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

ASSESSMENT OF ENDODONTIC IRRIGANTS USED IN THE MANAGEMENT OF OPEN APEX CASES - A RETROSPECTIVE STUDY

Running Title: Assessment of endodontic irrigants used in management of open apex

Shree Ranjan Pandey, S.Haripriya, Sowmya K

Abstract:*Normal physiological root end closure plays a significant role in development of the tooth.When this normal physiological root end closure does not occur it leads to incomplete root end closure where the walls of radicular dentine are parallel to each other. In the field of endodontics these cases are termed as open apex cases. Open apex cases are mostly having a history of trauma associated previously.Open apex cases are a challenge to deal in the field of endodontics as after trauma without the formation of complete root or without the closure of the apical barrier the infection caused due to pulpal necrosis.The following study deals with the association between the various kinds of endodontic irrigants used in management of open apex cases.This university based study involved collection of data from the hospital based records were 86000 patients case records were assessed.After analysing the data of 43 patients who had undergone treatment for 55 open apex cases were analysed .The data was compiled and tabulated in Microsoft Excel and exported to IBM SPSS 20. Data was represented through frequency distribution tables and Chi square tests were performed to compare the various endodontic irrigant used for the management of open apex cases. Maximum number of open cases were reported in the age group of 11-20 yrs (48.84%) .Prevalence of open apex was more in males (63.72%).Maximum number of open apex cases are seen in 11 & 21 (74.55%) and the least being 36,46 (1.82%).Association between teeth with open apex and the irrigants used revealed that most commonly used irrigant was saline and there was no statistical significant difference between the types of irrigants used in the management of open apex cases*

Key Words*: Endodontic irrigants; immature teeth; non vital teeth; open apex*

1. INTRODUCTION

Open apex (Torabinejad and Turman, 2011) is an important endodontic challenge to deal with. Most of the cases of the open apex are due to preexisting injury to the patient before the complete closure of the apex the root. Incomplete root closure occurs in patients with previous history of trauma. The necrotic pulp is removed in such cases with mechanical debridement and antiseptic irrigation. This is followed by apical hard tissue formation by means of calcific barrier. As a

[1]*Department of Conservative Dentistry and Endodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai 600 077, Tamil Nadu, India Email Id: 151906002.sdc@saveetha.com*

[2]*Senior Lecturer, Department of Conservative Dentistry and Endodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai 600 077, Tamil Nadu, India, E-mail: haripriyas.sdc@saveetha.com*

[3]*Senior lecturer, Department of Conservative Dentistry and Endodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai 600 077, Tamil Nadu, India, E-Mail: sowmyak.sdc@saveetha.com*

Corresponding Author: S.Haripriya

Senior Lecturer, Department of Conservative Dentistry and Endodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai 600 077, Tamil Nadu, India, E-mail: haripriyas.sdc@saveetha.com, Contact no: +91-9677139139

result of trauma mostly the tooth becomes non vital (Janani, Palanivelu and Sandhya, 2020). Such cases can have fracture of tooth structure also making the treatment a further challenge to deal with (Jose, P. and Subbaiyan, 2020).

In most of the open apex cases, treatment protocols requires the advent use of irrigants like saline, EDTA, chlorhexidine(Siddique et al., 2019) for proper biomechanical preparation of root canal. Conventionally during routine endodontic treatment sodium hypochlorite 5.25% is used in the management of the root irrigation(Teja and Ramesh, 2019), But this concentration is reduced to 1% hypochlorite during the management of cases with open apex as this concentration does not cause the periapical tissues to undergo a process of necrosis and subsequent inflammation if the irrigant is extruded to the adjacent periodontal tissues (Raldiet al., 2009). Irrigant extrusion signals the inflammatory mediators like IL-I,IL-6,PGE2 (Martinhoet al., 2011) to come into play.These inflammatory mediators trigger the process of inflammation (Teja, Ramesh and Priya, 2018) and cause the affected area to be affected by action of collagenase, hyaluronidase(Ridenour et al., 2001), which causes further spread of infection and resorption of adjacent tissues.

The management of the open apex cases requires removal of the infection source from the root canal , which is done with the help of irrigation protocol, which could be a combination of sodium hypochlorite ,chlorhexidine, EDTA and saline .These irrigants have the ability to dissolve the necrotic tissue within the root canal which is followed by conventional endodontic filing. The canal once cleaned with the irrigating solution , is made dry with paper points and then intracanal medicament is placed (Manohar and Sharma, 2018) .In order to make the debridement of the root canal more efficient in these cases , endodontic irrigants play an important role to eliminate the bacterial microflora. A better understanding about the irrigants would save the operators time and would offer better prognostic results in such cases.

The management of open apex cases is done by the process of apexification(Rafter, 2005),which is a method of dental treatment to induce a calcific barrier in a root with incomplete formation (open apex) of a tooth with necrotic pulp . Apexification leads to formation of osteo cementum(Blaney, Hartwell and Bellizzi, 1982).To create the apical plug calcium hydroxide was used initially but nowadays it has been replaced by better materials such as biodentine and MTA.The successful management (Harlamb, 2016)requires a series of radiographs over months for the follow up of the cases so that to check the apical barrier formation, once the apical barrier has been formed , the apical stop can be filled with gutta percha.

Previously our team had conducted numerous studies which include in vitro studies,(Ramanathan and Solete, 2015; Noor, S Syed Shihaab and Pradeep, 2016; Nandakumar and Nasim, 2018; Rajendran et al., 2019) review (Kumar and Delphine Priscilla Antony, 2018; Ravinthar and Jayalakshmi, 2018; R, Rajakeerthi and Ms, 2019),survey, clinical trial (Ramamoorthi, Nivedhitha and Divyanand, 2015; Nasim et al., 2018; Janani, Ajitha and Sandhya, 2020) in the field of conservative dentistry and endodontics.Now we are focussing on retrospective studies. The aim of the present study is to find association between various endodontic irrigants used in the management of open apex cases.

2. MATERIALS AND METHODS

This retrospective study was conducted in a University setting. Case sheets were analyzed from June 2019 to April 2020.Patient record was reviewed and analysed the data of 86000 patients for the appreciation of the kind of irrigant used in management of open apex cases. Open apex cases were selected and the case sheets were reviewed and the cross verification of the data was done. A total of 43 patients who had undergone treatment for 55 open apex cases were

evaluated. The age, gender, teeth distribution of patients was checked by both data and photographic evaluation. The first group focused on cases irrigated with saline, second group was focused on use of sodium hypochlorite, third group was EDTA, the fourth was chlorhexidine. The data was harnessed and was tabulated in the form of the excel sheet. Data was analyzed using SPSS software. The acknowledgeable aspects of this study design is that the patient data is readily available and the ethnicity is similar type. The disadvantage of such study design is that data location is not specific. The data were analyzed using Chi square test. The type of analysis performed was associative and descriptive using SPSS software (SPSS version 21.0, SPSS, Chicago IL, USA). The p value less than 0.05 was considered to be statistically significant.

3. RESULTS AND DISCUSSION

From our study we found that the maximum number of open cases were reported in the age group of 11-20 yrs (48.84%) and the least being 31-40 yrs (9.30%) (Figure 1). Prevalence of open apex was more in males 63.72% (Figure 2).Maximum number of open apex cases are seen in 11 & 21 (74.55%) and the least being 36,46 (1.82%) (Figure 3)..Association between teeth with open apex and the irrigants used revealed that most commonly used irrigant in the management of open apex was saline in 11 & 21 (54.55%) and the least being sodium hypochlorite and EDTA in 12 & 22 (1.82%) and saline in 36& 46 (1.82%) (p> 0.05)(Figure 4).However the results were not statistically significant.

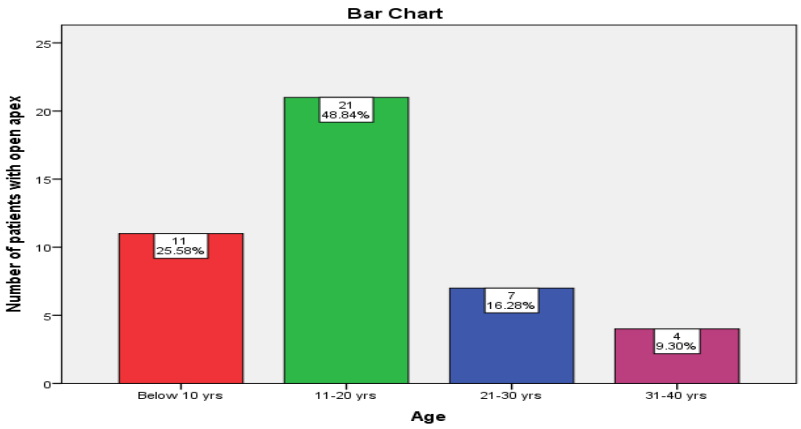

Figure 1: Bar graph depicts age distribution of patients with open apex. The X axis denotes the age distribution and Y axis denotes the number of patients with open apex. The maximum number of open cases were reported in the age group of 11-20 yrs (green) and the least being 31-40 yrs (purple).

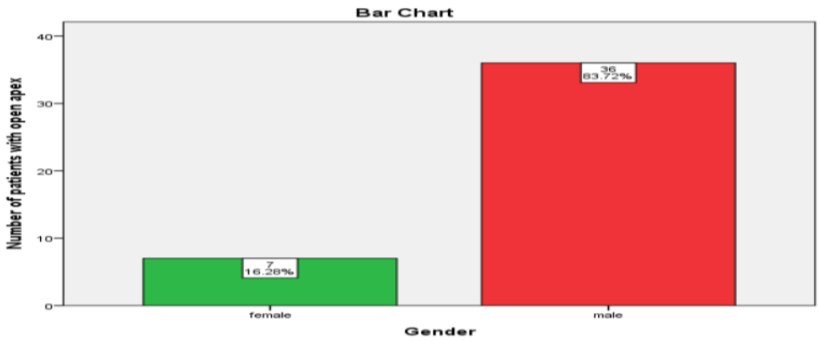

Figure 2: Bar graph depicts the gender distribution in patients with open apex. X axis denotes the gender of the patient and Y axis denotes the number of patients with open apex. Prevalence of open apex was more in males (red bar) and less in females (green bar).

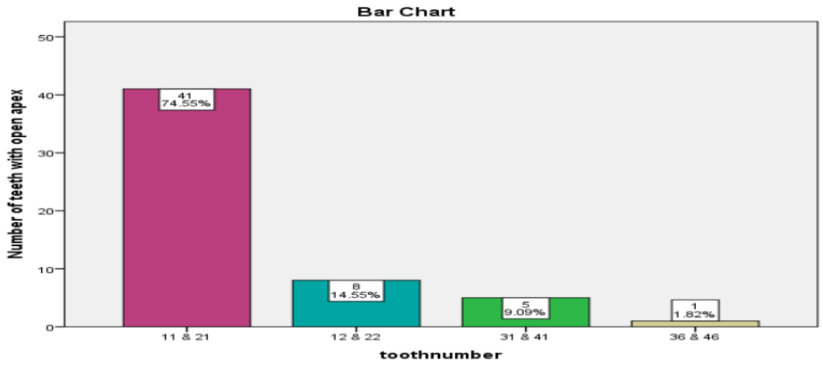

Figure 3 Bar graph depicts teeth distribution of patients with open apex. X axis denotes the teeth with open apex and Y axis denotes the number of patients with open apex. Maximum number of open apex cases are seen in 11 & 21 (purple bar) and the least being 36,46 (beige bar).

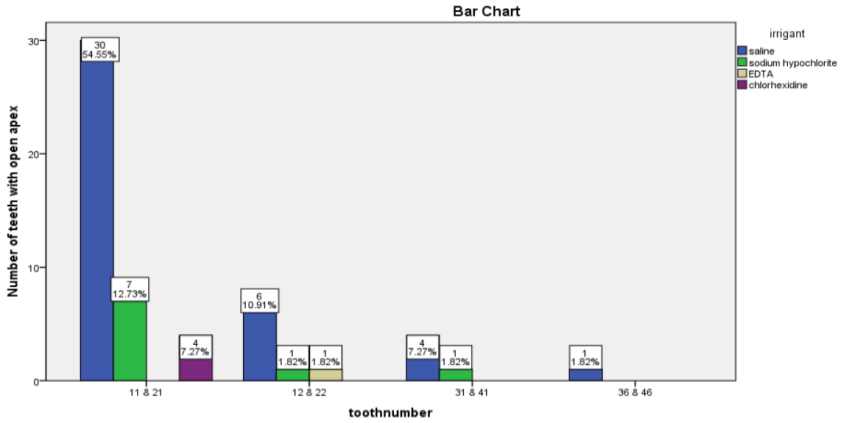

Figure 4 Bar graph depicts the association between teeth with open apex and the irrigantsused.X axis denotes the teeth with open apex and Y axis denotes the number of teeth with open apex. Most commonly used irrigant was saline in 11 & 21 and the least being sodium hypochlorite and EDTA in 12 & 22 and saline in 36& 46. Chi square test was done to find the association between the irrigants used and the teeth with open apex. Pearson's Chi-square value, p value 0.530 ($p > 0.05$) hence statistically not significant.

Because most of the non-vital teeth are infected , the first phase of treatment is to disinfect the root canal system , to assure periapical healing (Shuping et al., 2000).Clinicians often face the challenge of adequately debriding the root canal with open apex. Similar to conventional endodontic therapy microbial control is also crucial for open apex teeth. These canals with compromised, delicate, under developed dentinal walls serve as contraindication for mechanical preparation , thus chemical debridement plays a significant role in management of open apex cases.

Sodium hypochlorite is the most widely used agent for chemical disinfection in endodontic procedures including open apex 3teeth. In such cases the concentration of sodium hypochlorite should be at 1 percentage so that the cytotoxic effects do not affect the periapical tissues in proximity to the open apex tooth(Raldiet al., 2009).The conventional percentage of sodium hypochlorite used in routine endodontic procedures is near 5.2% which has proven cytotoxic effects when it comes in contact with periapical tissue (Bosch-Aranda et al., 2012).But contrary to the belief cited in literature our study revealed that the majority of the cases used saline also for chemical debridement.A better understanding about the use of sodium hypochlorite solution is needed so that the clinicians can use it in management of open apex cases. Sodium hypochlorite has the ability to oxidize and hydrolyze cell proteins and has tissue solvent capacity, which increases its value as an irrigating solution. At the same time there are major challenges while using sodium hypochlorite, the most predominant of them being apical extrusion. Apical extrusion leads intense pain , and necrosis of the tissues of periodontium(Bosch-Aranda et al., 2012).Previous studies suggest that biocompatibility of sodium hypochlorite is inversely proportional to its concentration(Goldman et al., 1981). With reference from the current study we can further educate the clinicians to use the sodium hypochlorite at a lesser concentration in the management of open apex cases as the first option of choice, in addition to use of saline for debridement of open apex cases. For better outcome a correct irrigation protocol needs to be followed for the management of open apex cases. Ideally Sodium hypochlorite at a lesser concentration should be used as it offers better chemical debridement of the canals in the management of root canals. The concentration of sodium hypochlorite used in the university is near 3%.

Chlorhexidine is a cationic bisbiguanide with a broad-spectrum antimicrobial activity. The concentration in which it is used as an endodontic irrigant is 2%. It kills both the gram positive and the gram-negative microflora from the root canals. One relevant fact with the use of chlorhexidine is the substantivity which is beneficial for cases with periapical infection as it exhibits retentiveness to the radicular dentinal walls in open apex cases.(Bashetty and Hegde, 2010)A more awareness is needed in the use of Chlorhexidine. In this retrospective study, it was found that EDTA was used for the irrigation of open apex in one case only. EDTA offers less benefit in the management of open apex cases as it has limited bactericidal activity. EDTA offers also no antimicrobial activity against E.faecalis .A combination of Edta with Sodium Hypochlorite can offer better root canal debridement in such cases.(Mohammadi, Shalavi and Jafarzadeh, 2013)

The sample size used in the study was small which required close monitoring of the follow up cases. Future scope would be more types of endodontic irrigants must be included in future studies for management of open apex cases with predefined protocol of irrigation .In order to formulate newer irrigation protocols further in vitro and in vivo studies can be done.A well differentiated retrospective analysis with larger sample size is needed to further validate the results of the current study.

4. CONCLUSION

Within the limitations of this study, it was found that the maximum number of open cases were reported in the age group of 11-20 yrs (48.84%) and in males (63.72%). Teeth commonly affected with open apex was 11 & 21 (74.55%). Association between teeth with open apex and the irrigants use, revealed that most commonly used irrigant was saline and there was no statistically significant difference between the types of irrigants used in the management of open apex cases. Knowledge should be imparted to clinicians regarding the appropriate use of irrigants open apex management. Advent use of combination of irrigants in open apex management ensures complete disinfection of the root canals and achieve long term success of the endodontic therapy.

REFERENCES

[1] Bashetty, K. and Hegde, J. (2010) 'Comparison of 2% chlorhexidine and 5.25% sodium hypochlorite irrigating solutions on postoperative pain: a randomized clinical trial', Indian journal of dental research: official publication of Indian Society for Dental Research, 21(4), pp. 523–527.

[2] Blaney, T. D., Hartwell, G. R. and Bellizzi, R. (1982) 'Endodontic management of a fused tooth: a case report', Journal of endodontia, 8(5), pp. 227–230.

[3] Bosch-Aranda, M. L. et al. (2012) 'Complications following an accidental sodium hypochlorite extrusion: A report of two cases', Journal of clinical and experimental dentistry, 4(3), pp. e194–8.

[4] Goldman, L. B. et al. (1981) 'The efficacy of several irrigating solutions for endodontics: a scanning electron microscopic study', Oral surgery, oral medicine, and oral pathology, 52(2), pp. 197–204.

[5] Harlamb, S. C. (2016) 'Management of incompletely developed teeth requiring root canal treatment', Australian dental journal, 61 Suppl 1, pp. 95–106.

[6] Janani, K., Ajitha, P. and Sandhya, R. (2020) 'Improved quality of life in patients with dentin hypersensitivity', Saudi Endodontic Journal, 10, p. 81.

[7] Janani, K., Palanivelu, A. and Sandhya, R. (2020) 'Diagnostic accuracy of dental pulse oximeter with customized sensor holder, thermal test and electric pulp test for the evaluation of pulp vitality: an in vivo study', Brazilian Dental Science, 23(1), p. 8.

[8] Jose, J., P., A. andSubbaiyan, H. (2020) 'Different Treatment Modalities followed by Dental Practitioners for Ellis Class 2 Fracture – A Questionnaire-based Survey', The Open Dentistry Journal, pp. 59–65. doi: 10.2174/1874210602014010059.

[9] Kumar, D. and Delphine Priscilla Antony, S. (2018) 'Calcified Canal and Negotiation-A Review', Research Journal of Pharmacy and Technology, p. 3727. doi: 10.5958/0974-360x.2018.00683.2.

[10] Manohar, M. P. and Sharma, S. (2018) 'A survey of the knowledge, attitude, and awareness about the principal choice of intracanal medicaments among the general dental practitioners and nonendodontic specialists', Indian journal of dental research: official publication of Indian Society for Dental Research, 29(6), pp. 716–720.

[11] Martinho, F. C. et al. (2011) 'Antigenicity of Primary Endodontic Infection against Macrophages by the Levels of PGE2 Production', Journal of endodontics, 37(5), pp. 602–607.

[12] Mohammadi, Z., Shalavi, S. and Jafarzadeh, H. (2013) 'Ethylenediaminetetraacetic acid in endodontics', European journal of dentistry, 7(Suppl 1), pp. S135–S142.

[13] Nandakumar, M. and Nasim, I. (2018) 'Comparative evaluation of grape seed and cranberry extracts in preventing enamel erosion: An optical emission spectrometric analysis', Journal of conservative dentistry: JCD, 21(5), pp. 516–520.

[14] Nasim, I. et al. (2018) 'Clinical performance of resin-modified glass ionomer cement, flowable composite, and polyacid-modified resin composite in noncarious cervical lesions: One-year follow-up', Journal of Conservative Dentistry, p. 510. doi: 10.4103/jcd.jcd_51_18.

[15] Noor, S. S. S. E., S Syed Shihaab and Pradeep (2016) 'Chlorhexidine: Its properties and effects', Research Journal of Pharmacy and Technology, p. 1755. doi: 10.5958/0974-360x.2016.00353.x.

[16] Rafter, M. (2005) 'Apexification: a review', Dental traumatology: official publication of International Association for Dental Traumatology, 21(1), pp. 1–8.

[17] Rajendran, R. et al. (2019) 'Comparative Evaluation of Remineralizing Potential of a Paste Containing Bioactive Glass and a Topical Cream Containing Casein Phosphopeptide-Amorphous Calcium Phosphate: An in Vitro Study', PesquisaBrasileiraemOdontopediatria e ClínicaIntegrada, pp. 1–10. doi: 10.4034/pboci.2019.191.61.

[18] Raldi, D. P. et al. (2009) 'Treatment options for teeth with open apices and apical periodontitis', Journal , 75(8), pp. 591–596.
[19] Ramamoorthi, S., Nivedhitha, M. S. and Divyanand, M. J. (2015) 'Comparative evaluation of postoperative pain after using endodontic needle and EndoActivator during root canal irrigation: A randomised controlled trial', Australian endodontic journal: the journal of the Australian Society of Endodontology Inc, 41(2), pp. 78–87.
[20] Ramanathan, S. and Solete, P. (2015) 'Cone-beam Computed Tomography Evaluation of Root Canal Preparation using Various Rotary Instruments: An in vitro Study', The Journal of Contemporary Dental Practice, pp. 869–872. doi: 10.5005/jp-journals-10024-1773.
[21] Ravinthar, K. and Jayalakshmi (2018) 'Recent Advancements in Laminates and Veneers in Dentistry', Research Journal of Pharmacy and Technology, p. 785. doi: 10.5958/0974-360x.2018.00148.8.
[22] Ridenour, S. et al. (2001) 'Anesthetic efficacy of a combination of hyaluronidase and lidocaine with epinephrine in inferior alveolar nerve blocks', Anesthesia progress, 48(1), pp. 9–15.
[23] R, R., Rajakeerthi, R. and Ms, N. (2019) 'Natural Product as the Storage medium for an avulsed tooth – A Systematic Review', Cumhuriyet Dental Journal, 22(2), pp. 249–256.
[24] Shuping, G. B. et al. (2000) 'Reduction of intracanal bacteria using nickel-titanium rotary instrumentation and various medications', Journal of endodontia, 26(12), pp. 751–755.
[25] Siddique, R. et al. (2019) 'Qualitative and quantitative analysis of precipitate formation following interaction of chlorhexidine with sodium hypochlorite, neem, and tulsi', Journal of conservative dentistry: JCD, 22(1), pp. 40–47.
[26] Teja, K. V. and Ramesh, S. (2019) 'Shape optimal and clean more', Saudi Endodontic Journal. Medknow Publications and Media Pvt. Ltd., 9(3), p. 235.
[27] Teja, K. V., Ramesh, S. and Priya, V. (2018) 'Regulation of matrix metalloproteinase-3 gene expression in inflammation: A molecular study', Journal of conservative dentistry: JCD, 21(6), pp. 592–596.
[28] Torabinejad, M. and Turman, M. (2011) 'Revitalization of tooth with necrotic pulp and open apex by using platelet-rich plasma: a case report', Journal of endodontia, 37(2), pp. 265–268.