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Periodontal Health Status Of 8-12 Year School Going Children - A Retrospective Study

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Abstract: This study aimed to evaluate the periodontal health status of 8-12-year-old school going children. A retrospective study was conducted amongst 2736 school going children aged 8-12 years reporting to a dental hospital in Chennai for treatment from June 2019 to March 2020. Digital case records of 2736 children were reviewed and the data was extracted. Data analysis was done using IBM SPSS Software Version 20.0 to run Chi square tests. The results revealed the overall prevalence of gingivitis amongst the 8-12 year old children to be 53.7% with 0.3% having periodontitis and 46% of children with clinically healthy gingiva. The study also found a significant relation between the diagnosis of periodontal health and age of the patients with $p<0.001$. No relation was established between gender and state of periodontal health.The study found the percentage of gingivitis to be 53.7% and periodontitis to be 0.3% in 8-12-year-old school going children.

Keywords: Clinically healthy gingiva, Gingivitis, Periodontal health, Periodontitis, School going children.

INTRODUCTION

Epidemiological studies suggest that gingivitis is common in children and adolescents. Untreated cases may progress to severe breakdown of the periodontium and loss of teeth in adults [(Califano, American Academy of Periodontology--Research, Science and Therapy Committee and American Academy of Pediatric Dentistry, 2005; Ketabi, Tazhibi and Moheb, 2006)]. Early diagnosis and appropriate treatment measures can ensure greater chances to prevent future periodontal disease [(McDonald, Avery and Dean, 2004)].Gingivitis is the inflammation of the gums. It is a nondestructive type of periodontal disease, but if left untreated, may progress to periodontitis. A patient is diagnosed with periodontitis if clinical attachment loss is ≥3mm with pocketing >3mm that is detectable in ≥2 teeth. The health of the periodontium is influenced by bacterial plaque and calculus, malpositioned teeth, endocrine disorders and nutrition [(Christabel and Linda Christabel, 2015; Somasundaram *et al.*, 2015; Gurunathan and Shanmugaavel, 2016; Govindaraju and Gurunathan, 2017; 'Fluoride, Fluoridated Toothpaste Efficacy And Its Safety In Children - Review', 2018)].

In the USA [(Albandar, Brown and Löe, 1997)] a study showed the prevalence of chronic periodontitis to be 2.3% and aggressive periodontitis to be 0.4% among children aged 13 to 15 years old. In Italy [(Paolantonio *et al.*, 2000)], 0.5% of aggressive periodontitis and 2% of chronic periodontitis was observed amongst 6-14-year-old children. In South Brazil [(Susin *et al.*, 2011)] chronic periodontitis was 18.2% in 14-19 year olds. Russel [(Russell, 1971)] found gingival diseases to be less common in children of higher family income.

Since a number of studies depict the prevalence of periodontitis in school going children in different countries, we evaluated the periodontal health of 8-12-year-old school going children in Chennai to check the severity of periodontal diseases and their correlation with geographic area, age and gender of the children.Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Deogade, Gupta and Ariga, 2018; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; Jeevanandan and Govindaraju, 2018; J *et al.*, 2018; Menon *et al.*, 2018; Prabakar *et al.*, 2018; Rajeshkumar *et al.*, 2018, 2019; Vishnu Prasad *et al.*, 2018; Wahab *et al.*, 2018; Dua *et al.*, 2019; Duraisamy *et al.*, 2019; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Gheena and Ezhilarasan, 2019; Malli Sureshbabu *et al.*, 2019; Mehta *et al.*, 2019; Rajendran *et al.*, 2019; Ramakrishnan, Dhanalakshmi and Subramanian, 2019; Sharma *et al.*, 2019; Varghese,

Ramesh and Veeraiyan, 2019; V. Panchal, Jeevanandan and Subramanian, 2019; Gomathi *et al.*, 2020; Samuel, Acharya and Rao, 2020)

MATERIALS AND METHODS

Study design and Study setting: The present study was conducted in a hospital in Chennai to evaluate the periodontal health status of 8-12-year-old school going children from June 2019 to March 2020. The retrospective study was carried out with the help of digital case records of 2736 children that reported to the dental hospital for treatment. Since it is a retrospective study, carried out using digital case records, no informed consent was required from the patient. Ethical clearance to conduct this study was obtained from the Scientific Review Board of the hospital with the following ethical approval number - SDC/SIHEC/2020/DIASDATA/0619-0320.

Sampling

The type of study was Retrospective. The data of 2736 children were reviewed and then extracted. Only relevant data was included to minimize bias. Non probability sampling method was carried out. Cross verification of data for errors was done with the help of clinical photographs. The study contained regional data generalised to the South Indian population.

Data Collection

A single calibrated examiner evaluated the digital case records of the 2736 patients from June 2019 to March 2020 and reviewed the diagnosis of the periodontal health status for the patients. They were categorized into 10 groups based on the diagnosis, Clinically healthy gingiva, Clinically healthy gingiva with stains and debris, Generalized marginal gingivitis, Generalized chronic gingivitis, Mild gingivitis, Localized chronic gingivitis, Plaque induced gingivitis, Herpetic gingivostomatitis, Localized chronic Periodontitis and Generalized chronic periodontitis.

Statistical Analysis

The collected data was validated, tabulated and analysed with Statistical Package for Social Sciences for Windows, version 20.0 (SPSS Inc., Chicago, IL, USA) and results were obtained. Categorical variables were expressed in frequency and percentage; and continuous variables in mean and standard deviation. Chi-square test was used to test associations between categorical variables. Chi Square tests were carried out using demographic data like age and gender as independent variables and periodontal health status as the dependent variable. P value < 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

This study evaluated the status of periodontal health and the influence of demographic factors like age and gender on its prevalence among 8-12-year-old school going children. This study was conducted in a dental hospital in Chennai.

Out of 2736 children aged 8-12 years, attending the hospital for treatment, the study found 53.7% of patients with gingivitis and 0.3% of patients with periodontitis. The remaining 46% of the children were diagnosed with Clinically healthy gingiva.

56.6% of males and 43.5% of females were included in the study with a maximum number of 10 year old children at 22.4% followed by 9 years at 20.4%, 19.2% of 11years and 19.1% of 12 year olds and 18.8% of 8-year old school children. (Figure 1,2)

The overall diagnosis of the children were Clinically healthy gingiva (38.4%), Clinically healthy gingiva with stains and debris (7.5%), Generalized marginal gingivitis (24.5%), Generalized chronic gingivitis (19.3%), Mild gingivitis (5.08%), Localized Chronic gingivitis (3.6%), Plaque induced gingivitis (1.1%), Herpetic gingivostomatitis (0.04%); Localized chronic periodontitis (0.26%) and Generalized chronic periodontitis (0.04%). (Figure 3)

In a study conducted in Southwest Jordan [(Rodan *et al.*, 2015)], only 29.8% had healthy gingiva, 38.5% with mild gingivitis, 31.4% with moderate gingivitis and 0.3% with severe gingivitis. Whereas, in Chennai our study found a prevalence of 46% of clinically healthy gingiva including those with stains and debris, 5.1% of mild Gingivitis, 24.6% with marginal gingivitis and 19.3% with generalized chronic gingivitis.

In Italy [(Paolantonio *et al.*, 2000)] 2% of children were diagnosed with chronic periodontitis; 2.3 in the USA [(Albandar, Brown and Löe, 1997)] and 18.2% in South Brazil [(Susin *et al.*, 2011)] whereas in Chennai only 0.3% were diagnosed with Localized chronic periodontitis and 0.03% with General periodontitis.

There is no relation between the findings of these studies and so it can be said that the prevalence of gingivitis and periodontitis is related geographically.

While analysing the diagnosis of periodontal health status based on the age of the patients, Clinically healthy gingiva is of the highest prevalence in all age groups followed by generalised marginal gingivitis (Table 1). The

study also found a significant association between the periodontal health status and the age of the patient ($p<0.001$). (Figure 4) In the 8-12-year age group however, we found 53.7% of patients with gingivitis and Ballouk [(Ballouk and Dashash, 2018)] found 97.93% of them with gingivitis. In a study done in the 6-14-year age groups, with children chosen from 27 schools, all the 1489 children were found to have gingivitis [(Al-Haddad and Al-Hebshi, 2010)]. This may be due to the fact that they used a Gingival index (GI) to assess the gingival health status and ours being a retrospective study, relied on the digital case records and had no personal contact with the patients.

In comparison of the diagnosis of periodontal health status, based on the gender of patients, Clinically healthy gingiva is again of the highest prevalence in both genders followed by generalised marginal gingivitis. (Table 1) However, there was no significant association was found between the gender of patients and the periodontal health status ($p=0.427$) (Figure 5) This statement was also supported by a study done by Rodan R [8]. However, other studies [(Farah and Ghandour, 2009; Ballouk and Dashash, 2018)] achieved a significant relation in comparison with genders. Kelly et. al [(Kelly and Sanchez, 1972)] found a higher prevalence of gingival disease in boys than in girls. This was also supported by El Quaderi SS [(El-Qaderi and Quteish Ta'ani, 2006)] whose results showed that males had a significantly lower plaque index but higher gingival scores than females. He even found significant gender variations between the Periodontal index (PI) and Gingival index (GI) scores.[(Packiri, Gurunathan and Selvarasu, 2017; Ravikumar, Jeevanandan and Subramanian, 2017; Subramanyam *et al.*, 2018)]

Since the present study took into account the general population of school going children attending the dental hospital for treatment, it could not assess the effect of education or socioeconomic status on the periodontal health of the child. A study carried out by Taani DQ [(Taani, 2002)] found significantly higher proportions of children attending public schools with bleeding on brushing and calculus deposits. The mean plaque and gingival scores were higher in public school children than in private school children but this difference was not statistically significant.

So socioeconomic statuses [(Russell, 1971)] would affect the standard of education which would in turn affect the knowledge of the patients on oral hygiene leading to periodontal problems. The mean GI and pocket depth of children in the upper and lower socioeconomic condition differed significantly [(*Website*, no date; Goswami and Saha, 2017; Govindaraju, Jeevanandan and E. M. G. Subramanian, 2017a, 2017b; Govindaraju, Jeevanandan and E. Subramanian, 2017; Jeevanandan, 2017; Jeevanandan and Govindaraju, 2018; Veerale Panchal, Jeevanandan and Subramanian, 2019)].

Oral hygiene, especially regular tooth brushing with fluoridated toothpaste was associated with not having periodontitis [(Chestnutt *et al.*, 1998)] and twice daily tooth brushing was significantly more effective than brushing once a day [(Nguyen *et al.*, 2008)]. The occurrence of periodontitis is rather infrequent in children and adolescence and increases with age [(AlGhamdi *et al.*, 2020)].

Limitations of the study include a restricted population group due to it being a single centered study. However, this limitation would be nullified due to our large sample size of 2736 patients. Another limitation includes the data being collected only for a period of 10 months. Also since it's a retrospective study based on digital records, the cases could not be assessed clinically to perform a Gingival or Periodontal index. Hence we relied on the diagnosis uploaded onto the software by the dentists in the hospital however; the clinical photographs were reviewed by a single calibrated examiner. Future scope of study could be improved by conducting it over a larger scale as a multicentered study for a longer duration of time.Our institution is passionate about high quality evidence based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Mathew *et al.*, 2020)

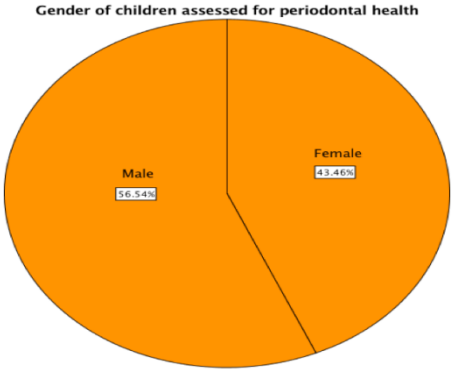

Fig.1: Pie chart depicting the gender of children assessed for periodontal health. 56.54% of males and 43.46% of females were assessed in this study.

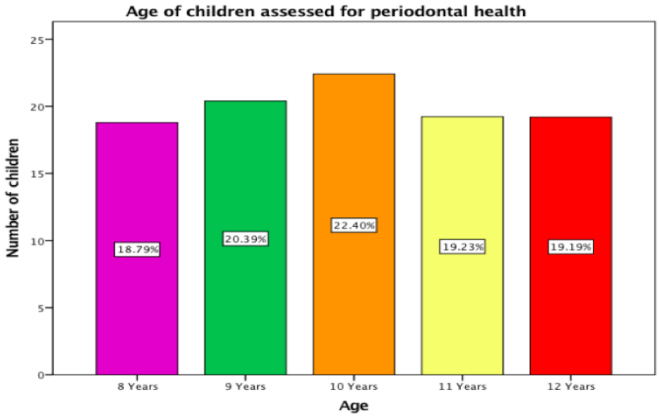

Fig.2: Bar graph depicting the percentage distribution of age of children assessed for periodontal health. X axis represents the age of children and Y axis represents the number of children. Majority of children assessed for periodontal health belong to the 10 year old age group at 22.4% (orange).

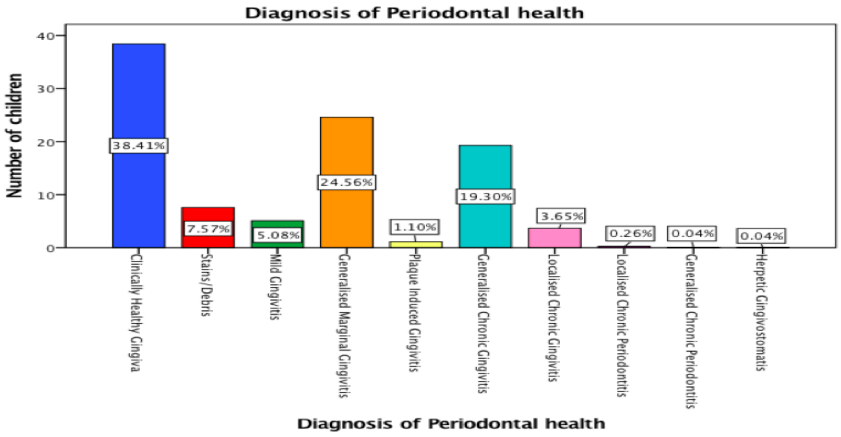

Fig.3: Bar graph depicting the percentage distribution of overall diagnosis of periodontal health status of children. X axis represents Diagnosis of periodontal health and Y axis represents the number of children. Majority of children were diagnosed with Clinically healthy gingiva at 38.4% (blue) followed by Generalized marginal gingivitis at 24.5% (orange).

Table 1: Association of Age and Gender of 8-12 year old children in relation with Periodontal health status in percentage. The association with age and periodontal health status was found to be statistically significant with p=0.00. However the association of periodontal health status with gender proved to have statistically not significant results with p=0.427.

Diagnosis of Periodontal health status	**Age (%)**					**Gender (%)**	
Groups	**8 yrs**	**9 yrs**	**10 yrs**	**11yrs**	**12yrs**	**Male**	**Female**
Clinically healthy gingiva	45.1	42.6	38.1	4.6	31.4	36.7	40.5
Clinically healthy gingiva with stains and debris	9.9	7.5	6.03	6.08	8.5	7.23	7.9
Mild Gingivitis	2.3	5.5	5.8	6.4	4.9	5.7	4.2
Generalized marginal gingivitis	23.5	19.5	22.8	26.9	30.4	24.8	24.1
Plaque induced gingivitis	1.5	1.9	0.9	0.38	0.5	1.09	1.09
Generalized chronic gingivitis	14.2	19.7	20.8	20.1	21.1	20.1	18.2
Localized chronic gingivitis	3.3	2.86	4.8	4.9	2.09	3.74	3.5
Herpetic gingivostomatitis	0	0	0	0	0.19	0.06	0
Localized chronic periodontitis	0	0	0.32	0.38	0.57	0.25	0.25
Generalized chronic periodontitis	0	0.17	0	0	0	0.06	0

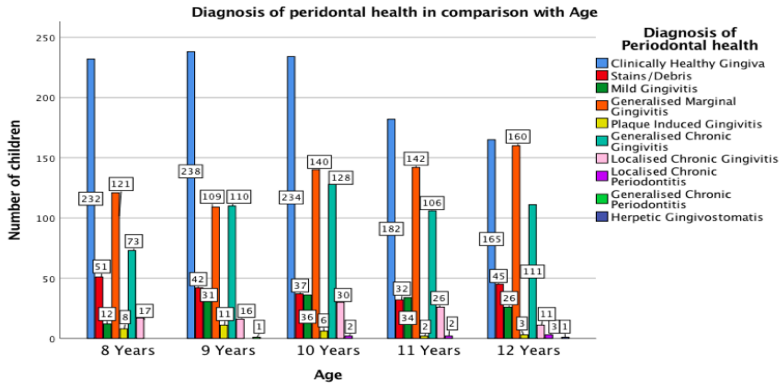

Fig.4: Bar graph depicting association between age of children and diagnosis of periodontal health status. X axis represents the age of children and Y axis represents the number of children. Association between age and periodontal health status was done using Chi square test and was found to be statistically significant with p value = 0.00 proving periodontal health status is dependent on the age of children.

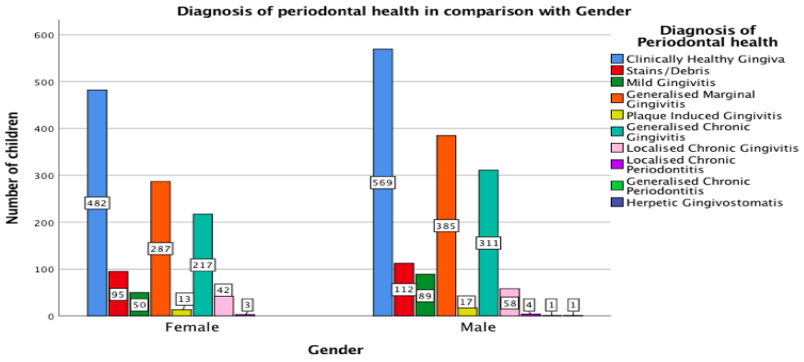

Fig.5: Bar graph depicting association between gender of children and diagnosis of periodontal health status. X axis represents gender of children and Y axis represents number of children. Association between gender and periodontal health status was done using Chi square test and was found to be statistically not significant with p=0.427 proving periodontal health status is not dependent on the gender of children.

CONCLUSION

This study found the prevalence of gingivitis among the 8-12 year old school children to be 53.7% and periodontitis to be 0.3%. A significant association between the age of patients and periodontal health status was also found stating that the periodontal health status is dependent on the age of the patients.

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AUTHORS CONTRIBUTION

G.J contributed to study conception and design, data collection, analysis and interpretation and drafted the work. A.M. contributed to data interpretation, study design and data collection. R.J. contributed to study conception and design and data collection. All authors critically reviewed the manuscript and approved the final version.

Conflict of interest

The authors declare no conflict of interest

REFERENCES

1. Albandar, J. M., Brown, L. J. and Löe, H. (1997) 'Clinical features of early-onset periodontitis', *Journal of the American Dental Association* , 128(10), pp. 1393–1399.
2. AlGhamdi, A. *et al.* (2020) 'Prevalence of periodontitis in high school children in Saudi Arabia: a national study', *Annals of Saudi medicine*, 40(1), pp. 7–14.
3. Al-Haddad, K. A. and Al-Hebshi, N. N. (2010) 'Oral health status and treatment needs among school

children in Sana'a City, Yemen', *International journal of*. Available at: https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1601-5037.2009.00398.x.

4. Ballouk, M. A.-H. and Dashash, M. (2018) 'The gingival health status of 8-12 year-old children in Damascus city in Syria during the Syrian Crisis: a cross-sectional epidemiological oral health survey', *BMC research notes*, 11(1), p. 887.
5. Califano, J. V., American Academy of Periodontology--Research, Science and Therapy Committee and American Academy of Pediatric Dentistry (2005) 'Periodontal diseases of children and adolescents', *Pediatric dentistry*, 27(7 Suppl), pp. 189–196.
6. Chestnutt, I. G. *et al.* (1998) 'The influence of toothbrushing frequency and post-brushing rinsing on caries experience in a caries clinical trial', *Community Dentistry and Oral Epidemiology*, pp. 406–411. doi: 10.1111/j.1600-0528.1998.tb01979.x.
7. Christabel, S. L. and Linda Christabel, S. (2015) 'Prevalence of Type of Frenal Attachment and Morphology of Frenum in Children, Chennai, Tamil Nadu', *World Journal of Dentistry*, pp. 203–207. doi: 10.5005/jp-journals-10015-1343.
8. Deogade, S., Gupta, P. and Ariga, P. (2018) 'Effect of monopoly-coating agent on the surface roughness of a tissue conditioner subjected to cleansing and disinfection: A Contact Profilometric In vitro study', *Contemporary Clinical Dentistry*, p. 122. doi: 10.4103/ccd.ccd_112_18.
9. Dua, K. *et al.* (2019) 'The potential of siRNA based drug delivery in respiratory disorders: Recent advances and progress', *Drug development research*, 80(6), pp. 714–730.
10. Duraisamy, R. *et al.* (2019) 'Compatibility of Nonoriginal Abutments With Implants: Evaluation of Microgap at the Implant-Abutment Interface, With Original and Nonoriginal Abutments', *Implant dentistry*, 28(3), pp. 289–295.
11. El-Qaderi, S. S. and Quteish Ta'ani, D. (2006) 'Dental plaque, caries prevalence and gingival conditions of 14--15-year-old schoolchildren in Jerash District, Jordan', *International journal of dental hygiene*, 4(3), pp. 150–153.
12. Ezhilarasan, D. (2018) 'Oxidative stress is bane in chronic liver diseases: Clinical and experimental perspective', *Arab journal of gastroenterology: the official publication of the Pan-Arab Association of Gastroenterology*, 19(2), pp. 56–64.
13. Ezhilarasan, D., Apoorva, V. S. and Ashok Vardhan, N. (2019) 'Syzygium cumini extract induced reactive oxygen species-mediated apoptosis in human oral squamous carcinoma cells', *Journal of oral pathology & medicine: official publication of the International Association of Oral Pathologists and the American Academy of Oral Pathology*, 48(2), pp. 115–121.
14. Ezhilarasan, D., Sokal, E. and Najimi, M. (2018) 'Hepatic fibrosis: It is time to go with hepatic stellate cell-specific therapeutic targets', *Hepatobiliary & pancreatic diseases international: HBPD INT*, 17(3), pp. 192–197.
15. Farah, H. H. and Ghandour, I. A. (2009) 'Periodontal health status of 12-year-old Sudanese schoolchildren and educational level of parents in Khartoum province', *Odonto-stomatologie tropicale= Tropical*. Available at: https://europepmc.org/abstract/med/20441126.
16. 'Fluoride, Fluoridated Toothpaste Efficacy And Its Safety In Children - Review' (2018) *International Journal of Pharmaceutical Research*, 10(04). doi: 10.31838/ijpr/2018.10.04.017.
17. Gheena, S. and Ezhilarasan, D. (2019) 'Syringic acid triggers reactive oxygen species-mediated cytotoxicity in HepG2 cells', *Human & experimental toxicology*, 38(6), pp. 694–702.
18. Gomathi, A. C. *et al.* (2020) 'Anticancer activity of silver nanoparticles synthesized using aqueous fruit shell extract of Tamarindus indica on MCF-7 human breast cancer cell line', *Journal of Drug Delivery Science and Technology*, p. 101376. doi: 10.1016/j.jddst.2019.101376.
19. Goswami, S. and Saha, S. (2017) 'The prevalence of gingivitis and periodontal diseases in preschool children in Kolkata', *Indian Journal of Multidisciplinary Dentistry*, 7(1), p. 3.
20. Govindaraju, L. and Gurunathan, D. (2017) 'Effectiveness of Chewable Tooth Brush in Children-A Prospective Clinical Study', *Journal of clinical and diagnostic research: JCDR*, 11(3), pp. ZC31–ZC34.
21. Govindaraju, L., Jeevanandan, G. and Subramanian, E. (2017) '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: JCDR*, 11(9), pp. ZC55–ZC58.
22. Govindaraju, L., Jeevanandan, G. and Subramanian, E. M. G. (2017a) '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*, pp. 376–379. doi: 10.4103/ejd.ejd_345_16.
23. Govindaraju, L., Jeevanandan, G. and Subramanian, E. M. G. (2017b) 'Knowledge and practice of rotary instrumentation in primary teeth among indian dentists: A questionnaire survey', *Journal of International Oral Health*, 9(2), p. 45.

24. Gurunathan, D. and Shanmugaavel, A. K. (2016) 'Dental neglect among children in Chennai', *Journal of the Indian Society of Pedodontics and Preventive Dentistry*, 34(4), pp. 364–369.
25. Jeevanandan, G. (2017) 'Kedo-S Paediatric Rotary Files for Root Canal Preparation in Primary Teeth - Case Report', *Journal of clinical and diagnostic research: JCDR*, 11(3), pp. ZR03–ZR05.
26. Jeevanandan, G. and Govindaraju, L. (2018) '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: official journal of the European Academy of Paediatric Dentistry*, 19(4), pp. 273–278.
27. J, P. C. *et al.* (2018) 'Prevalence and measurement of anterior loop of the mandibular canal using CBCT: A cross sectional study', *Clinical implant dentistry and related research*, 20(4), pp. 531–534.
28. Kelly, J. E. and Sanchez, M. J. (1972) 'Periodontal disease and oral hygiene among children. United States', *Vital and health statistics. Series 11, Data from the national health survey*, (117), pp. 1–28.
29. Ketabi, M., Tazhibi, M. and Moheb, R. S. (2006) 'The Prevalance and Risk Factors of Gingivitis Among the Children Referred to Isfahan Islamic Azad University (Khorasgan Branch) Dental School, In Iran'. Available at: https://www.sid.ir/en/journal/ViewPaper.aspx?ID=109831.
30. Malli Sureshbabu, N. *et al.* (2019) 'Concentrated Growth Factors as an Ingenious Biomaterial in Regeneration of Bony Defects after Periapical Surgery: A Report of Two Cases', *Case reports in dentistry*, 2019, p. 7046203.
31. Mathew, M. G. *et al.* (2020) 'Evaluation of adhesion of Streptococcus mutans, plaque accumulation on zirconia and stainless steel crowns, and surrounding gingival inflammation in primary …', *Clinical oral investigations*. Available at: https://link.springer.com/article/10.1007/s00784-020-03204-9.
32. McDonald, R. E., Avery, D. R. and Dean, J. A. (2004) 'Dentistry for the child and Adolescent. St', *Louis, Missouri: Mosby*.
33. Mehta, M. *et al.* (2019) 'Oligonucleotide therapy: An emerging focus area for drug delivery in chronic inflammatory respiratory diseases', *Chemico-biological interactions*, 308, pp. 206–215.
34. Menon, S. *et al.* (2018) 'Selenium nanoparticles: A potent chemotherapeutic agent and an elucidation of its mechanism', *Colloids and Surfaces B: Biointerfaces*, pp. 280–292. doi: 10.1016/j.colsurfb.2018.06.006.
35. Nguyen, L. *et al.* (2008) 'Should we brush twice a day? Determinants of dental health among young adults in Finland', *Health Economics*, pp. 267–286. doi: 10.1002/hec.1258.
36. Packiri, S., Gurunathan, D. and Selvarasu, K. (2017) 'Management of Paediatric Oral Ranula: A Systematic Review', *Journal of clinical and diagnostic research: JCDR*, 11(9), pp. ZE06–ZE09.
37. Panchal, V., Jeevanandan, G. and Subramanian, E. M. G. (2019) '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*, p. 75. doi: 10.4103/jisppd.jisppd_72_18.
38. Panchal, V., Jeevanandan, G. and Subramanian, E. M. G. (2019) 'Comparison of post-operative pain after root canal instrumentation with hand K-files, H-files and rotary Kedo-S files in primary teeth: a randomised clinical trial', *European archives of paediatric dentistry: official journal of the European Academy of Paediatric Dentistry*, 20(5), pp. 467–472.
39. Paolantonio, M. *et al.* (2000) 'Prevalence of Actinobacillus actinomycetemcomitans and clinical conditions in children and adolescents from rural and urban areas of central Italy', *Journal of Clinical Periodontology*, pp. 549–557. doi: 10.1034/j.1600-051x.2000.027008549.x.
40. Pc, J., Marimuthu, T. and Devadoss, P. (2018) 'Prevalence and measurement of anterior loop of the mandibular canal using CBCT: A cross sectional study', *Clinical implant dentistry and related research*. Available at: https://europepmc.org/article/med/29624863.
41. Prabakar, J. *et al.* (2018) 'Comparative Evaluation of Retention, Cariostatic Effect and Discoloration of Conventional and Hydrophilic Sealants - A Single Blinded Randomized Split Mouth Clinical Trial', *Contemporary clinical dentistry*, 9(Suppl 2), pp. S233–S239.
42. Rajendran, R. *et al.* (2019) 'Comparative Evaluation of Remineralizing Potential of a Paste Containing Bioactive Glass and a Topical Cream Containing Casein Phosphopeptide-Amorphous Calcium Phosphate: An in Vitro Study', *Pesquisa Brasileira em Odontopediatria e Clínica Integrada*, pp. 1–10. doi: 10.4034/pboci.2019.191.61.
43. Rajeshkumar, S. *et al.* (2018) 'Biosynthesis of zinc oxide nanoparticles usingMangifera indica leaves and evaluation of their antioxidant and cytotoxic properties in lung cancer (A549) cells', *Enzyme and microbial technology*, 117, pp. 91–95.
44. Rajeshkumar, S. *et al.* (2019) 'Antibacterial and antioxidant potential of biosynthesized copper nanoparticles mediated through Cissus arnotiana plant extract', *Journal of photochemistry and photobiology. B, Biology*, 197, p. 111531.
45. Ramadurai, N. *et al.* (2019) 'Effectiveness of 2% Articaine as an anesthetic agent in children: randomized controlled trial', *Clinical oral investigations*, 23(9), pp. 3543–3550.

46. Ramakrishnan, M., Dhanalakshmi, R. and Subramanian, E. M. G. (2019) 'Survival rate of different fixed posterior space maintainers used in Paediatric Dentistry - A systematic review', *The Saudi dental journal*, 31(2), pp. 165–172.
47. Ramesh, A. *et al.* (2018) 'Comparative estimation of sulfiredoxin levels between chronic periodontitis and healthy patients - A case-control study', *Journal of periodontology*, 89(10), pp. 1241–1248.
48. Ravikumar, D., Jeevanandan, G. and Subramanian, E. M. G. (2017) 'Evaluation of knowledge among general dentists in treatment of traumatic injuries in primary teeth: A cross-sectional questionnaire study', *European journal of dentistry*, 11(2), pp. 232–237.
49. Rodan, R. *et al.* (2015) 'Prevalence and severity of gingivitis in school students aged 6–11 years in Tafelah Governorate, South Jordan: results of the survey executed by National Woman's Health Care Center', *BMC Research Notes*. doi: 10.1186/s13104-015-1532-y.
50. Russell, A. L. (1971) 'The prevalence of periodontal disease in different populations during the circumpubertal period', *Journal of periodontology*, 42(8), pp. 508–512.
51. Samuel, S. R., Acharya, S. and Rao, J. C. (2020) 'School Interventions-based Prevention of Early-Childhood Caries among 3-5-year-old children from very low socioeconomic status: Two-year randomized trial', *Journal of public health dentistry*, 80(1), pp. 51–60.
52. Sharma, P. *et al.* (2019) 'Emerging trends in the novel drug delivery approaches for the treatment of lung cancer', *Chemico-biological interactions*, 309, p. 108720.
53. Somasundaram, S. *et al.* (2015) 'Fluoride Content of Bottled Drinking Water in Chennai, Tamilnadu', *Journal of clinical and diagnostic research: JCDR*, 9(10), pp. ZC32–4.
54. Sridharan, G. *et al.* (2019) 'Evaluation of salivary metabolomics in oral leukoplakia and oral squamous cell carcinoma', *Journal of oral pathology & medicine: official publication of the International Association of Oral Pathologists and the American Academy of Oral Pathology*, 48(4), pp. 299–306.
55. Subramanyam, D. *et al.* (2018) 'Comparative evaluation of salivary malondialdehyde levels as a marker of lipid peroxidation in early childhood caries', *European journal of dentistry*, 12(1), pp. 67–70.
56. Susin, C. *et al.* (2011) 'Prevalence and risk indicators for chronic periodontitis in adolescents and young adults in south Brazil', *Journal of Clinical Periodontology*, pp. 326–333. doi: 10.1111/j.1600-051x.2011.01699.x.
57. Taani, D. Q. (2002) 'Relationship of socioeconomic background to oral hygiene, gingival status, and dental caries in children', *Quintessence international* , 33(3), pp. 195–198.
58. Varghese, S. S., Ramesh, A. and Veeraiyan, D. N. (2019) 'Blended Module-Based Teaching in Biostatistics and Research Methodology: A Retrospective Study with Postgraduate Dental Students', *Journal of dental education*, 83(4), pp. 445–450.
59. Vijayashree Priyadharsini, J. (2019) 'In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens', *Journal of periodontology*, 90(12), pp. 1441–1448.
60. Vishnu Prasad, S. *et al.* (2018) 'Report on oral health status and treatment needs of 5-15 years old children with sensory deficits in Chennai, India', *Special care in dentistry: official publication of the American Association of Hospital Dentists, the Academy of Dentistry for the Handicapped, and the American Society for Geriatric Dentistry*, 38(1), pp. 58–59.
61. Wahab, P. U. A. *et al.* (2018) 'Scalpel Versus Diathermy in Wound Healing After Mucosal Incisions: A Split-Mouth Study', *Journal of oral and maxillofacial surgery: official journal of the American Association of Oral and Maxillofacial Surgeons*, 76(6), pp. 1160–1164.
62. *Website* (no date). Available at: Website (n.d.). Available at: NAIR M, JEEVANANDAN G, Vignesh R, Subramanian EMG. Assessing the quality of root canal filling and instrumentation time using kedo-s files, reciprocating files and kfiles. Braz Dent Sci 2020; 23(1):1-7 DOI: https://doi.org/10.14295/bds.2020.v23i1.1822 (accessed 3 June 2020b (Accessed: 10 June 2020).