Research Article

Association between Site of Perforation and Material Used for Perforation Repair

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Abstract

Perforation in endodontics refers to the artificial communication between the root canal system and supporting tissues of the teeth. The aim of the study is to evaluate the association between the site of the perforation and material used for perforation repair. In this retrospective study a total of 82000 patient records were reviewed and data related to perforation repair were extracted and tabulated for data analysis. Statistical analysis was done using SPSS software (version 9.0.3) and chi square test was used to determine the correlation between site of perforation and perforation repair material. Out of 32 cases, both crown perforation and furcal perforation (46.88%) was the most common site and MTA (78.13%) is the commonly used material for perforation repair. Within the limitations of the study, it was found that there was no association between site of perforation and perforation repair material. MTA is the most commonly used material for perforation repair.

Keywords: Bioaggregate; Calcium hydroxide; MTA; Perforation repair

Introduction

Perforation in endodontic is referred to the artificial communication between root canal system and tissues of the teeth. Root perforations can occur pathologically as a result of resorption and caries. [1]

Perforations may also occur during preparation of access cavities, post space or may occur as a result of extension of internal resorption into periradicular tissues. [2]

Three clinical factors are considered relevant in progress and healing of root perforations–time, extent and location of perforation. Coronal perforation, root perforation and furcal perforation are the types of perforation. [3]

Most of the causes are iatrogenic which occurs during the search of canal orifices and access preparation followed by excessive dentin that is removed during post placement. Root resorption and caries are the common causes for non-iatrogenic perforation.

In approximately 2%–12% of endodontically treated teeth, accidental root perforations may occur, which may have serious implications. [4]

An infectious process once started at the perforation site either from the root canal or from periodontal tissues impairs the healing and initiates an inflammatory process that exposes the supporting tissues to infection, pain and suppurations.

In chronic conditions it may lead to abscess and fistulae including bone resorptive processes, thus making prognosis for treatment questionable leading to extraction of the affected tooth. An ideal material for perforation repair should be biocompatible, should seal the perforation against bacterial ingress and should induce healing in periodontal tissues. [5]

Calcium hydroxide, also known as super EBA used for perforation repair which yielded good results. However calcium hydroxide paste plus iodoform for perforation repair showed necrosis at the site of perforation and different levels of cementum hyperplasia. [6]

Mineral Trioxide Aggregate (MTA) has shown reliable and successful outcomes in perforation repair. MTA is also biocompatible and osteoinductive. However the disadvantage of MTA was found to be higher setting time. [7] Biodentine as a perforation material that has very good antimicrobial properties.

The setting time of biodentine is around 12 minutes and it is easy to handle and has high alkaline pH which makes it both biocompatible and favorable material for perforation repair. [8]

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Bioaggregate is a bioceramic material composed of dicalcium silicate, calcium phosphate monobasic, amorphous silicon dioxide and tricalcium silicate. Bioaggregate is found to induce formation of mineralized tissue and there is precipitation of the apatite crystals. The advantage of bioaggregate is its biocompatibility and more sealing ability as compared to MTA. [9]

Calcium Enriched Mixture (CEM) was found to induce periodontal regeneration when used as perforation repair material. [10] Other materials which aid in perforation repair include GIC and RMGIC. They are biocompatible, nontoxic and promote bone healing. However, disadvantages are microleakage, brittleness, subsequently prone to fracture, poor wear resistance, and inadequate surface properties. [11]

Our team has conducted various comparative studies/reviews, [12-16] *in vitro* studies [17-21] and cohort studies [22-26] over the past 5 years. Previously our team has a rich experience in working on various research projects across multiple disciplines. [27-41] Now the growing trend in this area motivated us to pursue this project.

The main aim of the study is to evaluate the difference of each perforation material and its association with the site of perforation.

Materials and Methods

This retrospective study was done in a hospital setting. Patients reported from June 2019 to March 2020 were reviewed. Patients from the same geographical location were selected as the study population. Patients undergoing treatment for perforation repair were included in inclusion criteria. Patients undergoing treatment other than perforation repair were considered in exclusion criteria. Ethical approval was obtained from the Institutional Ethical committee of Saveetha University. Patients reported to Saveetha dental college were taken as full unit. 82000 patient records were reviewed and data related to perforation were extracted. Data includes age, gender and treatment relevant to the study and number of teeth. The collected data was tabulated in the excel sheet. Statistical analysis was done using SPSS software (version 9.0.3). Statistical analysis between the variables-site of perforation and perforation repair material was done using chi square test. The outcome data was represented in the form of a bar graph.

Results and Discussion

In this study crown perforation (46.88%) and furcal perforation (46.88%) was the most common site of perforation followed by root perforation (6%) [Figure 1]. MTA (78.13%) was the most common material used for perforation repair compared to GIC (12.5%) and RMGIC (9.38%) [Figure 2]. No significant difference was found between the site of perforation and material used for perforation repair. Chi square value; p value: 0.435 (>0.05) indicating statistically not significant [Figure 3].

In the study, the site of perforation and material used for perforation repair are compared. Study population included 32 patients. Out of 32 patients, crown perforation (46.88%) and furcal perforation (46.88%) was found to be higher compared to root perforation (6.25%). In the material used for perforation repair, it was found that MTA was the most preferred material (78.13%), followed by GIC (12.5%) and RMGIC (9.38%).

Hashem et al. [42] reported that out of 53 patients in Indian population, MTA showed good prognosis over super EBA when used as perforation material. Kakani et al. [43] reported that out of 240 patients in Arabian population, MTA was the most commonly used perforation material among patients which supports our present study.

Asgary et al. [44] repaired 10 patients of furcation perforation using calcium enriched mixture cement in causasian population. Studies regarding push-out bond strength in furcation perforation repair in extracted mandibular molars showed that blood contamination did not have an effect on the strength of Biodentine. The push-out bond strength of MTA samples was reduced to a setting time of 7 days, but had no significant effect on 24 hrs samples irrespective of the blood contamination. [10]

Perforations that are apical to the crestal bone and epithelial attachment are observed to have a good prognosis however prognosis depends upon cleaning, shaping and obturation procedures.

Mineral Trioxide Aggregate (MTA) has been considered as an ideal material for perforation repair, apexification retrograde filling, pulp capping etc. However, the drawback of the MTA is its difficult handling, slow setting, and 3-4 hours, with the possibility of solubilized by being in contact with oral fluids. [45] Bioaaggregate promotes mineralized tissue formation and leads to precipitation of apatite crystals that become larger which increases on immersion time suggesting it to be bioactive. [46] The sealing ability and biocompatibility is similar compared to that of MTA.

Tooth type, surface of the tooth and the level of the perforation influence the complexity of treatment. In lateral perforations, the relation of the crestal bone to the perforation can favor a good prognosis and sealing. However in furcal perforations in molars, tissue damage and the possibility of communication with the gingival sulcus may be seen. The probable extrusion of adhesive materials to seal large perforations constitutes a common occurrence. In small furcal perforations, the prognosis is favorable. [47] Our institution is passionate about high quality evidence based research and has excelled in various fields. [48-54] We hope this study adds to this rich legacy.

An important clinical feature is the thickness of the gingival and bone tissue, where prognosis can be seen in patients. [55] Overall, the sealing of a root perforation has shown a high level of success; however, the impact of new therapeutic procedures on the prognosis of endodontic therapy should be carefully considered.

Limitations of the current study were the smaller sample size. Future scope will be larger sample size with multicentered set up.

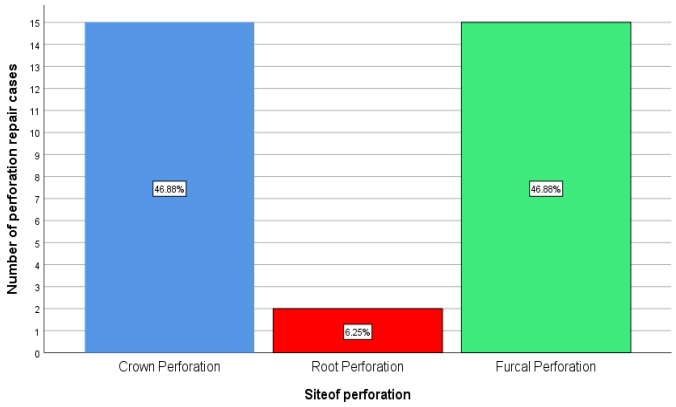

Figure 1: Bar chart shows frequency of total number of perforation cases and the site of perforation. X axis represents the site of perforation and Y axis represents the number of perforation repair cases. Crown perforation (blue), root perforation (red) and furcal perforation (green). Majority of the site of perforation was crown (46.88%) and furcal (46.88%) followed by root perforation.

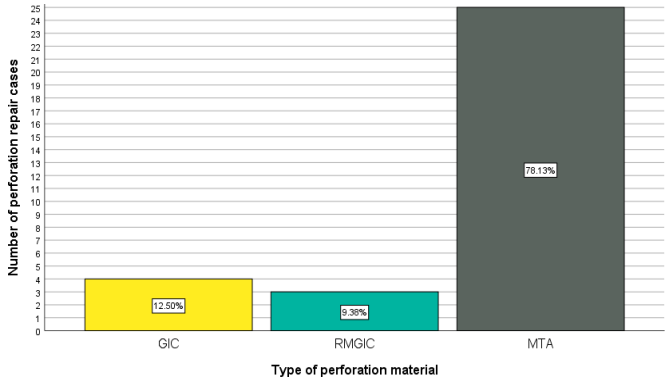

Figure 2: Bar chart shows frequency of total number of perforation cases and type of perforation material used. X axis represents type of perforation material and Y axis represents total number of perforation repair cases. GIC (yellow), RMGIC (cyan) and MTA (grey). MTA (78.13%) was the most commonly used perforation material followed by GIC (12.5%) and RMGIC (9.38%).

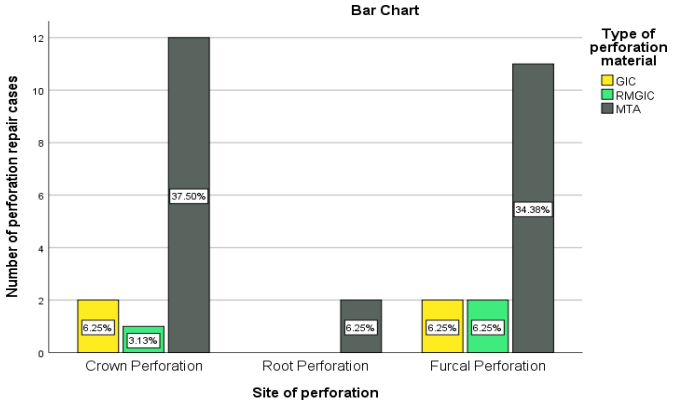

Figure 3: Bar chart represents association between perforation site and perforation material used. X axis represents the site of perforation and Y axis represents total number of perforation repair cases. Association was done by Chi square test. Chi square value; p value: 0.435 (>0.05) indicating statistically not significant. There is no association between the site of perforation and material used for perforation repair. Among the materials used, MTA is the commonly used material for perforation repair.

Conclusion

Within the limitations of the study, there is no association between the site of perforation and material used for perforation repair. Both Crown perforation and Furcal perforation was the most common site of perforation in root canal treated teeth and MTA is commonly used material for perforation repair. There are many factors affecting healing and repair of different types of root and crown perforation. MTA is the best material of choice due to its biocompatibility, promoting healing of inflammation, bone and cementum formation. Biodentine and Bioaggregate are newer perforation repair materials which can be used as an alternative for MTA.

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Author Contributions

Karthikeson PS contributed in concept, acquisition of data analysis, interpretation of data and also drafting the article and revisiting it critically for important intellectual content and manuscript preparation. Deepak S contributed in study design, correction, alignment, preparation of manuscript and supervision. Kiran Kumar P contributed to alignment and formatting and final approval of the submitted version of the manuscript.

Conflict of Interest

This research project is self funded and it is not sponsored or aided by any third party. There is no conflict of interest.

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