

A Retrospective Analysis of the Most Frequently Root Canal Treated Tooth in Pediatric Patients Visiting a University Hospital In Chennai

Shruthi Manivannan¹, Geo Mani², Murugan Thamaraiselvan³

¹Research Associate, Dental Research Cell, ²Reader, Department of Pedodontics and Preventive Dentistry, ³Reader, Department of Periodontics, Saveetha Dental College & Hospitals, Saveetha Institute of Medical and Technical sciences, Saveetha University, 162, Poonamallee High Road, Chennai- 600 077, Tamil Nadu, India

Abstract

Aim: The aim of this study was to determine the most common permanent tooth which requires RCT in patients below 18 years of age.

Materials and methods: A retrospective cross sectional study of 581 subjects to determine the most common permanent tooth which requires RCT in patients below 18 years of age was carried out. The investigation was done to relate the permanent tooth which requires an RCT to age and gender. Chi - square test was the statistical test used for correlation in this study.

Results: Among the 581 subjects, 238 were males (41%) and 343 were females (59%); Age 6-10 years (18.42%), Age 11-14 years (69.71%), Age 15-17 years (11.88%); Mandibular right first molar (25%); 11-14 years most common age group ($p=0.063$) that underwent RCT; Higher number girls underwent RCT ($p=0.006$).

Conclusion: Thus based on analysis it was found that permanent mandibular right first molar is the most common permanent tooth which requires RCT in patients below 18 years of age and there is a female predominance seen. Mandibular first molar was the most common permanent tooth that underwent RCT in the study due to its high susceptibility to caries.

Clinical significance: This study serves as a beneficial tool for the identification of common permanent teeth undergoing an RCT which in turn can lead to implementation of correct preventive strategies and awareness among dentists as well as the general population.

Keywords: *Young permanent tooth, Pulp necrosis, Root Canal Treatment, Children, Gender.*

Introduction

Functional dentition is an important factor in the process of growth and development of the child patient,

therefore preservation of the primary, permanent teeth in a functional state is a major task in achieving good oral health in children. ^{1,2}

Corresponding Author:

Geo Mani

Reader, Department of Pedodontics and Preventive Dentistry, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, 162, Poonamallee High Road, Chennai- 600 077, Tamil Nadu, India
Email Id: geomani.sdc@saveetha.com
Contact Number: +91-7358433246.

Young permanent teeth are more often sensitive to dental caries which affect the pulpal health of teeth leading to pulp necrosis. ^{3,4} Several risk factors may affect the dental pulp: one of the most injurious agents of dental pulp is caries disease, caused by oral microorganisms. Of these factors dental caries, periodontal disease and dental trauma have been generally reported to be the major and the commonest causes of pulp necrosis and periapical periodontitis. ⁵⁻⁸

Hence the need for RCT arrives. Tooth preservation being the ultimate goal of modern dental care, RCT is an available, efficacious therapeutic strategy to retain the teeth. Root canal treatment is one of the most technically demanding procedures and a very specialised aspect in restorative dentistry requiring high level of technical skills. The main objective of the root canal treatment is to make the affected tooth/root of a tooth, a proper functional unit which is free from symptoms and pathogenesis and is biologically compatible.^{9,10} On the other hand pulpectomy is a dental procedure in which all of the material in the pulp chamber and root canal of a tooth is removed. This procedure is recommended when the pulp has an infection that cannot be resolved. Previously our team had conducted numerous clinical trials focusing on reducing post operative pain, efficient instrumentation techniques for primary tooth.¹¹⁻¹⁸ Information on reasons for and pattern of a treatment are necessary for understanding the disease, performance of previous treatment, determination of cost effectiveness and devising future facilities based on patient need.^{19,20}

It is also important to notice that the RCT treatment has invariably led to a decline in the tendency amongst dentists to extract diseased teeth, since this treatment aims at the prevention of progression of infection, preservation of normal periradicular tissues and the restoration of the treated to its proper form and function in the dental arch.²¹ Teeth loss / absence due to periodontal disease, dental caries, trauma / some genetic disorders not only affect basic oral functions but also the aesthetic appearance and quality of life.⁸ The other fact which is evident from various previous studies is that the dental awareness in the population is much less than desired. Patients usually present when they have pain or advanced stage of dental disease i.e. complicated dental diseases and periodontal diseases. The late presentation and symptomatic visits attitude has made endodontic treatment inevitable among us. Demanding treatment at late stages may relate to several psychological factors such as dental anxiety, financial costs, perceptions of need and lack of access.^{5,22} Thus there is a need to educate children and their parents on the importance of early presentation of dental clinics and the possible sequel of late presentation in terms of morbidity, cost and time.²³ With this background in mind this study also creates awareness for the dentists and the general population.

Since there were no previous studies to encounter the commonest permanent teeth which require RCT in children in the South Indian population, this study was designed to fulfill this lacunae and leads to implementation of correct preventive strategies. Previously our team had also conducted numerous clinical trials which has led to the implementation of correct preventive strategies.²⁴⁻²⁹ This research also aims for the achievement of the same.

Materials and Methods

A retrospective cross-sectional study in the hospital setting of University Hospital was conducted. All the case records of patients below 18 years of age who had undergone RCT in permanent teeth in the University Dental Hospital between June 2019 - March 2020 were included for this study and all the records of patients with any major systemic illness or special health care conditions were excluded from the study. After obtaining the ethical clearance from the institutional ethical committee board of University Dental Hospital (Ethical Approval number: SDC/SIHEC/2020/DIASDATA/0619-0320), the list of 581 the subjects who were below 18 years of age and had undergone an RCT treatment during the study period were retrieved by reviewing 7415 case sheets. The demographic and clinical data especially age, sex and teeth involved were retrieved from the Dental records. Cross verification of data was done by using the photographs available in the image gallery to avoid errors available in the case sheet. Cross verification was done by another examiner who reviewed the photographs, radiographs to reduce the data errors available in the case sheet. The main advantage of such data collection was that data was readily available and it included larger sample size and larger distribution of data. Data collected were entered into a spreadsheet and analysed subsequently using the Statistical software SPSS (Version 20). Frequency and percentage were calculated from the study variable. Descriptive statistics was used to summarise the variable in the data set. Chi square test was employed to test the association involving discrete data with the level of significance set at $p < 0.05$.

Results

A total of 581 children aged between 6-17 years of age were treated at the University Dental hospital between study periods as mentioned above. Among

these two hundred thirty eight were males (41%) and three hundred and forty three were females (59%).

With regards to teeth undergone an RCT, Table 1 indicates that the permanent mandibular right first molar is the most common permanent tooth (25%) to get treated followed by the permanent mandibular left first molar (20.7%). It was found that 186 children had undergone RCT in anterior teeth 399 in the posterior teeth region.

It was noticed from the results that a greater proportion of children who belonged to the age group of 11-14 years had undergone root canal treatment (69.7%), followed by the children in the age group of

6-10 years (18.4%) and the age group of 15-17 years (11.9%) (Figure 1) but there is no statistically significant association between age and the individual teeth that underwent RCT in this study ($p=0.063$); however mandibular right first molar is the most common tooth that has undergone an RCT in almost all age groups (Figure 3).

Another finding of this study was that the girls (59%) underwent RCT more than the boys (41%) (Figure 2) and that there is a statistically significant association observed between the gender and teeth ($p= 0.006$); it can be found that the mandibular right first molar is the most common tooth that underwent an RCT in both boys and girls (Figure 4).

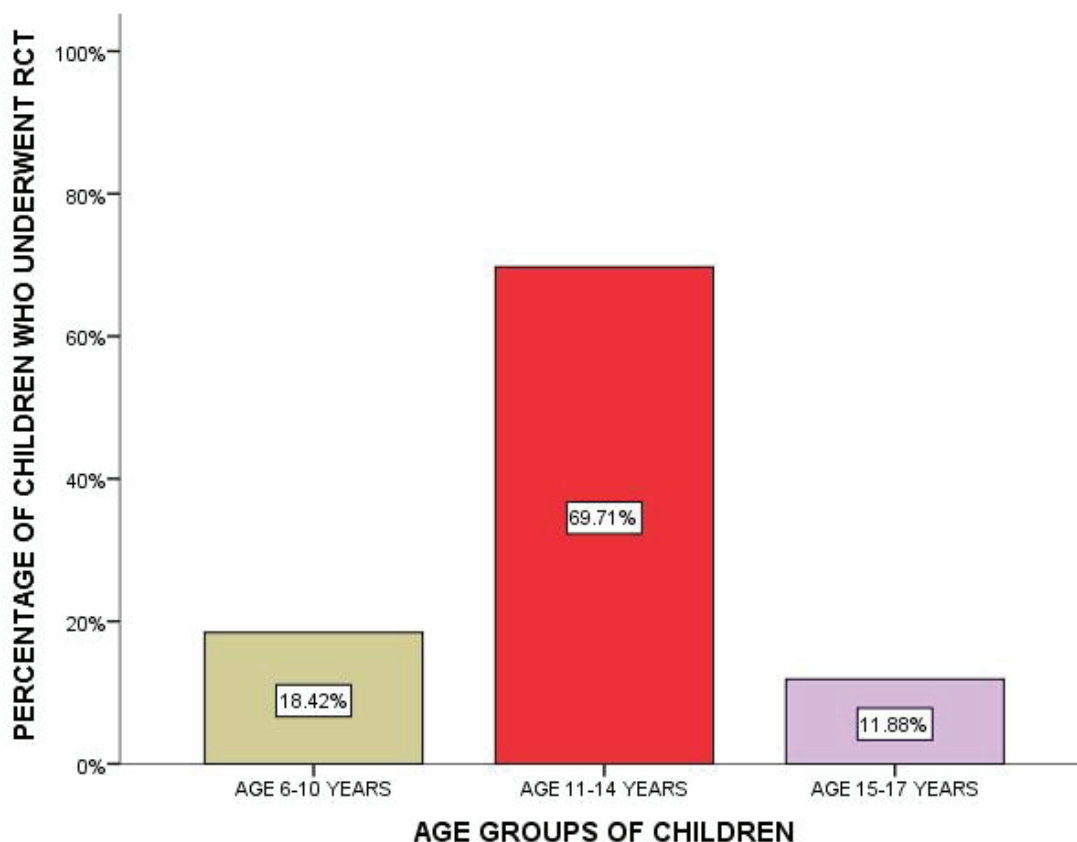


Figure 1 Image representing the frequency distribution of the different age groups that underwent RCT in the permanent teeth. X-axis shows the age groups while Y-axis shows the percentage of children who underwent RCT. Higher number of children in the age group of 11-14 years (69.71%) underwent RCT.

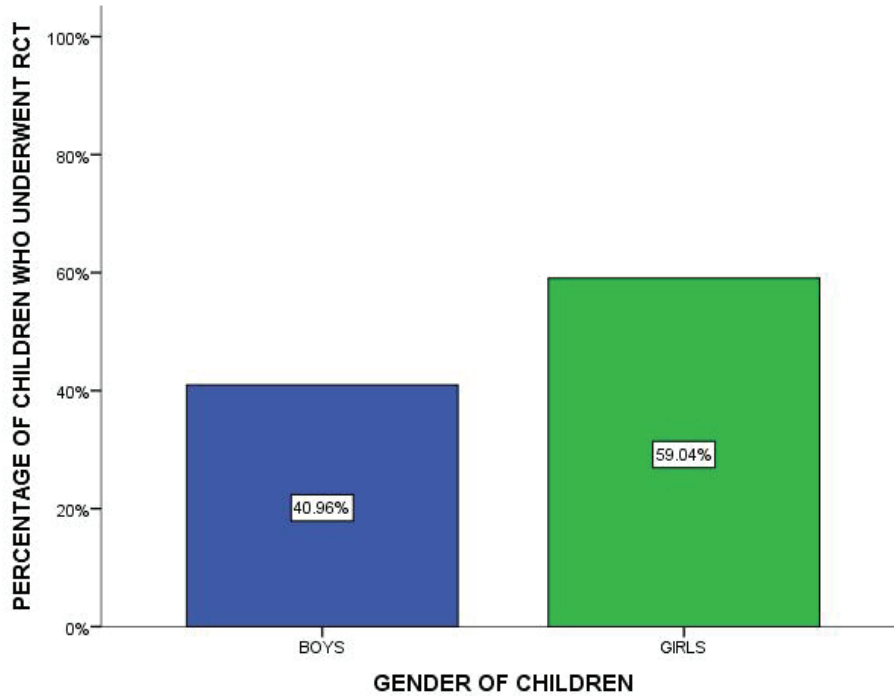


Figure 2 Image representing the frequency distribution of girls and boys who underwent RCT treatment. X-axis shows the gender while Y-axis shows the percentage of children who underwent RCT. Higher number of girls (59.04%) underwent RCT than boys.

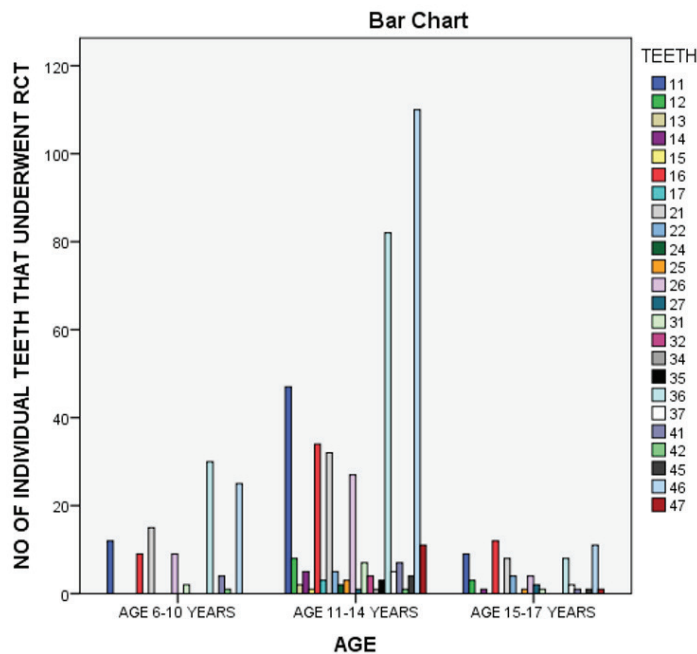


Figure 3 Image representing the association between different age groups and the RCT treated teeth. X-axis represents the age groups with tooth number in the X cluster in the FDI system of notation and Y-axis represents the number of individual teeth that underwent an RCT treatment. Chi square test was done and the association was found out to be not statistically significant. Pearson Chi-square value: 61.483, DF: 46, p value : 0.063 (>0.05) hence not statistically significant, however 11-14 years is the most common age group in which a higher number of children underwent RCT treatment in permanent teeth.

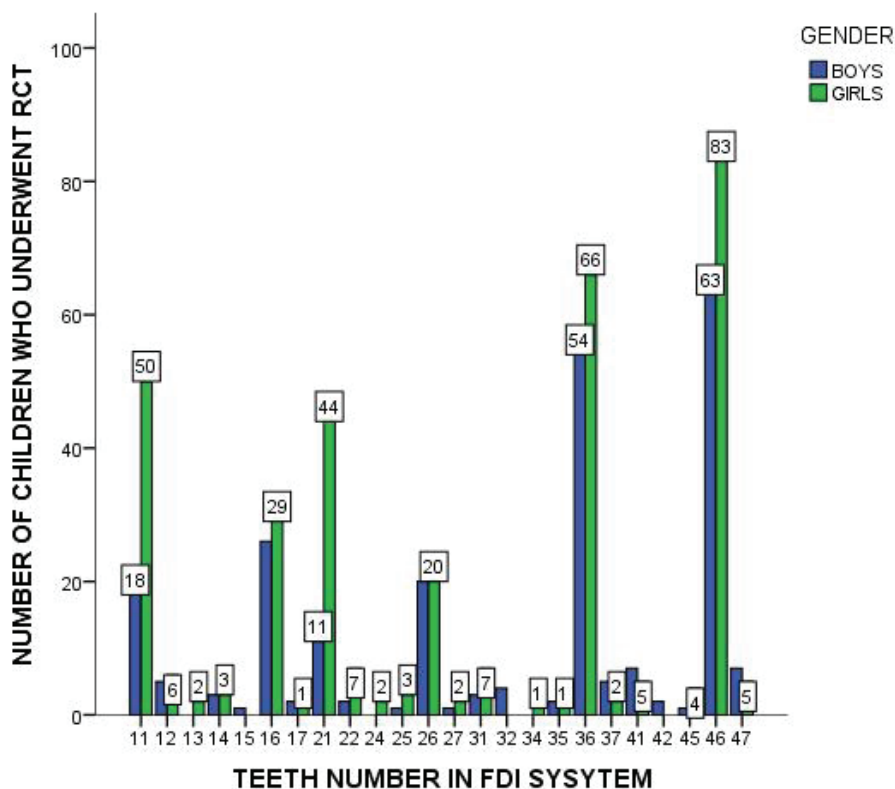


Figure 4 Image representing the association between gender and the RCT treated teeth. X- axis represents the individual tooth in the FDI system of notation and Y axis represents the number of children who underwent RCT. Blue colour represents boys and green colour represents girls. Chi square test was done and the association was found out to be statistically significant. Pearson chi-square value :43.632, DF:23, p value :0.006 (<0.05) hence statistically significant, proving that the need for root canal treatment was greater in girls compared to boys and the most frequently affected teeth were mandibular right first molar, followed by mandibular left first molar, maxillary right central incisor and maxillary left central incisor.

Table 1 Comparison of percentage distribution of different permanent teeth that underwent RCT. It can be inferred from this table that the permanent mandibular right first molar (46) is the most common tooth that underwent an RCT in children below 18 years of age (n=146, 25 %).

TEETH NO. IN FDI SYSTEM	FREQUENCY	PERCENTAGE
11/12/13	68/11/2	11.7/1.9/0.3
14/15	6/1	1/0.2
16/17	55/3	9.5/0.5
21/22	55/9	9.5/1.5
24/25	2/4	0.3/0.7
26/27	40/3	6.9/0.5

Cont ... Table 1 Comparison of percentage distribution of different permanent teeth that underwent RCT. It can be inferred from this table that the permanent mandibular right first molar (46) is the most common tooth that underwent an RCT in children below 18 years of age (n=146, 25 %).

31/32	10/4	1.7/0.7
34/35	1/3	0.2/0.5
36/37	120/7	20.7/1.2
41/42	12/2	2.1/0.3
45	5	0.9
46/47	146/12	25/2.1
TOTAL	581	100.0

Discussion

Data on the frequency and distribution of root canal treated teeth may reflect the attitude towards such treatment as well as the need and demand for it. In this study it was noted that the root canal treatment was needed mostly in the mandibular right first molar, followed by mandibular left first molars. This agrees with the findings of the study by Ridell et al. 2003.³⁰ The most probable reason for this finding was that the mandibular first molar is the first permanent tooth to erupt in the oral cavity hence it was more prone to caries. In addition the mandibular molars are more susceptible to food stagnation than the maxillary molars. Also it can be inferred that many parents may fail to recognise them as permanent teeth and thus neglect them through bad oral hygiene practices such as ineffective oral hygiene measures. Another reason for their susceptibility may be related to their period of eruption prolongation which makes oral hygiene measures ineffective. This also indicated the fact that preventive measurements for lower molars are extremely necessary.^{5,31-36} However Augusto et al., reported an occurrence of 68% of maxillary posterior treated teeth and 32% of mandibular posterior treated teeth in a study conducted in Sweden.³⁷ This could be related to the reasons such as the findings may be attributed to a particular population. However the overall consensus agrees with the findings of our current study.

Since the prominent factors necessitating RCT are caries related, it is therefore not surprising to observe the pattern of prevalence of RCT with respect to the teeth involved tends to follow the reported order of susceptibility of teeth to caries: Mandibular 1st molars; maxillary 1st molars; maxillary central incisors; maxillary lateral incisors; maxillary first and second molars; maxillary second molars; mandibular 2nd molars; maxillary and mandibular canines with mandibular central and lateral incisors being the least susceptible teeth. Similar findings were seen in the study conducted by many researchers.^{4,7,38}

About 59% of the sample population who underwent root canal treatment were females in the present study. The reason was that females had been reported to be more concerned about their oral health; hence they appeared to be better motivated to demand for oral health care and were found to attend dental services more often for various treatments than males who visit their dental professionals only when it is absolutely necessary. Another study by Ajayi et al., reported that the reason for female predominance to dental caries may be the facts of earlier tooth eruption in girls (and therefore increased time of exposure to cariogenic processes). Females may be more prone to dental caries due to excessive snacking of cariogenic food, hormonal and/or physiological differences. These may be the reasons why a larger proportion of the children who underwent root

canal treatment were females in the present study. This was in agreement with various previously conducted studies.^{19,22,39,40} Although studies by Ahmed MF et al in the year 2000 and Dadpe et al 2018 reported a higher requirement of root canal treatment in males^{10,21}. The reason suggested by them was males were physically active hence, have an increased susceptibility to falls and other forms of injuries, however Dadpe et al reported an over representation of males in their study populations. Overall consensus from various other studies also reported a higher need for endodontic treatment in females compared to males.

Another finding of this study was that, the greatest percentage of patients who received root canal treatment belonged to the age group of 11-14 years (69.7%) and was in agreement with the previous study as caries prevalence increases as age increases.^{19,41,42}

This study also found that the posterior teeth required a higher number of root canal treatments than the anterior teeth which is in agreement with the studies previously conducted.^{30,37,39} The higher incidence of maxillary central incisors (20%) being the second most RCT treated tooth in our study, can be attributed to factors such as trauma which is commoner in children. The maxillary incisors due to their location are more susceptible to injury as compared to the rest of the teeth. In addition to this, the person's aesthetic appeal could be the most attractive factor for the higher incidence of root canal therapy in maxillary incisors in this study. Similar findings are seen in the study conducted by Al - Negrish et al.,2019. Who proposed that the upper teeth appear more prominent than the lower teeth during smile making the patient more interested to preserve the upper teeth.⁴³

The strength of this study was that the records of patients seen during the period of study were used; therefore there was no issue regarding declined participation from patients and in addition there was no issue regarding improper patient selection. The weakness of the study being a retrospective study, there was no possibility for direct interactions and examinations with the patients and the study relied only on the radiographic and clinical photographs also the sample size was limited and confined to only the South Indian population. However this study will shed light

for future studies that study an even larger population. Continued advancements in the field of research can lead to the implementation of correct preventive strategies. More prospective studies can be conducted to clarify the reason for commonly undergoing RCT treatment.

Conclusion

Thus in this study it was determined that the permanent mandibular right first molar is the most common tooth which requires a root canal treatment in a patient below 18 years of age and there is statistically significant female predominance of about 59% ($p=0.006$) and the most common age group that underwent an RCT treatment was 11-14 years.

Clinical Significance

This study served as a beneficial tool for the identification of common permanent teeth undergoing an RCT. The data derived from the study is of high clinical value for evidence based practice and can be used for implementation of correct preventive strategies and imparting awareness among dentists as well as the general population.

Acknowledgements : The study was supported by the Research Department of Saveetha Dental College. We extend our gratitude to our colleagues who provided insight and expertise that greatly assisted the research.

Conflict of Interest : Nil

Ethical Approval: Ethical clearance from the institutional ethical committee board of University Dental Hospital was obtained prior to the study (Ethical Approval number: SDC/SIHEC/2020/DIASDATA/0619-0320).

Source of Funding : Self

References

1. Swift EJ, Trope M, Ritter AV. Vital pulp therapy for the mature tooth - can it work?. *Endodontic Topics* 2003;05(1): 49–56.
2. Mitsuhashi K, Takahashi K-I, Kato K, Okada H, Yatima M. Dental growth and permanent tooth caries occurrence in school children divided by family occupation. *Journal of Dental Health* 1960;10(4):290–9.

3. Gross EL, Leys EJ, Gasparovich SR, Firestone ND, Schwartzbaum JA, Janies DA. Bacterial 16S Sequence Analysis of Severe Caries in Young Permanent Teeth. *Journal of Clinical Microbiology* 2010;48(11):4121–8.
4. Aas JA, Griffen AL, Dardis SR, Lee AM, Olsen I, Dewhirst FE. Bacteria of Dental Caries in Primary and Permanent Teeth in Children and Young Adults. *Journal of Clinical Microbiology* 2008;46(4):1407–17.
5. Vejdani J, Simaei L. The Associated Factors of Permanent First Molar Caries in 7-9 Years Old Children. *Journal of Dentomaxillofacial Radiology, Pathology and Surgery* 2014;3(1):23–8.
6. Nordblad A, Larmas M. A 3-Year Longitudinal Caries Study of Permanent Tooth Surfaces at Risk in Finnish School Children. *Caries Research* 1985;19(3):271–7.
7. Halikis SE. A study of dental caries in a group of Western Australian children. Part I. The incidence of dental caries in permanent teeth. *Australian Dental Journal* 1962;7(4):465–70.
8. Oderinu OH, Shaba OP, Adegbulugbe IC. Reason for Endodontic Treatment of Permanent Teeth of Patients seen in a Nigerian Teaching Hospital. *Nigerian Quarterly Journal of Hospital Medicine* 2008;16(2):69-78
9. Umesi DC, Edionwe JI, Shaba OP. Single visit root canal treatment: A prospective study. *Nigerian Journal of Clinical Practice* 2014;17(3):276.
10. Ahmed MF, Elseed AI, Ibrahim YE. Root canal treatment in general practice in Sudan. *International Endodontic Journal* 2000;33(4):316–9.
11. Nair M, Jeevanandan G, Vignesh R, Subramanian EMG. Comparative evaluation of post-operative pain after pulpectomy with k-files, kedo-s files and mtwo files in deciduous molars -a randomized clinical trial. *Brazilian Dental Science* 2018;21(2):411.
12. Govindaraju L. Clinical Evaluation of Quality of Obturation and Instrumentation Time using Two Modified Rotary File Systems with Manual Instrumentation in Primary Teeth. *Journal of clinical and Diagnostic Research* 2017;11(3):55-58.
13. Jeevanandan G. Kedo-S Paediatric Rotary Files for Root Canal Preparation in Primary Teeth – Case Report. *Journal of clinical and diagnostic research* 2017;11(3):03-09.
14. Govindaraju L, Jeevanandan G, Subramanian EMG. Knowledge and practice of rotary instrumentation in primary teeth among indian dentists: A questionnaire survey. *Journal of International Oral Health* 2017;09(6):45-47.
15. Jeevanandan G, Govindaraju L. Clinical comparison of Kedo-S paediatric rotary files vs manual instrumentation for root canal preparation in primary molars: a double blinded randomised clinical trial. *European Archives of Paediatric Dentistry* 2018;19(4):273–8.
16. Panchal V, Jeevanandan G, Subramanian EMG. Comparison of instrumentation time and obturation quality between hand K-file, H-files, and rotary Kedo-S in root canal treatment of primary teeth: A randomized controlled trial. *Journal of Indian Society of Pedodontics and Preventive Dentistry* 2019;37(4):75.
17. Ravikumar D, Jeevanandan G, Subramanian EMG. Evaluation of knowledge among general dentists in treatment of traumatic injuries in primary teeth: A cross-sectional questionnaire study. *European Journal of Dentistry* 2017;11(2):232–7.
18. Govindaraju L, Jeevanandan G, Subramanian EMG. Comparison of quality of obturation and instrumentation time using hand files and two rotary file systems in primary molars: A single-blinded randomized controlled trial. *European Journal of Dentistry* 2017;11(2):376-9.
19. Umanah A, Osagbemi B, Arigbede A. Pattern of demand for endodontic treatment by adult patients in port-harcourt, South-South Nigeria. *J West Afr Coll Surg* 2012;2(3):12–23.
20. ElMubarak AHH, Abu-bakr NH, Ibrahim YE. Postoperative Pain in Multiple-visit and Single-visit Root Canal Treatment. *Journal of Endodontics* 2010;36(1):36–9.
21. Dadpe AM, Shah DY, Vinay V, Shetkar P. Factors Facilitating Academic Success in Dental Students After Initial Failure: A Qualitative Study. *Journal of Dental Education* 2018;82(11):1155–61.

22. Ajayi YO, Ajayi EO, Sote EO, Olatosi OO, Orenuga OO. Pattern of Endodontic Treatment in Children in a Nigerian Tertiary Hospital. *Nigerian quarterly journal of hospital medicine* 2009;19(1):47-49
23. Gurunathan D, Shanmugaavel AK. Dental neglect among children in Chennai. *J Indian Soc Pedod Prev Dent* 2016;34(2):364-9.
24. Christabel SL, Gurunathan D. Prevalence of Type of Frenal Attachment and Morphology of Frenum in Children, Chennai, Tamil Nadu. *World Journal of Dentistry* 2015;06(4):203-7.
25. Ramakrishnan M, Shukri MM. Fluoride, Fluoridated Toothpaste Efficacy And Its Safety In Children - Review. *International Journal of Pharmaceutical Research* 2018;10(5):25-29
26. Govindaraju L. Effectiveness of Chewable ToothBrush in Children-A Prospective Clinical Study. *Journal of clinical and Diagnostic Research* 2017;11(3):31.
27. Packiri S. Management of Paediatric Oral Ranula: A Systematic Review. *Journal of Clinical and Diagnostic Research* 2017;11(9):06.
28. Subramaniyam D, Gurunathan D, Gaayathri R, Vishnu Priya V. Comparative evaluation of salivary malondialdehyde levels as a marker of lipid peroxidation in early childhood caries. *European Journal of Dentistry* 2018;12(1):067-70.
29. Somasundaram S, Ravi K, Rajapandian K, Gurunathan D. Fluoride Content of Bottled Drinking Water in Chennai, Tamilnadu. *J Clin Diagn Res* 2015;9(10):32-4.
30. Ridell K, Sundin B, Matsson L. Endodontic treatment during childhood and adolescence. A survey of 19-year-olds living in the city of Malmö, Sweden. *Swed Dent J* 2003;27:83-9.
31. Nazir MA, Bakhurji E, Gaffar BO, Al-Ansari A, Al-Khalifa KS. First Permanent Molar Caries and its Association with Carious Lesions in Other Permanent Teeth. *Journal of clinical and diagnostic research* 2017;13(1):27-29
32. Zakirulla M. Prevalance of first permanent molar caries among 7-10 years old school going boys in Abha City, Saudi Arabia. *Bangladesh Journal of Medical Science* 2012;11(5):29-34.
33. Leroy R, Bogaerts K, Lesaffre E, Declerck D. Effect of Caries Experience in Primary Molars on Cavity Formation in the Adjacent Permanent First Molar. *Caries Research* 2005;39(5):342-9.
34. Srinivasan D, Louis C. Evaluation of caries in deciduous second molar and adjacent permanent molar in mixed dentition. *Journal of Pharmacy and Bioallied Sciences* 2015;7(2):572.
35. Phipps KR, Ricks TL, Blahut P. Permanent first molar eruption and caries patterns in American Indian and Alaska Native children: challenging the concept of targeting second grade for school-based sealant programs. *Journal of Public Health Dentistry* 2013;73(3):175-8.
36. Bolaños NC, Ramírez EAE, Ortiz L, Camacho D. Dental Caries Prevalence in First Permanent Molar among patients from the Universidad Cooperativa de Colombia. *Universitas Odontologica* 2014;33(70):71-75
37. Hollanda ACB, de Alencar AHG, de Araújo Estrela CR, Bueno MR, Estrela C. Prevalence of endodontically treated teeth in a Brazilian adult population. *Brazilian Dental Journal* 2008;19(4):313-7.
38. Kaur I, Singal P, Bhatnagar DP. Timing of Permanent Teeth Emergence and Dental Caries among Jatsikh Children of Public and Government Schools of Patiala District. *The Anthropologist* 2010;12(2):141-8.
39. Boykin M, Gilbert G, Tilashalski K, Shelton B. Incidence of Endodontic Treatment: A 48-Month Prospective Study. *Journal of Endodontics* 2003;29(12):806-9.
40. Tilashalski K, Gilbert G, Boykin M, Shelton B. Root Canal Treatment in a Population-Based Adult Sample: Status of Teeth After Endodontic Treatment. *Journal of Endodontics* 2004;30(8):577-81.
41. Scavo R, Lalis RM, Zmener O, DiPietro S, Grana D, Pameijer CH. Frequency and distribution of teeth requiring endodontic therapy in an Argentine population attending a specialty clinic in endodontics. *International Dental Journal* 2011;61(5):257-60.
42. Taşşöker M, Güleç M, Şener SÖ. Investigation of the frequency and distribution of teeth requiring

- endodontic treatment and endodontically treated teeth. *Yeditepe Dental Journal* 2018;14(2):19–24.
43. Abdulredah NJ, Abbas FS. Prevalence of Endodontically Treated Teeth in Baghdad Sub Population. *Indian Journal of Public Health Research & Development* 2019;10(10):2348-2351.