Prevalence of Nance Space Maintainer as a Treatment Modality among Children between the Age Group of 6-10 Years

Keerthiga Nagarajan

[1]Research Associate, Saveetha Dental College and Hospitals, [2]Reader, Department of Pedodonticsm, India, [3]Senior Lecturer, Department of Public Health Dentistry Saveetha Dental College and Hospitals Saveetha Institute of Medical and Technical Sciences Saveetha University, Chennai, India

Abstract

The early loss of deciduous teeth may lead to a decrease in arch length and result in crowding, rotation, and impaction of the succedaneous teeth. Space management plays a pivotal role in preventing these malocclusions. This study aims to assess the prevalence of Nance space maintainers among children between the age group of 6-10 years in Chennai. A retrospective cross-sectional study was conducted using the patient records from June 2019 to April 2020, and children who underwent space maintainer therapy were selected by non-probability sampling. Data was collected and then subjected to statistical analysis using Statistical Package for Social Science for Windows (version 20.0, SPSS Inc., Chicago Ill., USA). The prevalence of nance space maintainer among 6-10 year old children was found to be 76.5%, with most of them being delivered to 8 year olds. More males than females underwent nance space maintainer therapy. 53.85% of the 6-10 year olds receiving nance space maintenance therapy were found to be treated by the post graduate students ($p>0.05$, statistically not significant). The prevalence of nance space maintainer as a treatment option among the mixed dentition phase in this study seems to be high when compared to other studies. Considering the limitations of the nance appliance, extensive research needs to be done to find alternatives to nance space maintainer therapy and to spread awareness among dentists on the necessity of such further advancements.

Keywords: *Preventive orthodontics, Space maintainer, Nance appliance, Mixed dentition, Space management*

Introduction

The guidance of eruption and proper development of the primary, mixed, and permanent dentitions is a fundamental element of comprehensive oral health care for all pediatric patients[1]. It must contribute to the development of a permanent dentition that is stable, functional, and esthetically acceptable and subsequent normal dentofacial development[2]. Timely diagnosis and prompt treatment of developing malocclusions can have both short-term and long-term advantages while attaining the orthodontic goals of functional efficacy, structural balance and esthetic harmony[3].

Preventive orthodontics is defined as "*the action taken to preserve the integrity of what appears to be a normal occlusion at a specific time*". Early recognition of a future problem forms the basis of preventive orthodontics. One of the major challenges in Paediatric dentistry is the management of space loss due to the premature loss of primary teeth[4]. Any interruption in the sequence of transition from deciduous to permanent dentition leads to an occlusion that is not functionally stable and esthetically pleasing. Hence, there exists

Corresponding Author:
Ganesh Jeevanandan
Reader, Department of Pedodontics
Saveetha Dental College and Hospitals Saveetha Institute of Medical and Technical Sciences
Saveetha University 162, PH Road, Chennai 600077
Tamil Nadu, India
Contact no : +91 9884293869
Email id: ganesh.sdc@saveetha.com

a need to prevent such malocclusions at the primary stages in order to benefit the patient's functional as well as psychological development[5]. Space maintenance is concerned with the maintenance of space that is lost by the early loss of a primary tooth by means of a passive appliance or by means of gaining the space that is lost. Numerous appliances can be used for space maintenance based on the patient's age, growth and development of dental arches and patient compliance[6]. Space maintainers may potentially eliminate the ill consequences of early loss of primary teeth and the need for complex orthodontic treatment at a later stage[7].

Maintenance of the primary second molar space is key for guiding the eruption of the first permanent molar, else it may lead to mesial migration, space loss and reduction in arch length. It is particularly imperative when the leeway space is paramount to treat any crowding or in order to preserve the midline[8]. Conventionally, the treatment of choice for maxillary loss is the Nance appliance. The nance appliance (NA) is a modification of the maxillary lingual arch and was described by Nance in 1947. It has ever since been the conventional treatment choice for premature loss of deciduous maxillary posteriors. The NA does not contact the anterior teeth, but approximates the anterior palate. The palatal portion has an acrylic button incorporated in it that provides resistance to anterior movement of the posterior teeth. The molar bands are connected to the acrylic button using a 0.9 mm round stainless-steel wire [9-10].

Though the nance appliance is widely used, it has many limitations including soft tissue irritation, which is of major concern. Bacterial and food debris accumulation often leads to palatal inflammation and pain. The acrylic button may get embedded in the soft tissue in case of palatal tissue hypertrophy from poor oral hygiene or distortion of the appliance[11]. This study sheds light on the current scenario of the nance appliance as a treatment modality in the early mixed dentition phase by assessing the prevalence of Nance space maintainer as a treatment modality among children between the age group of 6-10 years in Chennai.

Materials and Methods

Study Design and Setting

This pilot retrospective study examined the records of 100 patients from June 2019-April 2020. Ethical approval was obtained from the Institutional Ethics Committee. The study population included children who underwent nance space maintainer treatment by means of non-probability sampling. Children with mental or physical disability, unable to maintain oral hygiene and children with active lesions were excluded from the study.

Data Collection

Out of the patient records, 13 patients were identified to be undergoing nance appliance therapy. Relevant data such as patient age, sex and operator qualification was recorded. Repeated patient records and incomplete records were excluded. Data was verified by an external reviewer.

Statistical Analysis

Data was recorded in Microsoft Excel/2016 (Microsoft office 10) and later exported to the Statistical Package for Social Science for Windows (version 20.0, SPSS Inc., Chicago Ill., USA) and subjected to statistical analysis. Chi square test was employed with a level of significance set at $p<0.05$.

Results and Discussion

The final dataset consisted of 13 patients of Indian origin undergoing nance appliance therapy. The mean age for NA treatment was 6.35 years (standard deviation = 1.579 years). The age group associated with the greatest prevalence of NA as a treatment option was 8 years, followed by 6 and 7 years (Table 1, Figure 1). The prevalence of NA among 6-10 year olds as a treatment modality was found to be 76.5%.

61.5% of the children receiving NA therapy were males showing a male dominance (Figure 2).

Among the NA delivered to the 6-10 year old age group, 53.8% were delivered by PG students and 46.2% of them were delivered by UG students (Figure 3).

There was no statistically significant difference between the operator's qualification and the age groups receiving NA therapy ($p=0.557$). Most of the NA was delivered by both PG students and UG students equally. 23.08% of NA was delivered to 6 years old by PG

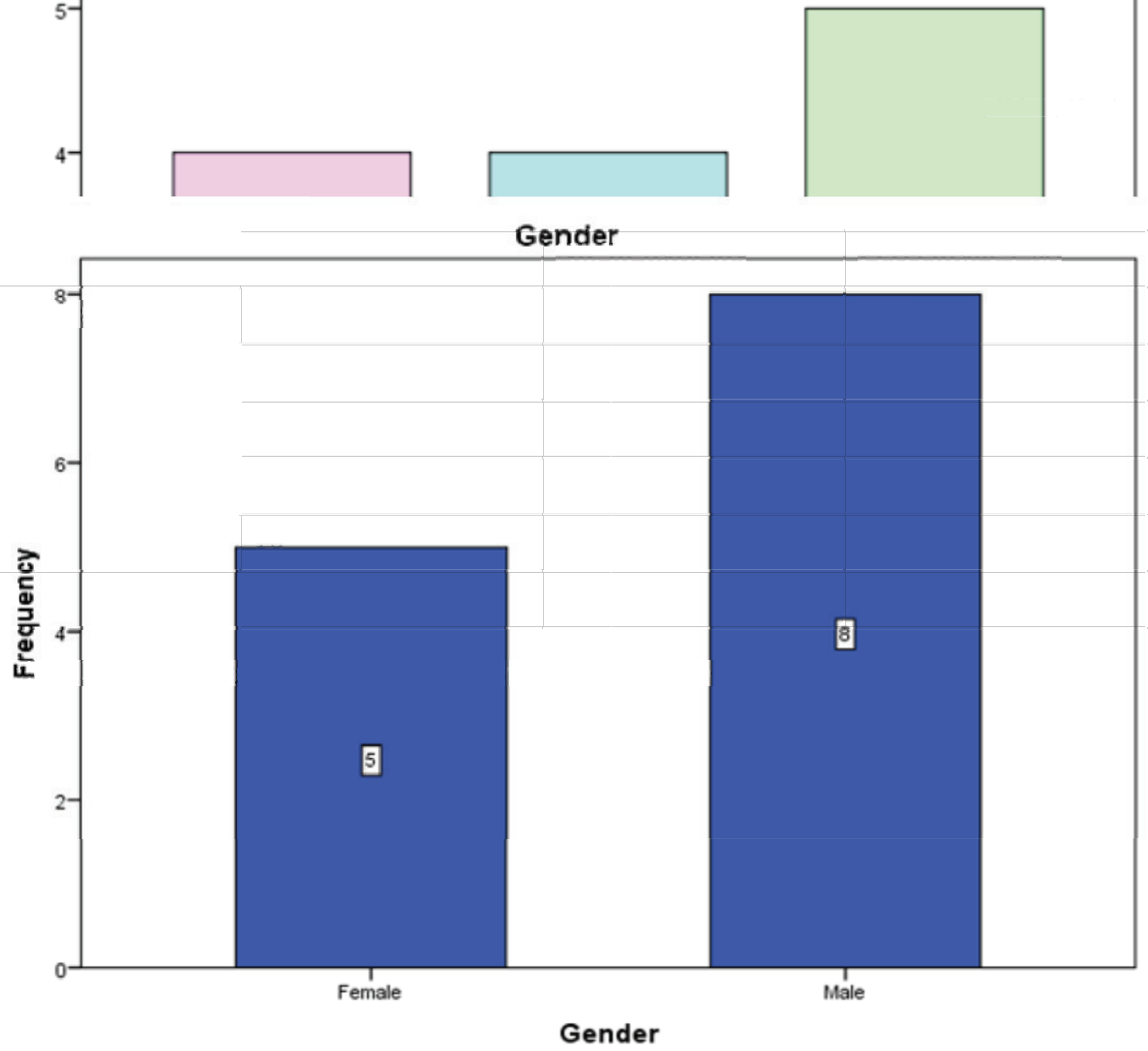

Figure 2: Bar graph depicts the gender distribution of children receiving NA treatment. X axis represents the gender and Y axis depicts the number of NA delivered. 61.5% were males and 38.5% were females.

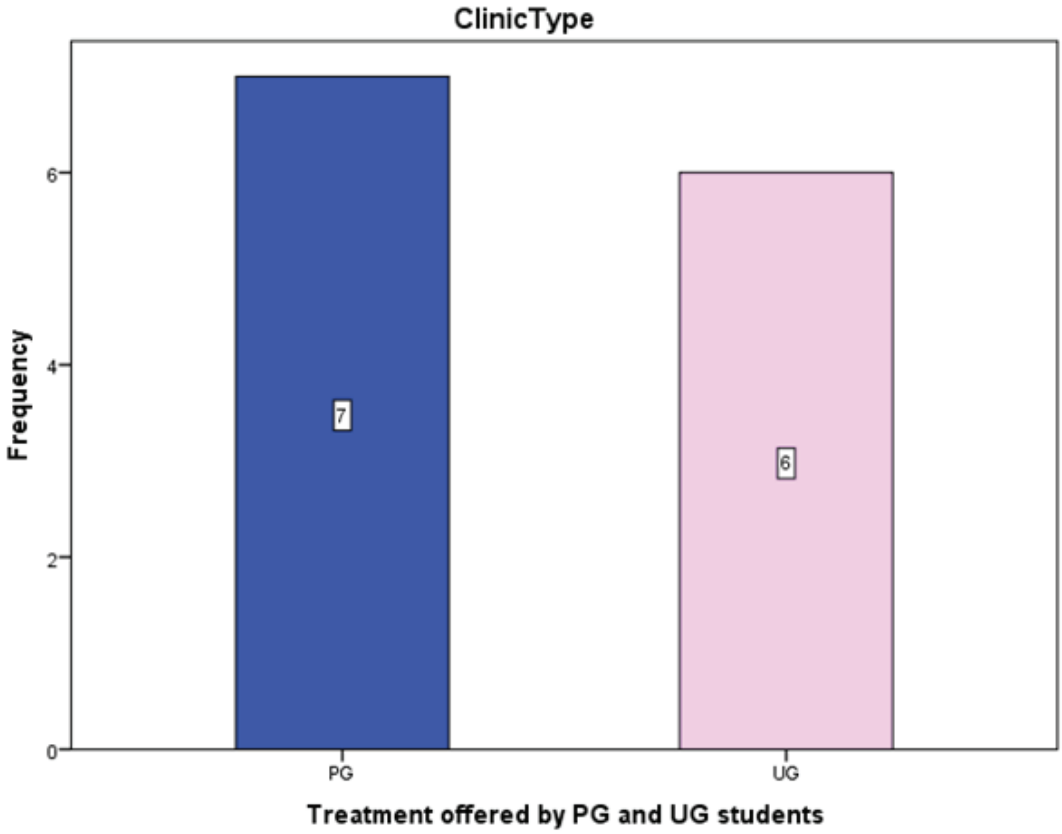

Figure 3: Bar graph depicts the operator qualification of those who delivered NA. X axis represents the operator qualification and Y axis depicts the number of NA delivered. Blue color denotes the PG students and pink color denotes the UG students. 53.8% of NA was delivered by PG students, 46.2% of NA was delivered by UG students.

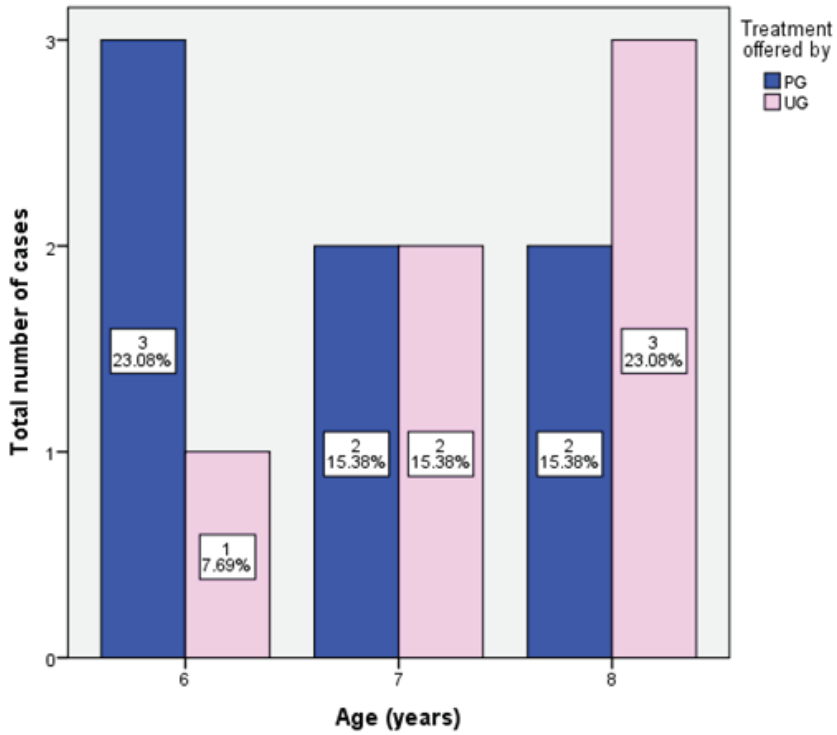

Figure 4: Bar chart depicts the association between operator qualification and the age groups treated with NA. X axis depicts the age groups and Y axis depicts the number of NA delivered. The blue color indicates the NA delivered by PG students and the pink color indicates the ones delivered by UG students. 23.08% of NA was delivered to 6 years old by PG students and 23.08% delivered by UG students to 8 years old. The least number of NA delivered was by UG students to 6 years old children. However, there was no statistically significant difference between operator qualification and the age groups to which NA was delivered. (Chi square test, p=0.557- not statistically significant)

The data for this retrospective study was based on residents of Chennai seeking treatment at Saveetha Dental College. Currently, there are no existing studies investigating the prevalence of nance space maintainer as a treatment modality among the children with mixed dentition phase in Chennai. Since all the data available was included without a sorting process, no bias was expected in the selection of patients. The current study aims to shed light on the current scenario of nance appliance as a treatment modality in the early mixed dentition phase, which is the golden time for prevention of malocclusions as described in literature[12].

In a study by Kumar et al,[13] it has been established that children belonging to the age group of 5-12 years in Chennai are more prone to dental caries. In another study by Jayashri Prabakar et al,[14] it has been proven that primary dentition is more prone to dental caries and there exists a need for treatment at its earliest possible stage [15–26]. This explains the higher prevalence of NA treatment among 6-10 year olds in this study, particularly the 8-year olds. The parent's encouragement and active participation in the child's oral health care are crucial in influencing the dental health of the child[27].

There exists a wide variation in the prevalence of malocclusion in Indian population, ranging from 20-43%, which may be due to disparities in ethnicity and nutritional status[28]. A study by Rajendra Reddy et al [29] showed 52% of the 6-10 year olds in Nalgonda had malocclusions. The most common reason for these malocclusions being premature loss of deciduous teeth due to dental caries[14]. The study by Danalakshmi Jayachandar et al [30] showed that 34.46% of 5-10 year old children in Chennai had early loss of primary teeth with boys showing an increased incidence of 54.64%. The most common missing tooth in the study carried out by Danalakshmi Jayachandar et al was found to be the first molar (43.8%) followed by second molars (33.2%). The study also showed a greater prevalence for early loss of primary teeth was among the age group of 8–9 years, which is similar to the results of the study. The probable reason for this similarity is that both the studies have been carried out in the same geographical location.

There exists a male predilection for NA therapy in the current study. This may be due to the fact that males are more prone to early exfoliation of primary teeth as established by previous literature. It has been established that males are more prone to traumatic injuries as well as dental caries[31]. This may be attributed to a variety of reasons. One of the reasons being an increased feeding in male children by mothers due to their preference of a male child than a female child, especially in India, leading to an increased susceptibility to dental caries[32]. An increased male predominance may also be due to differences in diet, geographical location, cultural differences, especially in a country like India that believes in an ancient belief of male priority [27,33-34].

In the current study, the prevalence of NA among 6-10 year olds was found to be 76.5%, with most of them being delivered by postgraduate students,[35] probably because of their higher clinical experience aiding them in treatment planning, course requirements and superior clinical skills. The prevalence of NA therapy in this study seems to be higher when compared to previous literature[6]. The study by Qudeimat MA et al [36] at a pediatric dental clinic in the UK showed a 11% prevalence of NA. Another study by Baroni et al [37] also showed a low prevalence of 31.15% for NA therapy. The current study is also not coherent with the low prevalence NA in the study by H. Shamsaddin et al [38] but is coherent in terms of the male predominance.

Despite the popularity of the nance appliance, it has many drawbacks including soft tissue irritation, which is of foremost concern. Bacterial and food debris accumulation often leads to palatal inflammation and pain. Poor oral hygiene or distortion of the appliance may result in the embedding of the acrylic button in the soft tissue because of palatal tissue hypertrophy.

Hence, other appliances like the Transpalatal arch came into use[11]. The current study shows that despite its drawbacks, NA is continuing to be used as a popular treatment modality for mixed dentition patients in Chennai in the prevention of malocclusions. This suggests the need to spread awareness amongst dentists in India on the disadvantages of the NA and encourage the use of alternative treatment modalities.

Conclusion

Within the limitations of this study, it was found that the prevalence of nance space maintainer as a treatment modality among the children between 6-10 years in Chennai seems to be higher when compared to literature from other countries. Considering the deleterious side effects of using the NA, it can be concluded that there exists a paramount need for more extensive research to be done in this area to find alternatives for NA therapy and to spread awareness among dentists in India on the dire necessity of such further advancements.

Acknowledgement: The authors thank everyone who enabled us to carry out this study.

Conflicts of Interest: Nil

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

References

1. Woodside DG. The significance of late developmental crowding to early treatment planning for incisor crowding. Am J Orthod Dentofacial Orthop [Internet]. 2000 May;117(5):559–61. Available from: http://dx.doi.org/10.1016/s0889-5406(00)70199-5
2. Kurol J. Early treatment of tooth-eruption disturbances. Am J Orthod Dentofacial Orthop [Internet]. 2002 Jun;121(6):588–91. Available from: http://dx.doi.org/10.1067/mod.2002.124173
3. Sankey WL, Buschang PH, English J, Owen AH. Early treatment of vertical skeletal dysplasia: The hyperdivergent phenotype [Internet]. Vol. 118, American Journal of Orthodontics and Dentofacial Orthopedics. 2000. p. 317–27. Available from: http://dx.doi.org/10.1067/mod.2000.106068
4. 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
5. 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
6. Ramakrishnan M, Dhanalakshmi R, Subramanian EMG. Survival rate of different fixed posterior space maintainers used in Paediatric Dentistry – A systematic review [Internet]. Vol. 31, The Saudi Dental Journal. 2019. p. 165–72. Available from: http://dx.doi.org/10.1016/j.sdentj.2019.02.037
7. Jitesh S, Mathew MG. Space maintainer – A review. Drug Invention Today [Internet]. 2019;11(1):21–5. Available from: http://jprsolutions.info/files/final-file-5db52c399928f2.82470840.pdf
8. Watt E, Ahmad A, Adamji R, Katsimbali A, Ashley P, Noar J. Space maintainers in the primary and mixed dentition – a clinical guide [Internet]. Vol. 225, British Dental Journal. 2018. p. 293–8. Available from: http://dx.doi.org/10.1038/sj.bdj.2018.650
9. Nance HN. The limitations of orthodontic treatment. II. Diagnosis and treatment in the permanent dentition [Internet]. Vol. 33, American Journal of Orthodontics and Oral Surgery. 1947. p. 253–301. Available from: http://dx.doi.org/10.1016/0096-6347(47)90123-3
10. Singh P, Cox S. Nance palatal arch: a cautionary tale [Internet]. Vol. 36, Journal of Orthodontics. 2009. p. 272–6. Available from: http://dx.doi.org/10.1179/14653120723301
11. Kupietzky A, Tal E. The transpalatal arch: an alternative to the Nance appliance for space maintenance. Pediatr Dent [Internet]. 2007 May;29(3):235–8. Available from: https://www.ncbi.nlm.nih.gov/pubmed/17688021
12. Albati M, Showlag R, Akili A, Hanafiyyah H, AlNashri H, Aladwani W, et al. Space maintainers application, indication and complications [Internet].

Vol. 5, International Journal Of Community Medicine And Public Health. 2018. p. 4970. Available from: http://dx.doi.org/10.18203/2394-6040.ijcmph20184251

13. Varma RB, Jayanthi M, Mahesh Kumar P, Joseph T. Oral health status of 5 years and 12 years school going children in Chennai city - An epidemiological study [Internet]. Vol. 23, Journal of Indian Society of Pedodontics and Preventive Dentistry. 2005. p. 17. Available from: http://dx.doi.org/10.4103/0970-4388.16021
14. Prabakar J, John J, Srisakthi D. Prevalence of dental caries and treatment needs among school going children of Chandigarh [Internet]. Vol. 27, Indian Journal of Dental Research. 2016. p. 547. Available from: http://dx.doi.org/10.4103/0970-9290.195683
15. Somasundaram S, Ravi K, Rajapandian K, Gurunathan D. Fluoride Content of Bottled Drinking Water in Chennai, Tamilnadu. J Clin Diagn Res [Internet]. 2015 Oct;9(10):ZC32–4. Available from: http://dx.doi.org/10.7860/JCDR/2015/14691.6594
16. Mahesh R MM. Fluoride, Fluoridated Toothpaste Efficacy And Its Safety In Children - Review. IJPR [Internet]. 2018 Oct 1;10(04):109–14. Available from: http://www.ijpronline.com/ViewArticleDetail.aspx?ID=7041
17. 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 [Internet]. Vol. 12, European Journal of Dentistry. 2018. p. 067–70. Available from: http://dx.doi.org/10.4103/ejd.ejd_266_17
18. 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
19. 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;11(03):376–9. Available from: https://www.thieme-connect.com/products/ejournals/html/10.4103/ejd.ejd_345_16
20. 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 [Internet]. 2017 Mar 1 [cited 2020 Jun 5];9(2):45. Available from: http://www.jioh.org/article.asp?issn=0976-7428;year=2017;volume=9;issue=2;spage=45;epage=48;aulast=Govindaraju
21. 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. Eur Arch Paediatr Dent [Internet]. 2018 Aug;19(4):273–8. Available from: http://dx.doi.org/10.1007/s40368-018-0356-6
22. 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
23. 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 [Internet]. Vol. 37, Journal of Indian Society of Pedodontics and Preventive Dentistry. 2019. p. 75. Available from: http://dx.doi.org/10.4103/jisppd.jisppd_72_18
24. 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
25. 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
26. 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

27. Paunio P, Rautava P, Sillanpaa M, Kaleva O. Dental health habits of 3-year-old Finnish children [Internet]. Vol. 21, Community Dentistry and Oral Epidemiology. 1993. p. 4–7. Available from: http://dx.doi.org/10.1111/j.1600-0528.1993.tb00708.x
28. Kharbanda OP, Sidhu SS, Sundaram KR, Shukla DK. Occlusion status during early mixed dentition in Delhi children. Project Report Indian Council of Medical Research. 1991;
29. Reddy ER, Manjula M, Sreelakshmi N, Rani ST, Aduri R, Patil BD. Prevalence of Malocclusion among 6 to 10 Year old Nalgonda School Children. J Int Oral Health [Internet]. 2013 Dec;5(6):49–54. Available from: https://www.ncbi.nlm.nih.gov/pubmed/24453444
30. Gurunathan D, Jayachandar D, Jeevanandan G. Prevalence of early loss of primary molars among children aged 5–10 years in Chennai: A cross-sectional study [Internet]. Vol. 37, Journal of Indian Society of Pedodontics and Preventive Dentistry. 2019. p. 115. Available from: http://dx.doi.org/10.4103/jisppd.jisppd_22_19
31. Maran S, Shashikiran ND, Ahirwar P, Maran P, Raj Kannojiya P, Niranjan B. Prevalence of Dental Caries and Traumatic Dental Injuries among 6- to 12-year-old Children in Bhopal City, India. Int J Clin Pediatr Dent [Internet]. 2017 Apr;10(2):172–6. Available from: http://dx.doi.org/10.5005/jp-journals-10005-1429
32. Saravanan S, Kalyani V, Vijayarani MP, Jayakodi P, Felix J, Arunmozhi P, et al. Caries prevalence and treatment needs of rural school children in Chidambaram Taluk, Tamil Nadu, South India. Indian J Dent Res [Internet]. 2008 Jul;19(3):186–90. Available from: http://dx.doi.org/10.4103/0970-9290.42948
33. 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
34. Sudha P, Kulkarni SS, Anegundi R, Mahejabeen R. Dental caries prevalence among preschool children of Hubli: Dharwad city [Internet]. Vol. 24, Journal of Indian Society of Pedodontics and Preventive Dentistry. 2006. p. 19. Available from: http://dx.doi.org/10.4103/0970-4388.22829
35. Qudeimat MA, Fayle SA. The longevity of space maintainers: a retrospective study. Pediatr Dent [Internet]. 1998 Jul;20(4):267–72. Available from: https://www.ncbi.nlm.nih.gov/pubmed/9783298
36. Qudeimat MA, Fayle SA. The Use of Space Maintainers at a UK Pediatric Dentistry Department. J Dent Child [Internet]. 1999;66(6):383–6. Available from: https://www.ingentaconnect.com/content/aapd/jodc/1999/00000066/00000006/art00012
37. Baroni C, Franchini A, Rimondini L. Survival of different types of space maintainers. Pediatr Dent [Internet]. 1994 Sep;16(5):360–1. Available from: https://www.ncbi.nlm.nih.gov/pubmed/7831141
38. Shamsaddin H, Shojaeipour R, Haghighat Seir T, Pouraskari Z, Sayadizadeh M. Assessing the Awareness of Parents and Satisfaction of Children with Intraoral Space Maintainers. Journal of Islamic Dental Association of Iran [Internet]. 2019;31(1):33–9. Available from: http://jidai.ir/browse.php?a_code=A-10-1-924&slc_lang=en&sid=1