March, 2020

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This article may be cited as: Zubedi T, Lavani M, Tulli M, Aboukoura K, Karunakaran S, Gandhi C. Knowledge on outcome and survival of Endodontically treated cracked posterior permanent teeth among Endodontists: A qualitative research. J Adv Med Dent Scie Res 2020;8(4):36-39.

INTRODUCTION

Endodontically treated tooth (ETT) is chiefly deteriorated due to dental caries, trauma, or pre-existing restorations.[1] Tooth fracture usually occurs when the ETT is not immediately or properly restored, which leads to unrestorable fracture or root canal retreatment due to coronal leakage.[2] Success rate in ETT with immediate permanent restorations is higher than those with long-term provisional restorations, especially in the posterior teeth with excessive loss of tooth structure.[3] For posterior ETT, a post-endodontic restoration with cuspal protection is traditionally recommended to reduce the potential of tooth fracture.[4] Incidence of tooth fracture after endodontic treatment was lower in posterior teeth with cuspal protection; cuspal-coverage restoration significantly improves clinical success in posterior ETT.[5] When a Vertical Root Fracture (VRF) occurs, whether incomplete or complete, it extends to the periodontal ligament, whereupon soft tissue grows into the fracture space and increases the separation of the root segments. On communication with the oral cavity through the gingival sulcus, material, food debris, and bacteria obtain access to the fracture area. Upon entry of these elements to the fracture space, an inflammatory process is induced in the adjacent periodontal tissue, resulting in periodontal ligament breakdown, alveolar bone loss, and granulation tissue formation.[6] The osseous defect usually propagates apically and inter-proximally in a very quick manner.

The breakdown is especially rapid in teeth and roots in which the buccal plate is thin, i.e., in the maxillary premolars and the mesial roots of the mandibular molars, the most susceptible teeth, and roots to fracture. The most fractured teeth and roots are the maxillary and mandibular premolars and the mesial roots of mandibular molars.[7] There are five separate classifications; from least to most severe: (1) craze lines; (2) fractured cusp; (3) cracked tooth; (4) split tooth; and (5) vertical root fracture. These differ but have frequently been confused or combined in clinical articles. Lack of knowledge concerning the type, characterization, and variety of fractures may lead to misunderstanding with incorrect diagnosis and inappropriate treatment.[8] A lot of different parameters which influence the prognosis of endodontically treated teeth have to be taken into consideration: apical status, position of the tooth in the dental arch, number of adjacent teeth, occlusal contacts, amount of hard tissue loss, remaining dentin wall thickness, collagen degradation and intermolecular cross linking of the root dentin, type of long-term coronal restoration, type of post and core material used, presence, if necessary, of a ferrule preparation.[9] The advisable clinical approach is to completely remove previous restorations and all existing caries before initiating root canal treatment, therefore a more accurate evaluation of the tooth status will be possible. Extensive absence of sound hard dental tissues leading to important coronal destruction often requires surgical crown lengthening or orthodontic eruption prior to endodontic treatment, in order to fulfil the basic principles of endodontically treated teeth restoration. [9] It is beneficial to preserve coronal tissues and avoid invasive endodontic procedures, because these approaches violate the biomechanical balance and compromise the long-term performance of restored teeth. As quantified by Dietschi et al, the cavity depth, isthmus width, and configuration are highly critical factors in determining the reduction in tooth stiffness and risk of fracture. The remaining vertical coronal tooth structure named “ferrule” is clearly considered the crucial factor for the optimal biomechanical behaviour of endodontically treated teeth. However, sufficient coronal structure is sometimes deficient in clinical situations and the teeth do not offer enough sound structure to generate a ferrule effect.[10]

AIM OF THE STUDY

The purpose of the study is to evaluate the success and survival rate of endodontically treated cracked posterior teeth and to assess the preoperative factors that affect teeth survival.

METHODOLOGY OF STUDY

A questionnaire survey in an open-ended format, was conducted amongst 45 endodontists, which consisted of 30 male and 15 female endodontists, for a period of 1 year. All the endodontists had minimum of 1 year of experience. The survey was sent by email where questions were posed regarding their experience of handling the failure of endodontically treated posterior teeth which experienced fracture either vertical or horizontal before restoration of teeth. It also requested answers to the survival rate of endodontically treated posterior teeth and other common reasons for endodontic lapses seen in their practice. Their replies were entered on an excel spread sheet and was analyzed by descriptive statistics.

RESULTS

Survival rates which 95% endodontists agreed upon were that the teeth which had less than two walls remaining of the coronal tooth structure survived less and was subsequently difficult to restore and build up after endodontic treatment as compared to teeth which had significant coronal tooth structure remaining. Teeth which had associated periodontal pockets had significant reduction in survival rates even after endodontic treatment according to various endodontists (56%). Time interval has an important role to play in this case, in which teeth which had not been restored with a full crown coverage after endodontic treatment even after a significant time lapse, exhibited shorted survival as compared to those cases where the restoration was done in a timely manner after endodontically treated teeth according to participating endodontists in the survey (78.4%). (**Table 1**) These factors are all the more important in posterior teeth which bear the brunt of opposing occlusal forces which can fracture already weakened structure of tooth after root canal therapy.

Table 1- Survival of endodontically treated posterior teeth according to various Endodontists

Opinions of poor survival of Endodontically treated posterior teeth	
Less than 2 walls of coronal structure	95%
Associated periodontal problems	56%
Increased time lapse for crown restoration after endodontic treatment	78.4%
Vertical fractures	94%
Horizontal fractures	47.3%

DISCUSSION

Endodontically treated teeth often lose substantial tooth structure from previous caries, pre-existing restorations, and/or endodontic procedures. Reduction in tooth bulk and loss of sound dentin resulting from tooth preparation causes weakening of teeth. Controversy exists as to whether endodontic procedures are the primary cause for the loss of strength for a tooth. [11] Panitvisai and Messer reported that cuspal deflection increased with the extension of cavity preparations and was greatest when endodontic access was incorporated into a preparation.[12] However, Reeh et al performed a similar non-destructive test of cuspal stiffness that allowed sequential testing on the same tooth.[13] Overall survival rates against fracture of full-coverage crowns ranged from 94% to 100%, while those of resin composite restorations ranged from 91.9% to 100%. For the short-term follow-up, 2 studies (Mannocci et al. and Cagidiaco et al.) reported 100% survival at 12–36 months of both full-coverage crowns and resin composite restorations.[14,15] For the long-term follow-up, the study of Dammaschke et al. reported survival rate of 94% for full-coverage crowns and 91.9% for resin composite restorations.[16] The remaining tooth structure affects the survival rate against fracture of posterior ETT. The posterior ETTs with 1 to 3 surfaces loss had a significantly higher survival rate than those with more than 3 surfaces loss. The higher the number of surface loss is, the higher the risk of tooth fracture after post-endodontic restorations is anticipated. For the ETT that has higher amount of residual walls with low or normal occlusal force, higher survival rate against fracture would be expected, regardless of the type of post-endodontic restorations.[16] Tooth type is also an important factor for the survival rate against the fracture of ETT. Several studies reported that the premolar ETT had significantly higher survival rate than the molar ETT. Occlusal load of posterior tooth is associated with the distance to temporo-mandibular joint. The closer the distance to the fulcrum (temporo-mandibular joint), the higher the mechanical biting force on the tooth is expected. It is possible that vertical occlusal forces to the premolars are lower than the molars. However, lateral occlusal forces on premolars are to be higher, and this may have more potential effect on tooth fracture, and should be a concern. Moreover, the smaller size of the occlusal area in premolars withstands less occlusal stress than molars. Therefore, a consideration of survival rate against the fracture in the posterior ETT should be separated between premolars and molars.[17] There are few data in the literature analysing the reasons for extraction of endodontically treated teeth. The most common reason found (44%) was a restorative consideration. The survival or functionality of the endodontically treated tooth is currently the emerging aspect of endodontic treatment outcome, rather than healing.[18] Amongst the many reasons cited for extraction of root-treated teeth, the most common reported by a study published beyond the time frame of this review, were ‘large carious lesion’ or ‘unrestorable tooth’, followed by ‘tooth fracture’, ‘periodontal disease’ and last of all ‘endodontically related diseases’ (Chen et al. 2008). The findings support those of the present review, which revealed a high probability of tooth survival (86–93%) following root canal treatment; if taken as a measure of success, the values exceed those for the probabilities of success judged by periapical healing (74–85%) (Ng et al. 2007, 2008b).[19] The prognostic factors for tooth survival and periapical healing following root canal treatment have not been previously investigated using the same patient and tooth dataset; therefore, the presence or absence of commonality between prognostic factors for the two outcome measures would be mere speculation at present. It is likely that unless the cause of tooth extraction was failure of periapical healing (Ng et al. 2008a,b), the prognostic factors would be different for the two outcome measures.[19]

CONCLUSION

The survival of ETT is contingent on the residual sound tooth structure that remains after the endodontic access and caries removal are performed, consequently the most important factors upon restoring ETT become the maximum preservation and conservation of enamel, dentin and the dentino-enamel junction.

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