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Common Irrigants used by Pediatric Dentists for Permanent molar root canal therapy

Vaishnavi Devi B[1], Vignesh Ravindran[*2], Delphine Priscilla Antony S[3]

[1]Saveetha Dental College & Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India
[2]Department of Pedodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India
[3]Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India

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ABSTRACT

Common irrigants used by pediatric dentists for permanent molar root canal therapy Maintenance of the deciduous teeth before exfoliation is necessary. The two most common oral diseases are caries and periodontal disease, and they often begin in childhood. Root canal treatment is the best treatment of choice for extensively carious teeth. Endodontic therapy with proper biomechanical preparation, irrigation, and obturation helps in removing the bacterial biofilm and preventing the loss of primary carious teeth. To effectively clean and disinfect the root canal, remove the smear layer, and irrigants are necessary. The main objective of the present study is to know the common irrigants used by pediatric dentists for permanent molar root canal therapy.All the cases reported in Jun 2019 to Mar 2020 for permanent molar RCT in pediatric patients, was chosen for the study. Information was collected from the dental hospital management system, and the result data was tabulated in excel and imported to SPSS for correlation and association. P<0.05 was considered to be the level of statistical significance in this study. The result - Within the limits of the present study the results obtained are, saline is the most preferred root canal irrigant in both single(53%) and multi-visit RCT(63%) with female preference in single visit RCT and equal gender preference of saline in multi-visit RCT and most commonly preferred in the age group of 11 to 14 years in both single and multi-visit root canal therapy. The knowledge about the proper choice of root canal irrigant will help in the canal disinfection and paves the way for the success of endodontic therapy.

*Corresponding Author

Name: Vignesh Ravindran
Phone: 919789934476
Email: vigneshr.sdc@saveetha.com

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INTRODUCTION

Oral health is an essential prerequisite for health-related behaviour (Gurunathan and Shanmugaavel, 2016). The two most common oral diseases are caries and periodontal disease, and they often begin in childhood. Dental caries is a global oral health problem with distinctive variations in its distribution (Govindaraju, 2017). It is necessary to maintain deciduous teeth in function until their natural exfoliation. Early loss of primary teeth can cause problems such as space loss, ectopic eruption, distur-

bance in eruption sequence, development of aberrant habits such as tongue thrusting, mouth breathing, altered phonation, and impairment of function (Reddy and Ramakrishna, 2007). Thus, primary dentition must be maintained in the dental arch, in its functional form, for proper dental, skeletal, and psychologic development of a child (Takushige *et al.*, 2004). The dentists should correlate the age of the child, the extensiveness of caries during their clinical examination to avoid misdiagnosis and unnecessary treatment (Christabel, 2015).

The pulp in primary dentition is histologically similar to permanent teeth and may be affected by caries, restorative procedure and trauma. Previous studies have shown that bacteria in infected root canals and periradicular tissues are capable of invading and residing deeply within dentin and in cementum around the periapex (Peters, 2001). Endodontic therapy is aimed at the elimination of bacteria from the infected root canal and at the prevention of reinfection (Kandaswamy and Venkateshbabu, 2010). Proper instrumentation, irrigation, and obturation of the root canal pave the way for the success of the root canal therapy. Of these three essential steps of root canal therapy, irrigation of the root canal is the most crucial determinant step in the healing of the periapical tissues. An ideal irrigant should penetrate dentinal tubules, provide long-term antibacterial effect, remove the smear layer, and be nonantigenic, non-toxic and non-carcinogenic apart from cleaning and disinfecting the root canal.

Primary teeth have zones inaccessible to debridement in the accessory canals which might lead to ramifications in the dentinal tubules, to avoid these auxiliary solutions are required. Irrigants can augment mechanical debridement by flushing out debris, dissolving tissue, and disinfecting the root canal system((Carson *et al.*, 2005)). It should also prevent the packing of hard and soft tissues in the apical portion of the root, causing extrusion of infected material into the periapical region ((Jolly, 2013)). The common irrigants in use for root canal therapy by pediatric dentists include saline, sodium hypochlorite, chlorhexidine, EDTA and sometimes to improve the properties of the irrigants, a combination of these types are also in prevalence. Saline is most readily available, universally accepted, inexpensive and non-toxigenic (Cobankara *et al.*, 2004). All of these root canal irrigants have some reactions to the oral tissues, so it's always a better choice to use it in combination to obtain better results and to prevent failure of the treatment. The main aim of this study is to know the commonly used root canal irrigants by pediatric dentists for endodontic therapy in a permanent molar.

MATERIALS AND METHODS

Study setting

This retrospective cross-sectional study is about knowing the common root canal irrigants used by pediatric dentists. A randomised sample of healthy pediatric patients who had undergone root canal therapy in the permanent molar was chosen for the study. The study took place in a university setting. The retrospective data was ethically approved by the institutional ethical committee(ethical approval number: SDC/SIHEC/2020/DIASDATA/0619-0320), and the number of people involved in the study includes three members - Guide, researcher, reviewing expert.

Sampling

All the cases reported for permanent molar endodontic therapy from June 2019 to March 2020 was chosen for the study. A total of 86000 patient records were reviewed and analysed, from which 8800 reports of patients who had undergone root canal treatment were chosen for the study. The records of all patient data were obtained from the dental hospital management system from initial to last and were arranged in chronological order. The inclusion criteria for this study is all the patients in the age group of 7 to 17 years who had undergone root canal therapy in the permanent molar were chosen for the study with a complete database in software. The exclusion criteria for this study includes all the patients above the age of 18 years undergoing root canal treatment in the tooth other than permanent molar, and the gross incomplete data were excluded from the study. All the data were verified correctly and cross-verified by another examiner. Sampling bias was minimised by simple random sampling. The sample size of the study includes a total of 405 patients' pediatric molar root canal treatment records.

Data analysis

The collected data includes both single visit and multi-visit, permanent molar RCT details of pediatric patients. Gross incomplete data were excluded as it affects the study. Excel tabulation of all the verified data was done. Data was imported to the Statistical Package for Social Sciences(SPSS) software, version 1.0.0.1327 64 bit edition(IBM corp., NY, USA) for the statistical tests. The data were assessed by being subjected to descriptive analysis with the help of frequencies, percentage and analysed by running descriptive statistics in the form of crosstabs. Non-parametric Chi-square statistical test was used, and the results were correlated and associated.

RESULTS AND DISCUSSION

The study evaluated the common irrigants preference in permanent molar RCT among pediatric patients visiting a private dental institute. A total of 405 patients' pediatric molar root canal treatment records were included in this study. It consists of 330 multi-visit RCT patients and 75 single visit RCT patients. The statistical software SPSS was used for descriptive and inferential analysis. Results on categorical measurement were presented in percentage(%). Level of significance was predetermined at the probability value of P = 0.05, and any value $\leq$ 0.05 was considered to be statistically significant.

Age prevalence in root canal treated patients infer that there is a higher preference of irrigants in the age group of 11 to 14 years(45.3%) in single visit RCT (Figure 1). Similarly, there is a higher preference of saline in the age group of 11 to 14 years(93%) followed by 15 to 17 years(75%) in multi-visit RCT (Figure 2). EDTA is highly preferred in the age group of 14 to 16 years. P-value is $\leq$0.05, and hence it is statistically significant.

Gender prevalence in this study shows that among the patients who had undergone endodontic therapy in a single visit RCT, there is a higher preference of female patients in saline usage (Figure 3). In multi-visit RCT, there is an equal preference for male and female patients in irrigant usage (Figure 4). P-value is $\leq$0.05, and hence it is statistically significant.

Root canal irrigant preference among the permanent molar reported patients shows that 53.3% saline was preferred, 13. 92% EDTA and combination of sodium hypochlorite, EDTA and saline was preferred. Sodium hypochlorite with saline was preferred in 7. 59% patients, in 5.06% patients, a combination of chlorhexidine with EDTA and saline was used with the remaining 3. 80% combination of sodium hypochlorite, chlorhexidine and saline were preferred. 2. 53% combination of sodium hypochlorite, chlorhexidine, EDTA and saline was preferred in single visit RCT (Figure 5). Similarly, 64. 16% saline, 17. 7% EDTA, 10. 24% sodium hypochlorite with saline, 6.02% chlorhexidine with EDTA and saline was preferred in multi-visit RCT with the remaining 0.90% sodium hypochlorite with EDTA and saline, 0.60% sodium hypochlorite, and 0.30% chlorhexidine, sodium hypochlorite with chlorhexidine, EDTA and saline, a combination of sodium hypochlorite with chlorhexidine and saline was preferred. P-value is $\leq$0.05, and hence it is statistically significant (Figure 6). The data shows that there is a higher prevalence of saline usage as root canal irrigant in a single visit and multi-visit RCT. The probability value is $\leq$0.05 for the study, and hence the study was statistically significant.

Figure 1 shows Bar graph showing the distribution of different age groups in the preference of root canal irrigants in single visit RCT across the scale of patient count in the y-axis and x-axis represents age prevalence. The blue colour represents the age group 8 to 10 years, the red colour represents 11 to 14 years, and the green colour represents the age group 15 to 17 years. There is a significantly higher preference in the age group of 11 to 14 years among these patients. Chi-square test, p =0.001, statistically significant.

Figure 2 shows The blue colour represents the age group 8 to 10 years, the red colour represents 11 to 14 years, and the green colour represents the age group 15 to 17 years. There is a significantly higher preference in the age group of 11 to 14 years among these patients. Chi-square test, p =0.001, statistically significant.

Figure 3 shows The blue colour represents the male patients, and the red colour represents for the female patients. There is a significantly higher preference of female patients in the usage of root canal irrigants than male patients—Chi-square test, p =0.001, statistically significant.

Figure 4 shows The blue colour represents the male patients, and the red colour represents for the female patients. There is a significant equal preference of male and female patients in the usage of root canal irrigants. Chi-square test, p =0.001, statistically significant.

Figure 5 shows There is a higher preference for saline in these patients when compared to the other root canal irrigants—Chi-square test, p =0.001, statistically significant.

Figure 6 shows There is a higher preference for saline in these patients when compared to the other root canal irrigants—Chi-square test, p =0.001, statistically significant.

High prevalence and incidence of oral diseases qualify it as a significant public health problem. It has been shown that Indian children have low levels of oral health awareness and practice as compared to their western counterparts due to this, there is a high caries prevalence. There is a need to create awareness and education regarding caries and traumatic injuries of primary teeth leading to its loss (Ravikumar *et al.*, 2017; Subramanyam, 2018). Fluoride by far is one of the effective ways in declining the prevalence of caries and its progression (Somasundaram, 2015; Ramakrishnan and Shukri, 2018). In paediatric dentistry, the essen-

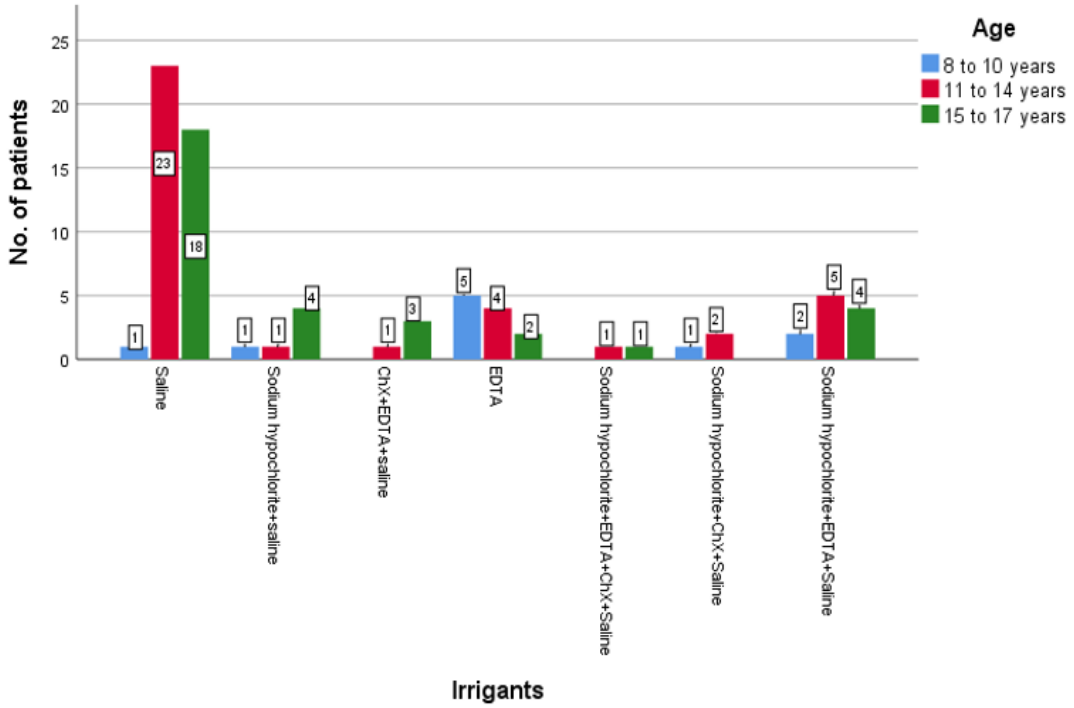

Figure 1: Bar graph showing the distribution of different age groups in the preference of root canal irrigants in single visit RCT across the scale of patient count in the y-axis and x-axis represents age prevalence

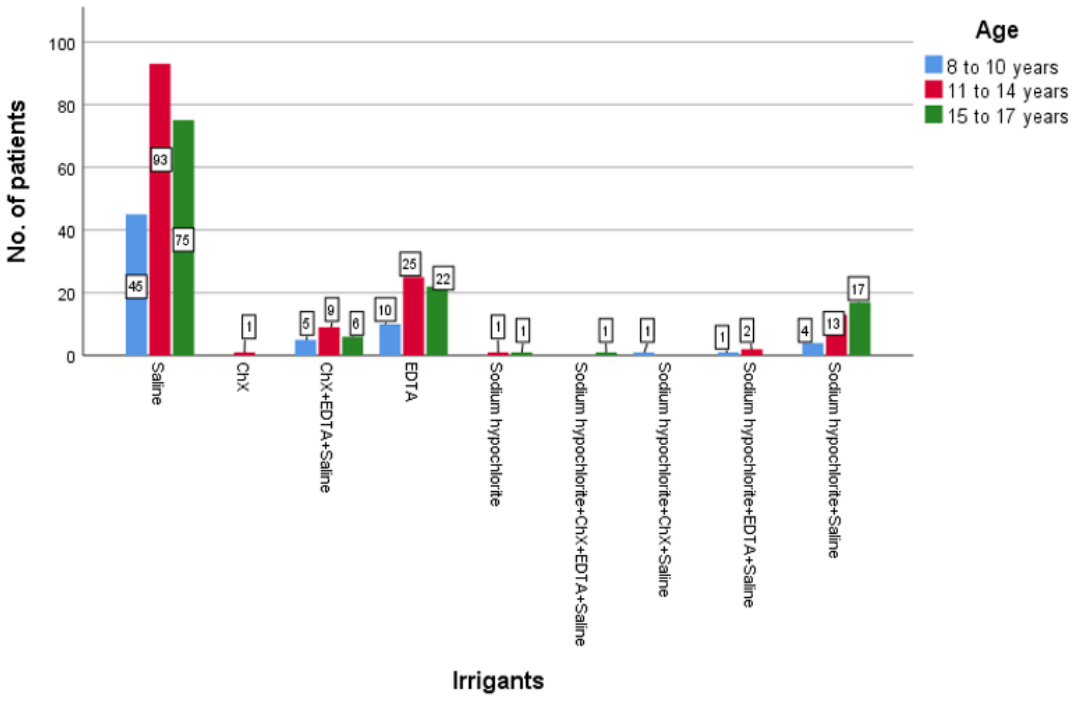

Figure 2: Bar graph showing the distribution of different age groups in the preference of root canal irrigants in multi-visit RCT across the scale of patient count in the y-axis and x-axis represents age prevalence

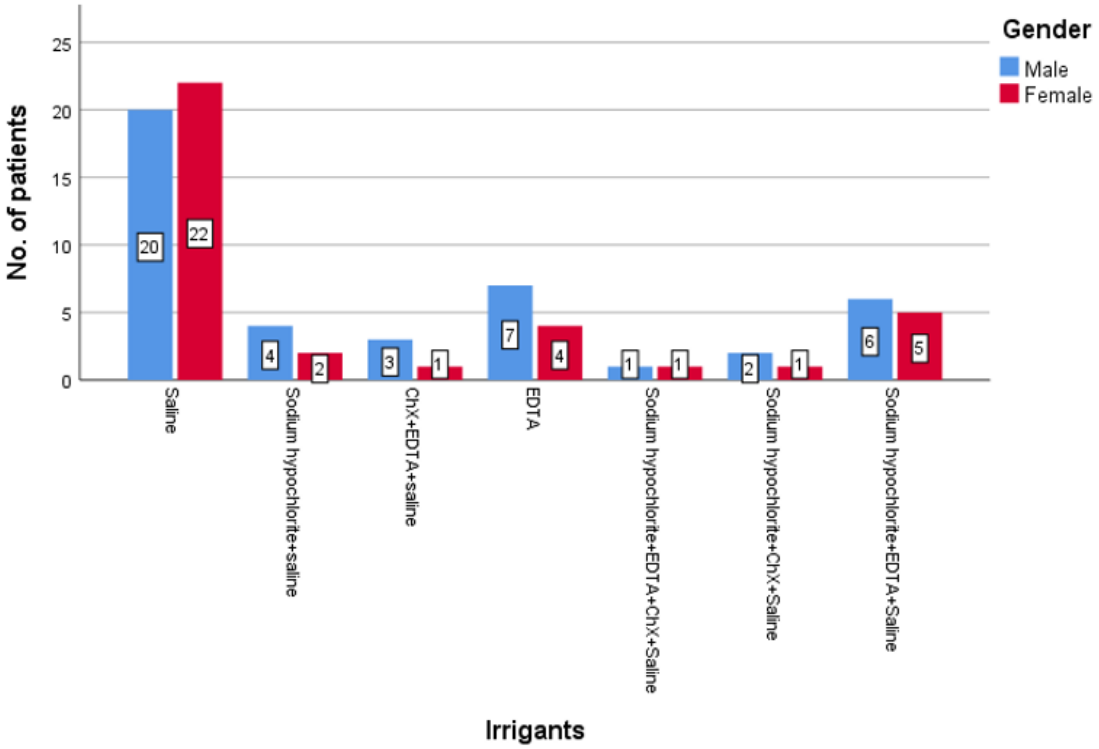

Figure 3: Bar graph showing the gender distribution in single visit RCT patients across the scale of patient count in the y-axis and gender prevalence in the x-axis

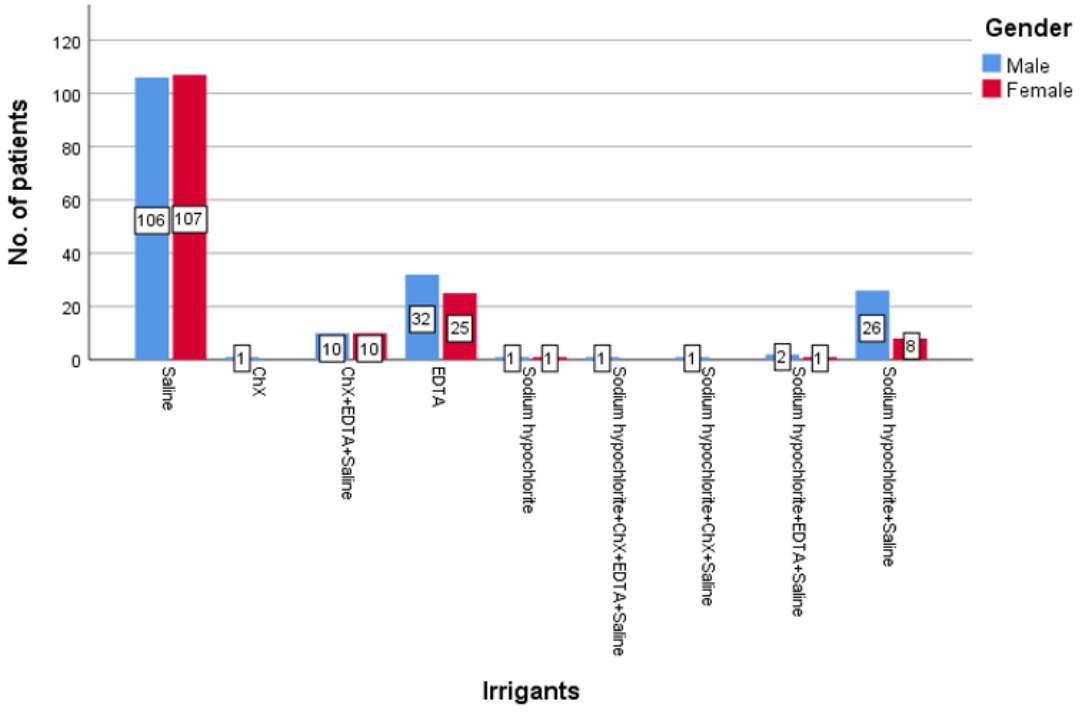

Figure 4: Bar graph showing the gender distribution in multi-visit RCT patients across the scale of patient count in the y-axis and gender prevalence in the x-axis

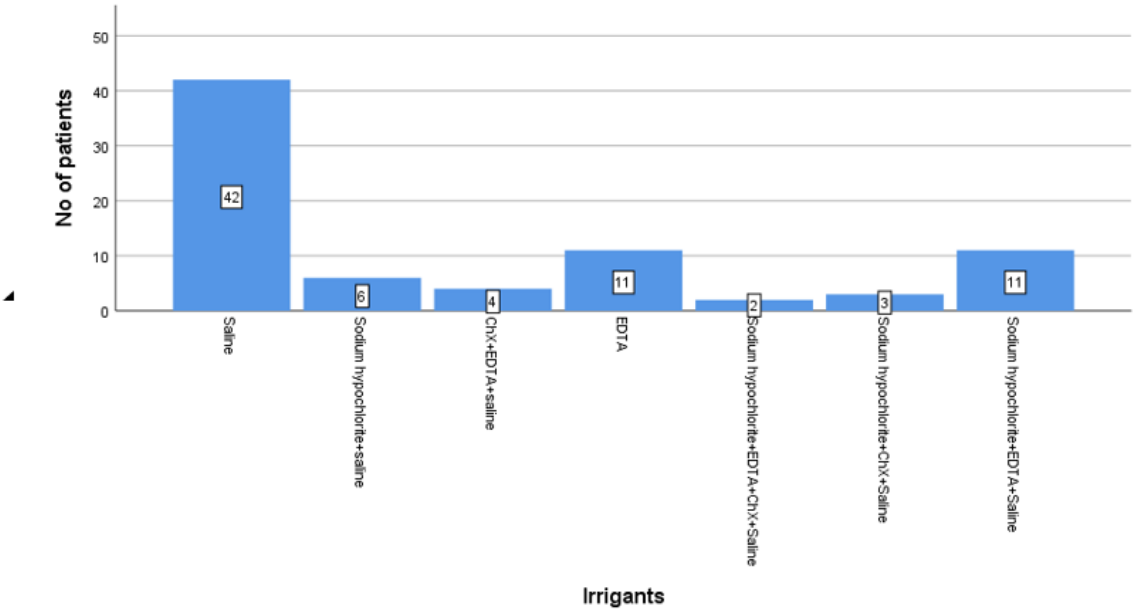

Figure 5: Bar graph showing the distribution of common root canal irrigants preferred in single visit mandibular molar RCT patients across the scale of patient count in the y-axis and canal irrigants in the x-axis

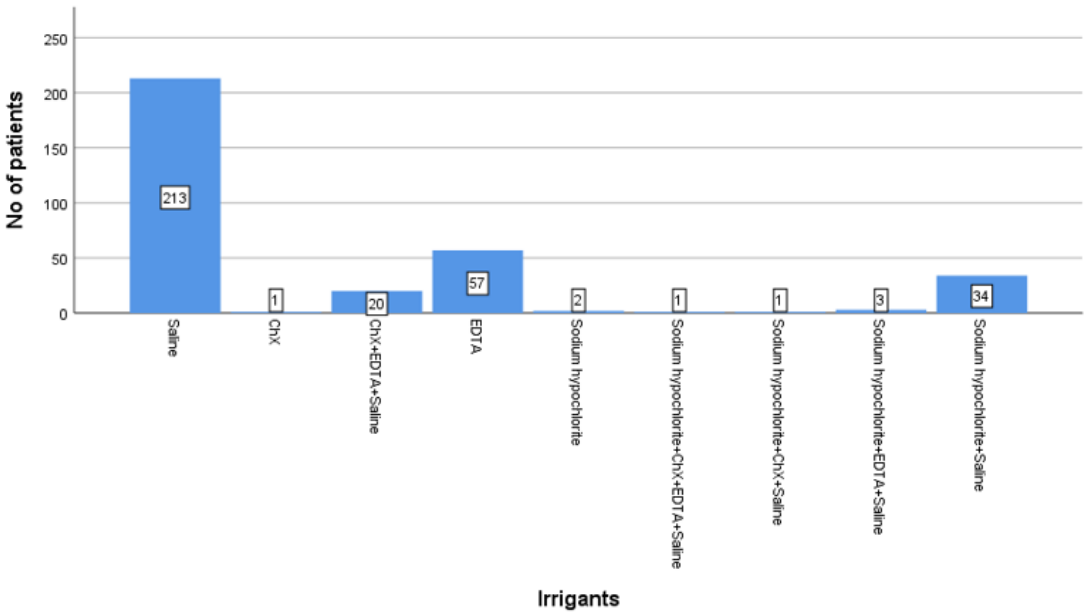

Figure 6: Bar graph showing the distribution of common root canal irrigants preferred in multi-visit mandibular molar RCT patients across the scale of patient count in the y-axis and canal irrigants in the x-axis

tial concern is the loss of necrotic primary molars leading to space loss (Jeevanandan, 2017). The retention and preservation of the primary tooth in the dental arch in its normal function and free of pathology is of utmost importance (Panchal *et al.*, 2019). The primary aim of vital root canal therapy in deciduous teeth is to debride the root canal and maintain the nonpathological state until the exfoliation of the tooth. Due to the perceived difficulty of behaviour management in the pediatric population, differences in morphology of primary and permanent teeth desired timely resorption of primary teeth, and difficulties with root canal filling materials have added to the reluctance among dentists to carry out the procedure. But to save the grossly decayed tooth, necessary root canal treatment is considered to be the best treatment of choice for primary teeth with pulp involvement.

Bacteria have long been recognised as the primary etiologic factors in the development of pulp and periapical lesions (Fuks *et al.*, 2010). The common problem in the primary dentition is the infection spreading around the apical foramen. This leads to extravasation and accumulation of the saliva within the tissue (Packiri, 2017). The primary endodontic treatment goal must thus be to optimise root canal disinfection and to prevent reinfection (Govindaraju *et al.*, 2017b). The goal of cleaning and shaping the root canals in primary teeth is to remove the organic debris in a shorter time with a better quality of obturation (Govindaraju *et al.*, 2017a,c; Nair, 2018; Lakshmanan, 2020; Jeevanandan and Govindaraju, 2018). Along with the root canal cleaning and shaping, auxiliary solutions like canal irrigants also play an essential role. It is essential to use irrigants in primary teeth because of the bizarre internal geometry and features like internal connections and horizontal anastomoses (Radeva and Radosveta, 2014).

The ideal features of a root canal irrigant include the ability to dissolve necrotic pulp remnants with a high antimicrobial spectrum and ability to prevent the formation of a smear layer. Besides, it should have no adverse effects on dentin or the sealing ability of filling materials. In our study, the irrigant commonly preferred is saline with 53.2% in a single visit and 64% in multi-visit (Figures 5 and 6). Normal saline is highly preferred as it is isotonic to body fluids. It is also said to have no side effects even when pushed into the periapical tissues with reduced postoperative pain. Sodium hypochlorite is more commonly used due to its antimicrobial properties, and it's also inexpensive, but it is highly cytotoxic. According to a previous study, sodium hypochlorite is the most preferred root canal irrigant. It has lots of beneficial properties, but it also has an unpleasant taste, odour and might damage the permanent tooth follicle.

And similarly, EDTA is more commonly used as a neutralised solution and its effective in dissolving the inorganic material. Chlorhexidine has gained popularity in endodontics due to its substantivity, and it can be used as an intracanal medicament apart from irrigating solution. No single irrigant has optimal properties; studies have reported the use of two or more solutions in a specific sequence. It would be better to use these irrigants in combinations to outweigh their drawbacks.

Due to poor oral hygiene and increased caries susceptibility, there is an increased prevalence of male patients undergoing endodontic treatment in our study. In the gender preference among the irrigant usage, saline was preferred among the female patients in single visit RCT which may be attributed to the less sensitive nature of saline, it might have gained confidence in the patients (Figure 3), and there is an equal preference of the irrigants among both male and female patients in multi-visit RCT (Figure 4). In our study, the saline irrigant preference was highly noted in the age group of 11 to 14 years in single visit RCT and 15 to 17 years in multi-visit RCT (Figures 1 and 2). This finding of correlating the age and gender distribution in the root canal irrigant preference is first data to correlate these parameters based on the best of knowledge obtained from the available data.

The main advantages of this study are the availability of data and similar ethnicity. Internal validity applies to this study. The finding of this study will have a significant impact on oral health planners to help prepare more reliable preventive and health care measures in endodontic therapy. The study provides essential information regarding the preference of root canal irrigants among different age groups and study. As this is a retrospective study, we were not able to gauge the impact of the physical and chemical properties of the irrigants and its postoperative effect on the patients. The present study includes a lesser sample size in a restricted geographic area of study which can be corroborated further with a larger population in a different ethnicity along with elaborate prospective surveys in creating awareness among the clinicians about the root canal irrigants.

CONCLUSION

Within the limits of the present study, the most commonly used irrigant for permanent molar endodontic therapy in pediatric patients is saline in both single and multi-visit RCT with a higher prefer-

ence among female patients in a single visit and equal preference in multi-visit RCT and more commonly preferred in the age group of 11 to 14 years. The knowledge of the proper choice of irrigants will increase the chance of a successful outcome of endodontic therapy with the healing of the periapical tissues.

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The authors declare that they have no funding support for this study.

Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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