Type of the Manuscript- Survey

Knowledge and Awareness of Various Dental Biomaterials Used In Pediatric Patients - A Survey

Aleena Alex[1], Balaji Ganesh S[2], Lavanya Prathap[3]

[1]Research Associate, Dental Research Cell, [2]Scientist, White lab - Materials Research Centre, Lavanya Prathap, [3]Assistant Professor, Department of Anatomy, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamilnadu, India

Abstract

Restoration of decayed primary teeth is important and significant for proper maintenance of child health and also for the development of their teeth. The materials preferred for restoration are composite, glass ionomer, compomer, resin modified glass ionomer cement, stainless steel crown. Therefore it is important to have knowledge about materials and its uses which makes the durability of restoration longer. The aim of the study is to assess the knowledge and awareness of various dental biomaterials used in pediatric patients among the undergraduate dental students. A questionnaire of 12 questions based on different dental biomaterials used in pediatric patients was prepared and it responded by 140 students. Data was collected and with the help of SPSS software data was analysed. Only 9% of students were aware that pit and fissure sealants are bound to tooth surface by both chemical and mechanical bonding. Only 33% opted correctly that stainless steel crowns are semi permanent restorations. Amalgam was the most used restorative material in primary molar by both the male and female students. The material of choice for restoring primary molars with proximal caries and in multi surface carious lesions is glass ionomer cement. The students considered ease of manipulation and durability of the restorative material while selecting it for use in pediatric cases. Within the limitations of this survey, it can be concluded that the participants have an average level of knowledge about various dental biomaterials used in pediatric patients.

Keywords: *Restoration, Caries, Pulpotomy, Pediatric Dentistry, Biomaterials, Composites*

Introduction

Pediatric dentistry is related to considering the child's feeling, to gain the child's confidence and cooperation to perform the desired treatment in a kind manner. Pediatric dentists promote dental health for children as well as serve as educational resources for the parents. It plays an important role in promoting a child's future dental health by stimulating the attitude and behaviour regarding dental care.[1] Children and young adults usually are more prone to develop deep carious lesions due to the poor oral hygiene and maintenance. These carious lesions must be treated early to prevent pulpal involvement in these teeth. Despite the modern advances in prevention of dental caries and increased understanding of the importance of maintaining the natural dentition yet still many teeth are lost prematurely. The preservation of primary tooth until the eruption of the permanent successor is very important in maintaining the integrity of the arch length and form. Pulpotomy and pulpectomy are the standard methods of pulp therapy for the treatment of carious tooth, which pulpally involved in various primary teeth, it is done to stop premature exfoliation and the main objective is total elimination of all the microorganisms from the canal and prevention of re-infection.[2,3]

One of the main challenging aspects for a pediatric dentist is endodontic treatment in primary teeth. The

Corresponding author:
Balaji Ganesh S, MDS
Scientist, White lab - Materials Research Centre
Saveetha Dental College and Hospital,
Saveetha Institute of Medical and Technical Sciences,
Saveetha University,
Chennai - 600077, Tamilnadu, India
Email id:balajiganeshs.sdc@saveetha.com

key factors for successful endodontic treatment in primary teeth are diagnosis of pulp pathology and deciding the correct treatment plan. Other factors such as instrumentation technique, working length determination, obturating materials, irrigants, root canal morphology, root resorption and follow up period plays a important role in deciding the endodontic treatment is successful or not, so that the primary tooth can be saved without any further complications. As many times, the treatment done remains incomplete either due to the lacking knowledge of the dentist or due to an uncooperative child or their parents. So many dental practitioners usually prefer to extract the tooth as the desired treatment option for the primary pulpal involved tooth because of these challenges. But knowing the importance of primary teeth in maintaining the arch length and prevention of malocclusion we have to keep the pulpal involved primary teeth wherever possible and that too free from infection.[4,5]

Therefore the pulpal therapy depends on whether the pulp is vital or non vital. It depends on clinical diagnosis of normal pulp, reversible pulpitis, symptomatic and asymptomatic irreversible pulpitis or necrotic pulp. Meticulous biochemical preparation determines the success or outcomes of root canal treatment in permanent teeth and the resorble nature and antimicrobial properties of the filling materials also determine the success of pulpectomy in primary teeth.[6,7] The aim of the study is to assess the knowledge and awareness of various dental biomaterials used in pediatric patients among the undergraduate dental students.

Materialsand Methods

A cross sectional questionnaire survey was conducted to assess the knowledge and awareness of the use of biomaterials in pediatric patients with the approval of the Institutional Review Board. The questionnaire consists of 12 questions, which were distributed among undergraduate dental students of 3rd, 4th and 5th year. The questionnaire shared on the online survey platform was responded to by 140 students. Following this data entry, verification, validation in standard computer software was done in SPSS to interpret the results. Chi Square analysis was performed. P value less than 0.05 was considered to be statistically significant.

Results and Discussion

TABLE 1: Percentage distribution of responses to questions on knowledge level about restorative materials.

Questions	Responses			
What is the most important factor we consider to select the restorative material for posterior teeth in primary dentition?	49% - Easy manipulation and durability of material	22% - Patient age and cooperation of child	9% - Cavity shape, size	20% - All of the above
Pit and fissure sealants are bound to surface by?	37% - Adhesive bond	30% - Mechanical retention	23% - Chemical bond	9% - Chemical and mechanical bond
Main reason for use of tooth coloured material for posterior primary teeth.	42% - Fluoride release	25% - Longevity as good as amalgam	23% - Aesthetic superior to amalgam	10% - Tooth does not need pulp therapy
The longevity of conventional GIC in primary molar is mostly?	33% - 3yrs	26% - 2yrs	24% - 10 yrs	16% - 5 yrs

CTABLE 1: Percentage distribution of responses to questions on knowledge level about restorative materials.

Primary function of MTA is ?	36% - Pulpotomy use	35% - Root canal obturation material in primary teeth	15% - Root canal irrigant	13% -Apexification in immature traumatised pulpless tooth
Stainless steel crown is a ?	35% - Temporary restoration	33% - Semi Permanent restoration	13% -Permanent restoration	17% - None of the above

TABLE 2: Percentage distribution of responses to questions on preferences of usage of restorative materials.

Questions	**Responses**			
Restoring proximal lesion in primary molars is better with?	46% - Resin modified glass ionomer cement	27% - Conventional glass ionomer cement	18% - Composite	10% - Amalgam
Which of the following materials is referred to as 'smart material'?	40% - Flowable composites	37% - Amorphous calcium phosphate	23% - Packable composites	-
Which of the following materials is the most ideal for indirect pulp capping?	36% - Zinc oxide powder	30% - Calcium hydroxide	25% - Zinc oxide eugenol cement	8% - Zinc oxyphosphate cement
Which is the most ideal root canal filling for primary teeth?	34% - Ferric sulphate	30% - Zinc oxide eugenol	21% - Calcium hydroxide iodine mixture	13% - Gutta-percha
Which restorative material do you use most frequently in primary molar?	45% - Amalgam	29% - Composite	15% - Glass ionomer cement	10% - Compomer
Material of choice for restoring primary molars with multi surface carious lesion?	36% - Glass ionomer cement,	32% - Amalgam	21% - Stainless steel crown	11% - Composite

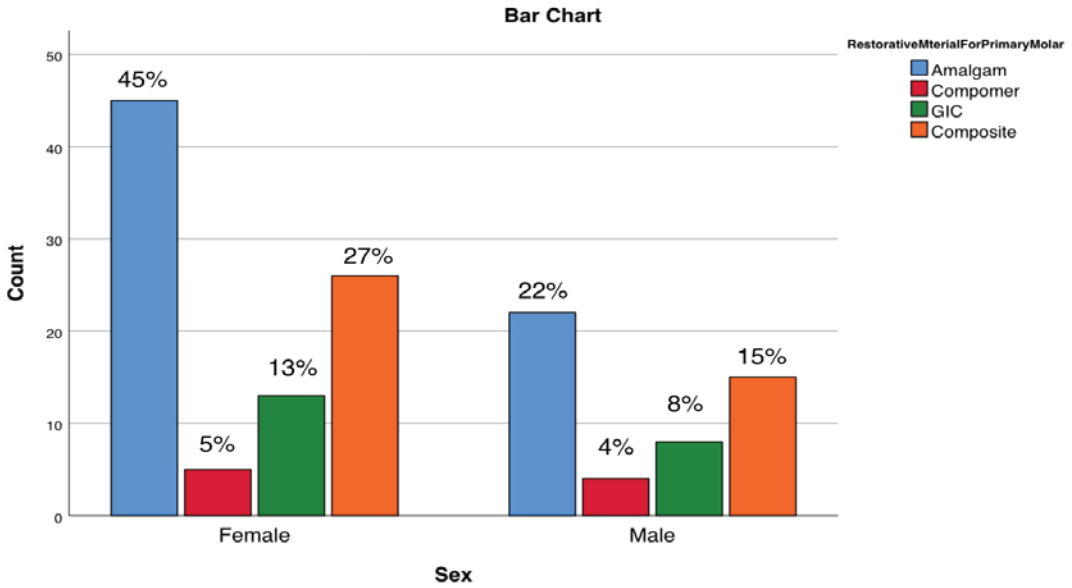

Figure 1: Bar chart represents the association between gender of students and most frequently used restorative material in primary molar. X-axis represents gender and Y-axis represents the count. Amalgam was the most used restorative material in primary molar by both the male and female students. P value = 0.897(> 0.05), hence not statistically significant.

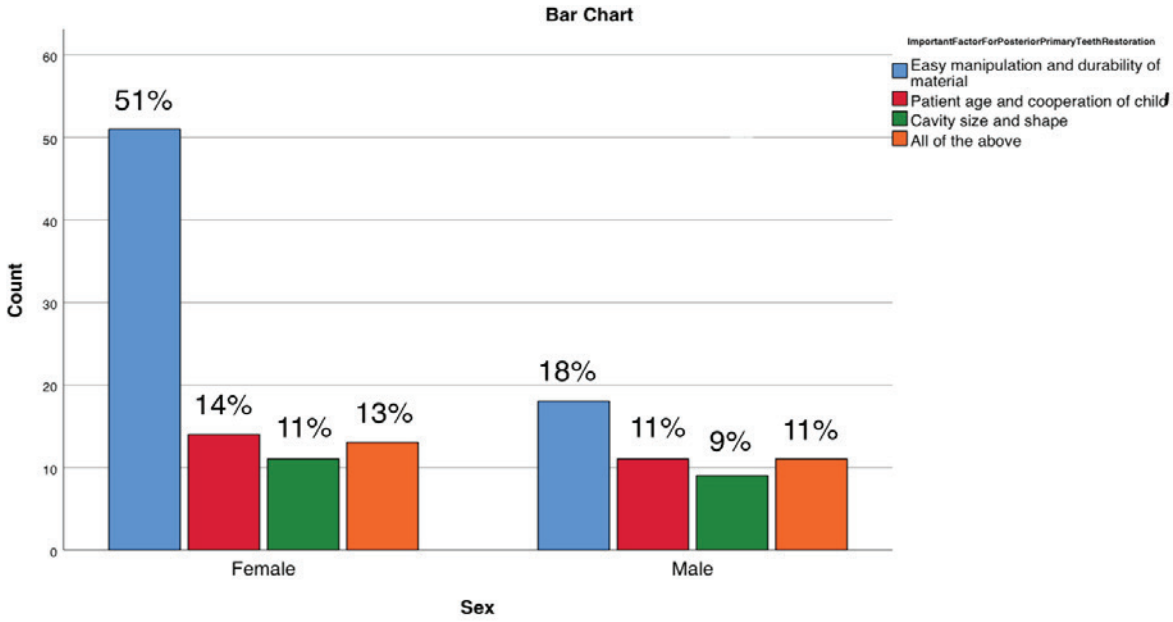

Figure 2: Bar chart represents the association between gender and important factors to consider in selecting the material for posterior teeth in primary dentition. X-axis represents gender and Y-axis represents the count. Most important factor considered was easy manipulation and durability of the material for posterior teeth in primary dentition by both the male and female students. P value = 0.144 (> 0.05), hence not statistically significant.

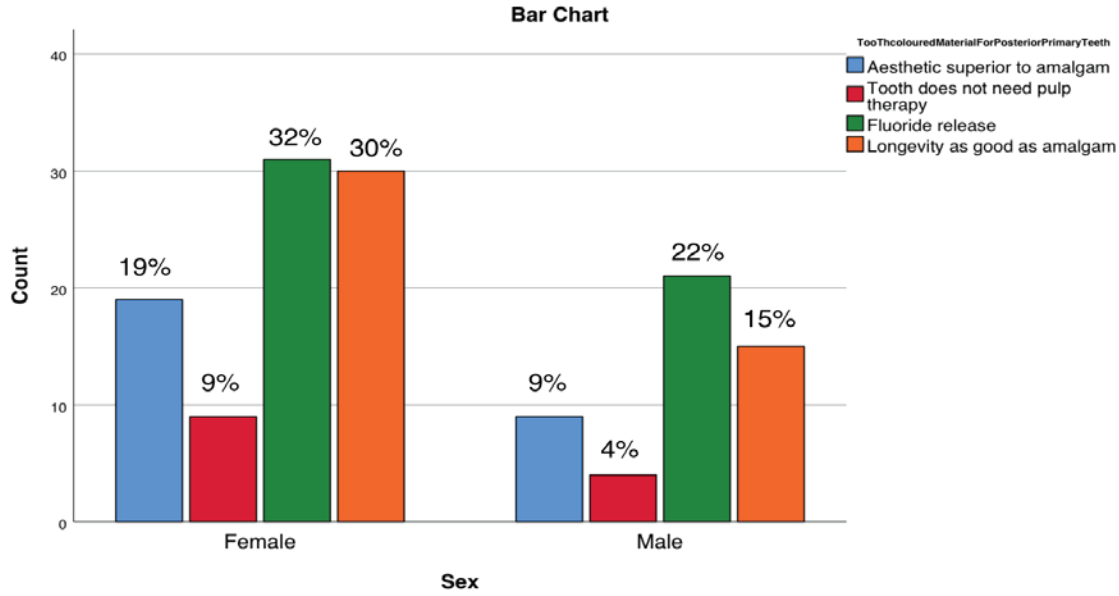

Figure 3: Bar chart represents the association between gender and reason for use of tooth coloured material for posterior primary teeth. X-axis represents gender and Y-axis represents the count. Fluoride release was the most common reason for use of tooth coloured material in posterior primary teeth by both the male and female students. P value = 0.837(>0.05), hence not statistically significant.

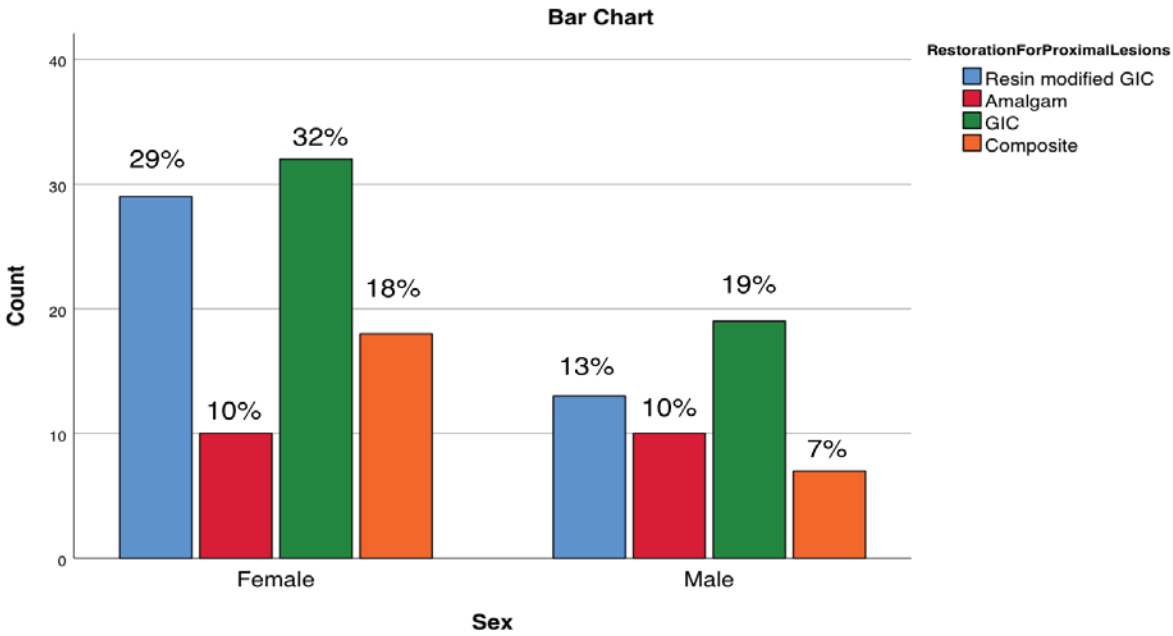

Figure 4: Bar chart represents the association between gender and restorative material used for proximal lesion in primary molars. X-axis represents gender and Y-axis represents the count. GIC was most often used for restoring the proximal lesion in primary molars by both the male and female students. Chi square analysis, P value = 0.415(>0.05), hence not statistically significant.

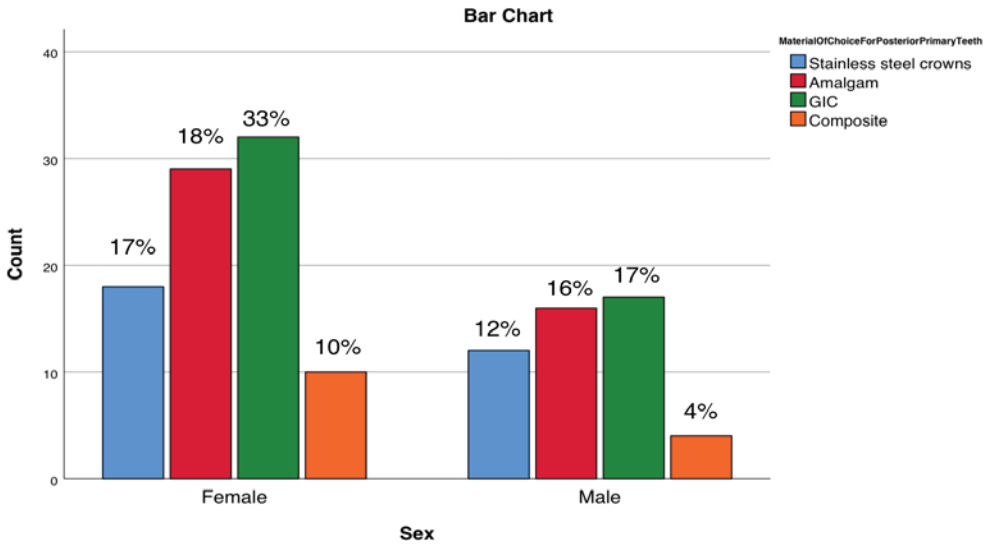

Figure 5: Bar chart represents the association between gender and material used for restoring primary molars with multi surface carious lesion. X-axis represents gender and Y-axis represents the count. GIC was the most used material for restoring primary molars with multi surface carious lesions by both the male and female students. P value = 0.901 (>0.05), hence not statistically significant.

The questionnaire was shared online and it was responded by 140 students. First set of 6 questions dealt with the knowledge level about the dental restorative materials. The results of the study have revealed that for the question about the important factors to be considered for selecting restorative material for posterior teeth in primary dentition about 49% of students chose easy manipulation and durability of material, 22% chose patient age and cooperation of child, 9% chose cavity shape, size and about 20% selected that all the above factors influence the material selection (Table 1). Only 9% of students were aware that pit and fissure sealants are bound to tooth surface by both chemical and mechanical bonding. For the reasons for the use of tooth coloured material in posterior primary teeth 42% chose fluoride release, 25% chose longevity as good as amalgam, 23% chose aesthetic superior to amalgam and 10% chose tooth does not need pulp therapy. 33% of students selected that 3 years is the longevity of conventional glass ionomer cement restorative material in primary molar, 26% selected 2 years, 24% opted for 10 years and 16% for 5 years (Table 1).

Only 33% opted correctly that stainless steel crowns are semi permanent restorations, whereas 35% think that they are temporary restoration, 13% chose permanent restoration option and 17% of study population selected none of the above. Primary function of mineral trioxide aggregate (MTA) is pulpotomy for 36% of study population, root canal obturation material in primary teeth for 35%, 15% opted as root canal irrigant and 13% as apexification material in immature traumatised pulpless tooth (Table 1).

Second set of 6 questions dealt with the preferences or the restorative materials of choice for various carious lesions, in which for restoring proximal lesion in primary molars about 46% opted for resin modified glass ionomer cement, 27% for glass ionomer cement, 18% for composite and only 10% chose amalgam. Among the total population the most used restorative material in primary molar was amalgam as 45% students selected it , 29% opted for composite, 15% for glass ionomer cement and remaining 10% for compomer (Table 2).

Material of choice for restoring primary molars with multi surface carious lesion is glass ionomer cement as 36% opted for it. 32% opted for amalgam, 21% for stainless steel crown and remaining 11% for composite. Only 37% selected correctly that the amorphous calcium phosphate is a smart restorative material. Only 30% selected calcium hydroxide as the most ideal material for indirect pulp capping. 30% selected zinc oxide eugenol as ideal root canal filling for primary teeth and 21% opted for calcium hydroxide-iodine mixture and

remaining 13% opted gutta - percha (Table 2).

The factors guiding the choice in pediatric restorations are age of the child, caries risk cooperation of the child, type of the tooth and type of material used. This is to ensure appropriate care within each materials limits because each restorative material has its advantages and disadvantages.[8] Also the cavity should be sealed so that further tooth destruction does not happen and it renders the tooth and tooth-restoration interface caries resistant. In a clinical scenario, the material selected for the procedure must survive in the extreme environment of the mouth for the period in which it is placed to be effective.[9,10]

Amalgam was the most used restorative material in primary molar by both the male and female students (Figure 1). Most important factor considered was easy manipulation and durability of the restorative material for posterior teeth in primary dentition by both the male and female students (Figure 2). Fluoride release was the most common reason for use of tooth coloured material in posterior primary teeth by both the male and female students (Figure 3). GIC was most often used for restoring the proximal lesion in primary molars by both the male and female students (Figure 4). GIC was the most used material for restoring primary molars with multi surface carious lesions by both the male and female students (Figure 5). However, all the associations were not statistically significant.

Glass ionomer cement is the restorative material which is made from calcium, strontium aluminosilicate glass powder combined with a water-soluble polymer. The components are mixed together which undergoes a setting reaction involving neutralization of the acid groups by the powdered solid glass base.[11] It has the property to stick with the tooth structure because it possesses the identical properties that will adhere to the encompassing enamel and dentin. It is used in Class I, II and V restorations.[12,13] Composite resin, the tooth colored material have completely replaced silicate cement and acrylic.[14] It is used for pit and fissure caries, occlusal surface caries extending into the dentin, Class II restorations in primary teeth, Class III, IV and V restorations in primary and permanent teeth, strip crowns in primary and permanent dentition.[15,16,17] Composite resins are the most preferred dental materials for anterior and posterior teeth. They have an important role in aesthetic and restorative dentistry. Paramount importance of composite resins is because they have an optical appearance, glossy surface and better colour stability. Different types of composite resins are conventional (Packable), flowable(Bulkfill), microfill, hybrid and fluoride releasing composites.[18] Resin-based composites are an integral component of contemporary pediatric restorative dentistry.[19,20] They can be utilized effectively for preventive resin restorations, moderate Class II restorations, Class III restorations, Class IV restorations, Class V restorations and strip crowns.[21,22,23] It has greater ability to seal the margin, which can help to prevent postoperative sensitivity and secondary caries.[24,25] The future scope is to create awareness among dental students regarding new and improved restorative materials, with better knowledge about the complex caries process and its prevention.

Conclusion

Within the limitations of this survey, it can be concluded that the participants have an average level of knowledge about various dental biomaterials used in pediatric patients. The material of choice for restoring primary molars with proximal caries and in multi surface carious lesions is glass ionomer cement. The students considered ease of manipulation and durability of the restorative material while selecting it for use in pediatric cases. Many new developments have occurred in restorative dentistry, one should develop a clear cut understanding of the unique features, strengths, weaknesses and requirements of each material available, which helps to use the right material in the right clinical situation.

Acknowledgement: The authors are very thankful to Saveetha Dental College for providing a platform to express our knowledge.

Conflict of Interest: The authors declare no potential conflict of interest relevant to this article.

Source of Funding: Self

Ethical Clearance: It is taken from "Saveetha Institute Human Ethical Committee" (Ethical Approval Number- SDC/SIHEC/2020/DIASDATA/0619-0320)

References

1. Jeevanandan G. Kedo-S Paediatric Rotary Files for Root Canal Preparation in Primary Teeth - Case Report. J Clin Diagn Res [Internet]. 2017 Mar;11(3):ZR03–5. Available from: http://dx.doi.org/10.7860/JCDR/2017/25856.9508
2. Christabel SL, Linda Christabel S. Prevalence of Type of Frenal Attachment and Morphology of Frenum in Children, Chennai, Tamil Nadu [Internet]. Vol. 6, World Journal of Dentistry. 2015. p. 203–7. Available from: http://dx.doi.org/10.5005/jp-journals-10015-1343
3. Packiri S, Gurunathan D, Selvarasu K. Management of Paediatric Oral Ranula: A Systematic Review. J Clin Diagn Res [Internet]. 2017 Sep;11(9):ZE06–9. Available from: http://dx.doi.org/10.7860/JCDR/2017/28498.10622
4. Gurunathan D, Shanmugaavel AK. Dental neglect among children in Chennai. J Indian Soc Pedod Prev Dent [Internet]. 2016 Oct;34(4):364–9. Available from: http://dx.doi.org/10.4103/0970-4388.191420
5. Govindaraju L, Gurunathan D. Effectiveness of Chewable Tooth Brush in Children-A Prospective Clinical Study. J Clin Diagn Res [Internet]. 2017 Mar;11(3):ZC31–4. Available from: http://dx.doi.org/10.7860/JCDR/2017/24238.9528
6. 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. Eur J Dent [Internet]. 2017 Jul;11(3):376–9. Available from: http://dx.doi.org/10.4103/ejd.ejd_345_16
7. Govindaraju L, Jeevanandan G, Subramanian EMG. Knowledge and practice of rotary instrumentation in primary teeth among indian dentists: A questionnaire survey [Internet]. Vol. 9, Journal of International Oral Health. 2017. p. 45. Available from: http://dx.doi.org/10.4103/jioh.jioh_4_17
8. Somasundaram S. Fluoride Content of Bottled Drinking Water in Chennai, Tamilnadu [Internet]. Journal Of Clinical And Diagnostic Research. 2015. Available from: http://dx.doi.org/10.7860/jcdr/2015/14691.6594
9. Govindaraju L, Jeevanandan G, Subramanian E. Clinical Evaluation of Quality of Obturation and Instrumentation Time using Two Modified Rotary File Systems with Manual Instrumentation in Primary Teeth. J Clin Diagn Res [Internet]. 2017 Sep;11(9):ZC55–8. Available from: http://dx.doi.org/10.7860/JCDR/2017/30069.10602
10. 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. Eur J Dent [Internet]. 2017 Apr;11(2):232–7. Available from: http://dx.doi.org/10.4103/ejd.ejd_357_16
11. Panchal V, Jeevanandan G, Subramanian E. 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. J Indian Soc Pedod Prev Dent [Internet]. 2019 Jan;37(1):75–9. Available from: http://dx.doi.org/10.4103/JISPPD.JISPPD_72_18
12. Subramanyam D, Gurunathan D, Gaayathri R, Vishnu Priya V. Comparative evaluation of salivary malondialdehyde levels as a marker of lipid peroxidation in early childhood caries. Eur J Dent [Internet]. 2018 Jan;12(1):67–70. Available from: http://dx.doi.org/10.4103/ejd.ejd_266_17
13. 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 [Internet]. Vol. 19, European Archives of Paediatric Dentistry. 2018. p. 273–8. Available from: http://dx.doi.org/10.1007/s40368-018-0356-6
14. Ramakrishnan, Mahesh & Shukri, M.M.. (2018). Fluoride, Fluoridated Toothpaste Efficacy And Its Safety In Children - Review. International Journal of Pharmaceutical Research. 10. 109-114. Available from: http://dx.doi.org/10.31838/ijpr/2018.10.04.017
15. 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 [Internet]. Vol. 21, Brazilian Dental Science. 2018. p. 411. Available from: http://dx.doi.org/10.14295/bds.2018.v21i4.1617
16. Moorrees CF, Sisson WR, Peckos PS, Christie RG, Baldwin DC Jr. Need for collaboration of pediatrician and orthodontist. Pediatrics [Internet]. 1962 Jan;29:142–7. Available from: https://www.ncbi.nlm.nih.gov/pubmed/14475735

17. W.c.d., W. CD. The complete pediatrician [Internet]. Vol. 60, The Journal of Pediatrics. 1962. p. 320. Available from: http://dx.doi.org/10.1016/s0022-3476(62)80054-7

18. Brudney D. Practical Wisdom, Rules, and the Parent–Pediatrician Conversation [Internet]. Vol. 142, Pediatrics. 2018. p. S193–8. Available from: http://dx.doi.org/10.1542/peds.2018-0516k

19. Jr. ELL, Lach EL, Jr. Diamond, Louis K. (1902-1999), pediatrician [Internet]. American National Biography Online. 2001. Available from: http://dx.doi.org/10.1093/anb/9780198606697.article.1202108

20. Murthy GA, Mohandas U. The knowledge, attitude and practice in prevention of dental caries amongst pediatricians in Bangalore: A cross-sectional study [Internet]. Vol. 28, Journal of Indian Society of Pedodontics and Preventive Dentistry. 2010. p. 100. Available from: http://dx.doi.org/10.4103/0970-4388.66747

21. Chandan GD, Mohandas U. Knowledge, attitude and practice in emergency management of dental injury among physical education teachers: A survey in Bangalore urban schools [Internet]. Vol. 27, Journal of Indian Society of Pedodontics and Preventive Dentistry. 2009. p. 242. Available from: http://dx.doi.org/10.4103/0970-4388.57660

22. Viswanath D, Krishna A. Correlation between dental anxiety, sense of coherence (SOC) and dental caries in school children from Bangalore North: A cross-sectional study [Internet]. Vol. 33, Journal of Indian Society of Pedodontics and Preventive Dentistry. 2015. p. 15. Available from: http://dx.doi.org/10.4103/0970-4388.148962

23. Ferreira M, Frazao J, Machado L. Dental erosion in schoolchildren and associated factors: A cross-sectional study [Internet]. Vol. 36, Journal of Indian Society of Pedodontics and Preventive Dentistry. 2018. p. 113. Available from: http://dx.doi.org/10.4103/jisppd.jisppd_1041_17

24. Utreja D, Tewari A, Chawla HS. A study of influence of sugars on the modulations of dental plaque pH in children with rampant caries, moderate caries and no caries [Internet]. Vol. 28, Journal of Indian Society of Pedodontics and Preventive Dentistry. 2010. p. 278. Available from: http://dx.doi.org/10.4103/0970-4388.76158

25. Kumar V, Shivanna V, Kopuri R. Knowledge and attitude of pediatricians toward digit sucking habit in children [Internet]. Vol. 37, Journal of Indian Society of Pedodontics and Preventive Dentistry. 2019. p. 18. Available from: http://dx.doi.org/10.4103/jisppd.jisppd_136_18