International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 03, 2020
ISSN: 1475-7192

RADIOGRAPHIC ASSESSMENT OF PERFORATION REPAIR QUALITY- AN OBSERVATIONAL STUDY

Type of Research: Original Article

Running Title: Radiographic assessment of perforation repair

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Abstract:*Perforation of a tooth is an unfortunate event caused in the endodontic practice which can be induced by various factors such as Iatrogenic resorption or by caries. The prognosis of these scenarios depends on various factors like the site of perforation, seal quality. The aim of the current study is to do an observational analysis using Electronic medical records from the time frame of April 2019 to April 2020 in which all the cases of perforation repair were assessed. The site of perforation and the seal quality was assessed radiographically with a scoring was given depending on the level of quality. From the results achieved, Crown perforation and furcal perforation was seen to be observed highest. The chi square test was used to assess the association statistics and was shown to be statistically insignificant (p>0.005) thus showing there is no correlation with site of perforation and quality of seal. The sealing of the perforation site was done usually with bioaggregate material - MTA and the seal quality was judged to be overall satisfactory in the crown region with the furcal region being least satisfactory.*

Keywords: *Electronic medical records; Endodontic Perforations; Perforation Seal; MTA*

1. INTRODUCTION

Perforation of a tooth during an endodontic procedure is an unfortunate event which happens in the endodontic practice which causes undesirable pain(Ramesh, Teja and Priya, 2018) to the patient in certain case scenarios in spite of different irrigation protocols used (Ramamoorthi, Nivedhitha and Divyanand, 2015). The prognosis depends on various factors such as location of the perforation, the time of exposure and the seal quality (Sinai, 1977; Teja and Ramesh, 2019). The seal quality is determined by various factors such as the practical ability of the clinician and the choice of perforation repair material used. These factors have a crucial role in prevention of bacterial contamination and prevent epithelial proliferation to take place (Chong, 2019).

Different materials have been used for perforation with initial perforation repair materials some of them being Indium foil, Amalgam, IRM, Super EBA, Calcium hydroxide respectively. Though these materials were used for sealing the perforation and achieved optimal seal it showed some disadvantages such as continuous bone resorption, necrosis at the perforation site as well as delayed healing(Unal, Maden and Isidan, 2010; Silva et al., 2012; Kakani, 2015).

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The initial introduction of MTA has shown several advantages such as increased osteogenic activity at the site as well as reduction of inflammatory response at the perforation site(Margunatoet al., 2015; Kim et al., 2019) Another one advantage of MTA is its ability to release calcium ions for cell attachment and proliferation; it is shown to exhibit adequate antibacterial properties because of its alkaline pH and under ideal conditions allows it to grow as well(Parirokh and Torabinejad, 2010). Even due to huge advantages various disadvantages are seen as well some of them being long setting time and staining of the tooth in the long run (Clauder and Shin, 2006).

The recent advancements such as ProRoot MTA (Dentsply Tulsa, Dental) has allowed great strides in the practical application and the long term prognosis of a perforated tooth (Camilleri, 2014). The ProRoot MTA, which was a modified version of the Grey MTA allowed the clinician to better use the material and also showed a decreased sealing time and lesser discolouration (Lee, Monsef and Torabinejad, 1993; Camilleri, 2014). Al-Hezins had compared the sealing ability of gray and white MTA and found no significant difference in saliva leakage with the 2 preparations (Al-Hezaimiet al., 2005).

The recent innovation of Biodentine which is a modification of Calcium carbonate process has shown considerable better outcome than MTA with better successful outcome due to its shorter setting time and more better physical and mechanical properties than conventional MTA(Aggarwal et al., 2013)(Kim et al., 2019) though the certain advantages seen research is still going on about the use of this material and the material being comparatively expensive than conventional MTA.

Another one advantage of MTA is its ability to release calcium ions for cell attachment and proliferation; it is shown to exhibit adequate antibacterial properties because of its alkaline pH and under ideal conditions allows it to grow as well(Parirokh and Torabinejad, 2010) . Recent literature shows that not many studies have shown an assessment of the proliferation repair to evaluate the sealing quality and the location of the perforation occurrence in a common institutional setup. The aim of this study is to do an observational based retrospective analysis of the perforation repair quality among postgraduate students in a dental institutional setup.

2. MATERIAL AND METHODS

The documentation was done using Electronic medical records of Saveetha Dental College, Chennai, India where a total of 86000 records were assessed. The data was taken from the time frame from 01 JUNE 2019 to 31 MARCH 2020 with an ethical clearance number of SDC/SIHEC/2020/DIASDATA/0619-0320. From the assessed data, Twenty eight intra-alveolar perforation data from 27 patients were identified which were standardized based on the documentation and these perforation repair cases data were assessed as follows.

1. Location of perforation
2. Frequency of age group occurrence
3. Perforation seal quality

The seal perforation quality assessment was done by using Hommez et al,2002 criteria (Hommez, Coppens and De Moor, 2002). The scoring criteria is as follows

1. Score 1: Intact restoration without any leakage (Acceptable)
2. Score 2: Restoration with open seal (Unacceptable)
3. Score 3: Restoration with recurrent decay (Unacceptable)

Two calibrated investigators who were not involved in the clinical treatment graded the quality using preoperative and postoperative radiograph

3. RESULTS AND DISCUSSION

Crown perforations and furcal perforations was shown to have the highest frequency MTA (ProRoot MTA) was seen to be used highest. The quality of perforation repair was seen to be satisfactory. There was a high level of agreement by the 2 investigators and statistical analysis was performed using SPSS 21.0 (IBM Corp, NY, USA).

The descriptive analysis such as median, first and third quartile was taken, maximum and minimum frequencies established for descriptive analysis. The chi square test was used to assess the association statistics and was shown to be statistically insignificant (p>0.005) thus showing there is no correlation with site of perforation and quality of seal.

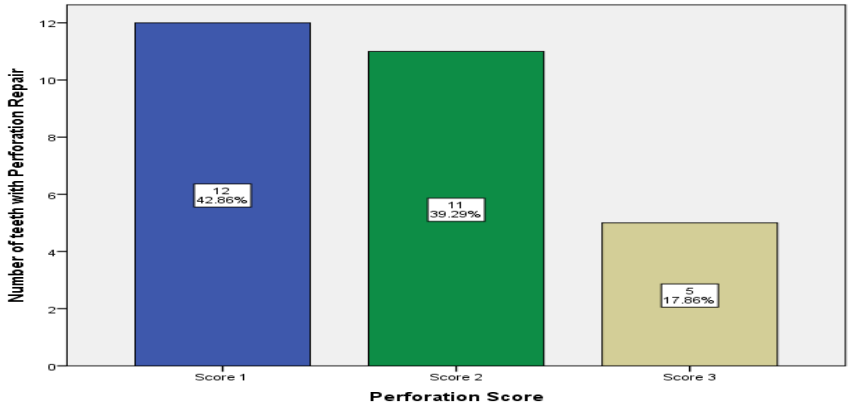

Figure 1: Bar chart showing the quality of perforation repair. X axis represents perforation score in a scale of Score 1 (Intact restoration without any leakage - Acceptable), Score 2 (Restoration with open seal - Unacceptable) and Score 3 (Restoration with recurrent decay - Unacceptable) and Y axis represents the number of teeth with perforation repair. Majority of the scores were seen in Score 1 (42.86%) and Score 2 (39.29%) followed by Score 3 (17.86%).

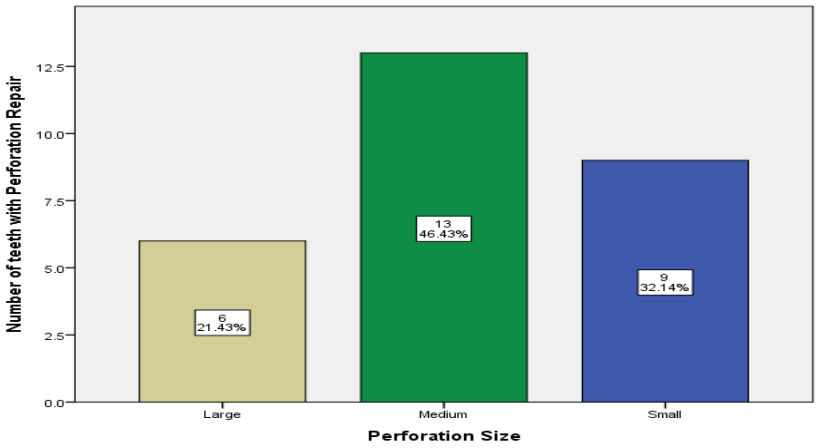

Figure 2: Bar chart showing the assessment of the size of perforation repair. X axis represents the size of perforation (Large, Medium, Small) based on radiographic determination and Y axis represents the number of teeth with perforation repair. Majority of the perforation size was seen with Medium (46.43%) followed by Small (32.14%) and Large (21.43%).

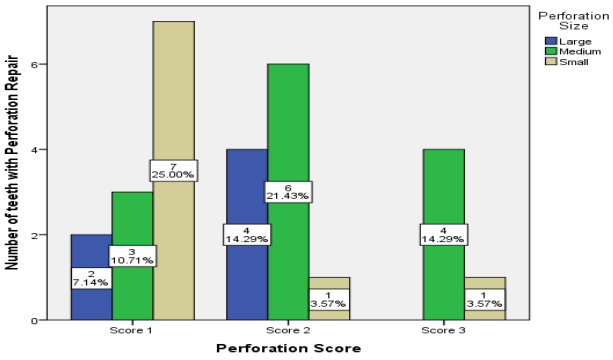

Figure 3: Bar chart showing the association of total number of perforation and their repair quality. X axis represents the perforation score and Y axis represents number of teeth with perforation repair, with respect to large perforation size (blue), medium size (green) and small size (beige). Statistical analysis was done using Chi-square test to assess the association between the perforation size and quality of perforation seal and p value = 0.50 ($p>0.05$) which is statistically not significant. It was seen that the quality of perforation repair was seen to be acceptable when the perforation size was small, however it was not statistically significant.

Institutional based educational programs do not emphasize on training in a specific component rather multicomponent for providing more linear understanding of the different treatment protocols given (Jose, P. and Subbaiyan, 2020)(Manohar and Sharma, 2018). Retrospective observational based studies are in definition taken based on the treatment outcome and tooth with incomplete data was generally excluded from the study sample (Wright, 1977). The sample size was taken as 28 teeth which is seen to be in agreement to previous study ranging from 4-26 teeth (Fuss and Trope, 1996; Tsesis and Fuss, 2006; Rozaet al., 2011). Diagnostic value is one of the crucial factors to be considered during the treatment of these problems(Janani, Palanivelu and Sandhya, 2020) Studies have shown assessment of various factors but none of studies have shown been conducted in an institutional based assessment of the treatment quality of perforation repair.

Perforation repair does not occur frequently and depends on various factors for the prognosis of treatment (Kumar and Delphine Priscilla Antony, 2018). Mente et al (Menteet al., 2010) had reported a success rate of 86% was seen in perforation repair depending on the different materials assessed. The location of perforation is one of the most critical prognostic factors in which our study was seen that crown perforation and furcal perforation was seen to be highest. Harris et al (Harris, 1976) had shown in their study that perforation in the floor of the chamber and cervical third has shown poor prognosis compared to other sites of perforation.The use of different intracanal irrigants also have been contraindicated since it causes a reactionary reaction during the interaction with various tissues(Siddique et al., 2019)(Noor, S Syed Shihaab and Pradeep, 2016)during this scenario the use of natural based products could provide a better viable alternative compared to conventional irrigants(Rajakeerthi and Ms, 2019)(Nandakumar and Nasim, 2018)

Imaging modality is a crucial factor which can help detect the site and size of perforation. The use of CBCT is advised to be used since it better helps the clinician to achieve and analyze the extent and depth of the defect (Ramanathan and Solete, 2015). The use of radiographs in our assessment could have a possible effect on the scoring criteria assessment by the interpreters.

It is was seen that the perforation repair based on size and score that in large perforation sites the seal quality of perforation repair was assessed at Score 1 (7.14%) and Score 2(14.29%), Medium perforations the seal quality was seen to be of Score 1(10.71%), Score 2(21.43%), Score 3(14.29%) and for small perforations the seal quality was seen

to be Score 1(25%), Score 2(3.57%) and Score 3(3.57%). In our results it was seen that overall quality of the perforation seal was seen to be satisfactory with good depth and seal which varied depending on the site of perforation. Most of the scoring was categorized was of Score 1 and Score 2 with most of the repairs opting for a nonsurgical approach. It was seen that surgical approach management the seal quality was assessed was of Score 2 and Score 3. This could be due to various factors such as operators ability and the method of management(Tellez et al., 2013)

The association between the site of perforation and quality of seal was shown to be insignificant ($p>0.005$). This has shown probably due to the factors of good treatment planning and proper guidelines followed during the perforation repair procedure(Endodontology and EUROPEAN SOCIETY OF ENDODONTOLOGY, 1994). The data also shows that successful management of perforation can be achieved by meticulous cleaning and shaping, adequate disinfection and proper handling of repair material and obturation.

Some factors to be assessed depend on important considerations such as remaining tooth structure, functional loads, aesthetic considerations and periodontal status have an influence on the tooth prognosis and influences the clinician decision process .(Zitzmannet al., 2009; Ree and Schwartz, 2010; Khandelwal and Palanivelu, 2019)

The presence of other repair materials have shown to some extent effects such as composite, gutta percha, glass-ionomer cement (Nikoloudakiet al., 2014; Rajendran et al., 2019)(Nasim et al., 2018; Ravinthar and Jayalakshmi, 2018). Though MTA is the gold standard material followed it has some disadvantages. Ramazani et al (Ramezani, Savadkouhi and Sayahpour, 2017) in their study had shown that bacterial leakage was seen to be highest with MTA compared to calcium enriched cement and Biodentine. Biodentine is also shown to have better bond strength to structure and has lesser setting time compared to other materials (Aggarwal et al., 2013). Calcium enriched cement (CEM) has shown to be better alternative having shown more better antimicrobial activity than other counterparts and better seal even in a moist environment contaminated with proving a better viable alternative compared to Biodentine and MTA in a institutional setup which allow better learning process to occur (Utnejaet al., 2015). The limitations of the study being limited sample size and more assessment criterias can be done to assess the perforation seal and quality. A CBCT analysis would give a better perspective of the seal quality. The future scope of the study can be done in a pan india based setup in various educational institutions to assess the quality of seal among different institutions. An assessment also can be done among private practitioners and postgraduate students.

4. CONCLUSION

Institutional based studies are pragmatic and are influenced by various factors. Retrospective observational studies help assess the different protocols for the betterment of the treatment protocols to be followed in the long run. From the achieved results, it can be concluded the highest amount of perforation was seen in crown region, followed by furcal region and root perforation. There was no association between the seal quality and site of perforation indicating that it did not influence the overall sealing ability of the operator. More emphasis must be given in institutional practice for the better diagnosis and prognosis of these case scenarios which can help the postgraduates to better emphasize their clinical skill for the management of these case scenarios.

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