



A Comparative Evaluation of Grades Obtained for Placement of Stainless Steel Crowns on Maxillary Molars Among Post Graduate Students

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Article History:

Received on: 05 Sep 2020

Revised on: 10 Oct 2020

Accepted on: 12 Oct 2020

Keywords:

Primary maxillary 1st molars,
Postgraduates,
Stainless steel crowns,
Clinical skill

ABSTRACT

Success of any restoration depends on the material used and the skill of the operator. This study aims to compare the clinical efficiency of postgraduates of various years in placing stainless steel crowns in maxillary 1st molars and thereby finding how operator skills affect the placement by analyzing their grades. In this retrospective study the dental records of pediatric patients who had visited the dental hospital located in Chennai, Tamil Nadu, India from June 2019 to March 2020 were reviewed. Patients who underwent stainless steel crown placement of at least one primary maxillary 1st molar teeth under local or general anesthesia of 2-6 years of age by postgraduates were included in the study. Out of the 467 teeth treated 268 (57.38%) were of males and 199 (42.61%) females. The percentage of treatment done at various ages were at 2 years: 33(7.06%), 3 years: 110(23.55%), 4 years: 150(32.11%), 5 years: 102(21.84%), 6 years: 71(15.20%). The percentage of crowns placed by postgraduates of various years were 1st year postgraduates: 86(18.41%), 2nd year postgraduates: 170(36.40%), 3rd year postgraduates: 211(45.18%). Chi-square test was done and the association was found to be not significant (p-value = 0.139). The frequency of each tooth treated being primary right 1st molar: 164(35.11%), primary right 2nd molar: 56(11.99%), primary left 1st molar: 180(38.54%), and primary left 2nd molar: 67(14.34%). This data showed that the 3rd year postgraduates got the most number of high grades 211(45.18%). Chi-square test was done and the association was found to be significant (p-value = 0.000). There is a significant difference in the placement of stainless steel crowns among the various postgraduates. There was a gradual increase in the clinical performance with the 3rd years performing the best among the three years.

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ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v11iSPL3.3476>

Production and Hosted by

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INTRODUCTION

In today's world one of the major health problems affecting the overall oral health of children is dental caries (Innes *et al.*, 2015; Govindaraju and Gurunathan, 2017). Early childhood caries is defined as "the existence of one or more tooth decay (cavitated or non cavitated) removed (due to caries) or filled tooth surfaces in any primary dentition of children under 71 months of age" (Pediatric Dentistry, 2018; Subramanyam *et al.*, 2018). It is multifactorial in nature (Leake, 1992; Pernessini *et al.*, 2004; Harrison and Davis, 1980). It

is seen to affect families with low socioeconomic status and seen only in children (Dye *et al.*, 1988; Kanatami, 2008; Rowan-Legg, 2013). Any carious teeth has to be immediately restored which restores the arch integrity and disrupts the dental caries progress (Innes *et al.*, 2015).

One of the major problems faced in the field of paediatric dentistry is the loss of primary teeth though various efforts are there present in the prevention of dental caries in children. The principal goal in paediatric dentistry is to retain the primary teeth in the oral cavity until its physiological exfoliation to preserve arch integrity (Ranly and Garcia-Godoy, 2000; Jeevanandan and Govindaraju, 2018).

Stainless steel crowns were first introduced by Rocky Mountains in 1947 and have been used successfully for the past 70 years. They are placed both in primary and permanent teeth which require multi surface restorations (Randall, 2002) high risk and mostly after pulp therapy. The success to these crowns was due to the easy availability, high durability and cost effective treatment (Seale, 2002; Rodd *et al.*, 2006).

Stainless steel crowns are given for various purposes. They can range from simple restorations involving class 1 caries to multiple surface caries in class 1 or a class 2 or class 3 caries according to G.V Black classification. Stainless steel crowns are also preferred after pulpectomy procedure. Pulpectomy of the primary teeth involves removal of the infected tissue from the root canal and filling it with a resorbable material (Govindaraju *et al.*, 2017b,a; Jeevanandan, 2017; Nair *et al.*, 2018).

One cannot deny the fact that procedures preceding the placement of stainless steel crowns are also important in the long term success. The type of restorative material used below the crown and the optimal filling achieved during pulpectomy is also important. Type of obturation material, biomechanical preparation, entrance filling used are also ideal requirements. The rationale of the procedure includes chemical and mechanical removal of irreversibly inflamed or necrotic radicular pulp tissue, followed by root canal filling with an inert resorbable material (Govindaraju *et al.*, 2017c; Lakshmanan *et al.*, 2020). A survey that was conducted among the endodontists and the general dentists in Tehran regarding the use of NiTi rotary instrumentation in permanent teeth concluded that there is a lack of knowledge in using rotary NiTi instruments and hence more training and comprehensive education is needed for the dentists (Govindaraju *et al.*, 2017c).

Care must be taken before placing any restoration

as any intraoral pathologies and dental emergencies must be treated with priority. They could include trauma (Ravikumar *et al.*, 2017), high frenal attachment (Christabel, 2015), tongue tie causing difficulty in swallowing and speech, or any benign or malignant tumours that could be fatal and other salivary gland pathologies that could cause obstructions in the oral cavity or obstruct the flow of saliva which will affect the day to day life of the child causing discomfort and pain and ultimately interfering with the treatment procedure and cooperativeness (Packiri, 2017).

Proper post operative care and maintenance of good oral hygiene also determines the success of restorations. In this regard, the lack of parent's or guardian's attention will have a negative influence on the child's oral status (Gurunathan and Shanmugaavel, 2016).

An accurate marginal fit was required between the tooth and the crown for protection of the tooth against the various external factors like bacterial, physical, chemical and thermal influence (Erdemci *et al.*, 2014). This further leads to increase in plaque accumulation and gingivitis and hence adversely affecting periodontal health when there are marginal discrepancies due to poor adaptation (Durr *et al.*, 1982; Ramazani *et al.*, 2010; Webber, 1974).

It is also important to note that the challenges exist not only in the material itself but also in the understanding and incorporation implications of the skill of the operator on placement of the restoration. This ranges from proper caries removal, cavity preparation, restoration use, knowledge of material properties, operators' judgement and intraoral location (anatomy of tooth structure, salivary flow, stress, temperature) can all affect the proper placement of a stainless steel crown. This study aims to compare the clinical efficiency of postgraduates of various years in placing stainless steel crowns in maxillary 1st molars and thereby finding how operator skills affect the placement by analyzing their grades.

MATERIALS AND METHODS

This was a hospital based retrospective study. Dental records of 86000 patients who had visited a private dental hospital from June 2019 to March 2020, located in Chennai, Tamil Nadu, India were retrieved manually and analysed. Patient ID, postgraduate ID, age, gender, tooth treated, grade value these data were extracted. Children who were diagnosed with ECC between 2- 6 years who had at least one stainless steel crown placed in 1st maxillary molars were included. A total of 268 males and 199 females

were included in the study totalling up to 467 teeth. Children with systemic disorders, special children were excluded. This data was analysed by 2 examiners. Cross verification for incomplete and inaccurate data was cross verified using intraoral photographs and radiographs.

All the procedures were done by only a single operator for a specific patient. A full mouth examination with intraoral periapical radiographs of the teeth indicated for stainless steel crowns was taken before the start of the clinical procedure. After confirmation of the diagnosis, local anesthesia was administered using 2% lignocaine with 1:200,000 adrenaline (LOX* 2% ADRENALINE, Neon Laboratories limited, India). The tooth was isolated using rubber dam (GDC Marketing, Hoshiarpur, Punjab, India). Using a round carbide bur in a high-speed handpiece, all the caries were removed. The glass ionomer cement type 2 (Shofu, Shofuinc. Japan) was used to restore the cavity.

Crown preparation was done where occlusal reduction using a football shaped diamond bur ISO 257/018 (MANI.Inc, Japan) was followed by Interproximal using tapering fissure conical ended diamond bur ISO 197/016 (MANI.Inc, Japan), Buccal and Lingual reductions using tapering fissure round ended diamond bur ISO 197/016 (MANI.Inc, Japan). Crimping and Contouring were done to bend the gingival $\frac{1}{3}$ rd of the crown's margins inward to establish a tight marginal fit and adaptation. This was achieved by using pliers No. 114, 417. This tooth was then restored with a stainless steel crown (3M, ESPE, US) of the appropriate size. For luting glass ionomer cement type 1 (Shofu, Shofuinc. Japan) was filled up to $\frac{2}{3}$ rd of the inner surface of the stainless steel crown and cemented and excess cement was removed. The interproximal areas were rinsed and checked for occlusion.

Ethical aspect

The study was conducted with ethical approval from the ethical board of Saveetha Institute of Medical And Technical Sciences.

Statistical Analysis

The collected data were entered into Microsoft office excel 2013 datasheet transferred to SPSS version 26.0 software (SPSS version Chicago, IL, USA) for statistical analysis. The independent variables are age, gender. The dependant variables are teeth treated, grade value and student Id. They were put to descriptive analysis and mean, standard deviation and chi-square test were done to assess the significance of association between the categorical variables.

RESULTS AND DISCUSSION

Out of the 467 teeth treated 268 (57.38%) were of males and 199 (42.61%) females [Figure 2]. The percentage of treatment done at various ages were at 2 years: 33 (7.06%), 3 years: 110 (23.55%), 4 years: 150 (32.11%), 5 years: 102 (21.84%), 6 years: 71 (15.20%) [Figure 1]. The percentage of crowns placed by postgraduates of various years was 1st year postgraduates: 86 (18.41%), 2nd year postgraduates: 170 (36.40%), 3rd year postgraduates: 211 (45.18%) [Figure 3]. The frequency of each tooth treated being primary maxillary right 1st molar: 164 (35.11%), primary maxillary right 2nd molar: 56 (11.99%), primary maxillary left 1st molar: 180 (38.54%), and primary maxillary left 2nd molar: 67 (14.34%) [Figure 4].

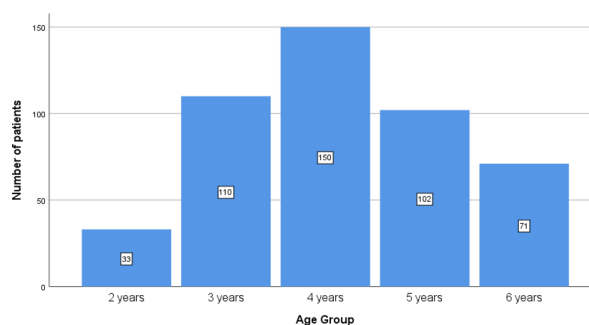


Figure 1: Bar graph showing the distribution of number of procedures for each age group represented in blue colour

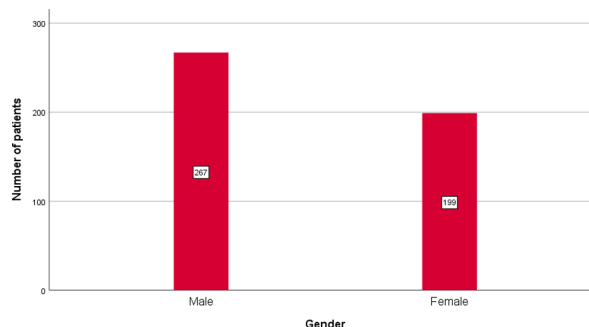


Figure 2: Bar graph showing the distribution of patients based on gender represented in red colour

Boys were mostly affected (75.38%). The maximum number of crowns were placed in 4 year olds (32.11%). Each postgraduate showed varying grades of clinical efficiency. This data showed that the 3rd year postgraduates got the most number of high grades 211 (45.18%). Chi-square test was done and the association was found to be significant (p-value = 0.000). The primary maxillary left 1st molar: 180 (38.54%) was the most treated tooth by all post-

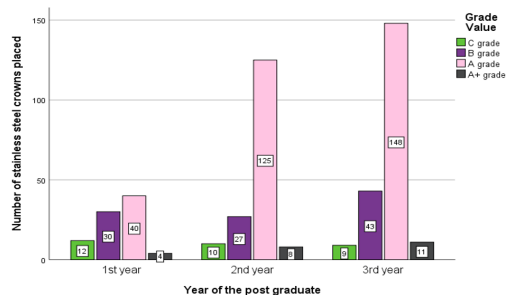


Figure 3: Bar graph showing the distribution of the percentage of crowns placed by postgraduates of various years

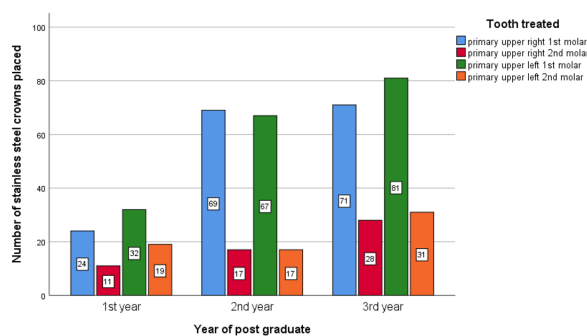


Figure 4: Bar graph showing the distribution of the frequency of each treated tooth

graduates. Chi-square test was done and the association was found to be not significant (p -value = 0.139).

There is very scarce literature regarding the effect of the skill set of clinicians on treatment and its success worldwide. Design modifications have simplified the fitting procedure and improved the morphology so that it accurately duplicates the anatomy of primary molar teeth (Randall, 2002). In the dental records that were analysed the scores statistically were significant on the basis of grade values, PG student and the tooth treated upto the age of 6.

Age Distribution

Most of the stainless steel crowns for the upper molars was done at 4 years and then there is a decrease. This can be attributed to the long retention time of the tooth in the oral cavity, highest caries prevalence, and increase in snacking time and once at around at 4 years they join school and the exposure to school dental programs, proper meal times, awareness of oral hygiene practices lead to a gradual decrease in caries incidence. This was in concordance with the study by Ramos-Gomez et al. (2003).

Grade Distribution

Grade values for each postgraduate changes from teeth to teeth and from person to person. Overall we

can see that the 3rd year postgraduates have got the higher grades as compared to the other years. This gives us adequate reason to believe that experience develops over the years of clinical practice. Their varying skill set (Randall, 2002; Chadwick et al., 2007; Zimmerman et al., 2009) variations in the methods practiced, using advanced techniques and varying exposures to clinical scenarios are also plausible.

In a mail survey in the US, 98% of the specialists recommended stainless steel crowns whereas 81% of the general dentists recommended restorations showing the difference in decision making based on knowledge based on skill set (Mcknight-Hanes et al., 1994). In countries like the UK, inadequate expertise in behaviour management techniques of children for advanced treatment has led to improper and underutilization of advanced techniques (Randall, 2002), M Duggal Leeds dental institute UK, personal communications). Dental students have also reported that low levels of exposure to stainless steel crowns during undergraduate curriculum (Rodd et al., 2010).

The most common tooth restored with a stainless steel crown was the maxillary 1st molar which coincides with the previous study (Bell et al., 2010; Demirci et al., 2010; Rodd et al., 2010) which states the deep pits and fissures, chronological age of eruption being major factors with most prone area being the distal surface of the tooth. The duration spent on the treatment is very essential in decreasing the anxiety among children. Shorter time duration decreases anxiety and renders optimal treatment to children (Ramakrishnan and Bhukri, 2018).

Parents must also follow oral hygiene measures, use fluoridated toothpastes, water and bring them for timely follow up to prevent damage to the tooth structure (Somasundaram et al., 2015; Panchal et al., 2019).

The study does have a few limitations. This study was limited to data from a single hospital. This severely restricts the geographical distribution and the ethnicity of the various patients who undergo treatment. Inclusion of only the 1st maxillary molars is also considered as a potential confounder in the current study. The number of postgraduates were also very less this can lead to operator bias and data cannot be generalized to the undergraduates for the study population. The sample size was also small. Promoting individual based academic strategies can lead to a uniformity in clinical efficiency, evidence based learning and incorporating the latest techniques and latest advancements can significantly improve the efficiency in the placement of

stainless steel crowns.

In Figure 1, X-axis represents the age group and y-axis represents the number of patients. This graph shows that most of number of procedures were done at 4 years 150 (32.11%). In Figure 2, X-axis represents gender and y-axis represents the number of patients. This graph shows that male patients 268 (57.38%) were more as compared to female patients 199 (42.61%). In Figure 3, X-axis represents the year of the postgraduate and y-axis represents the various grades received for the number of stainless steel crowns placed. Green colour represents C grade, purple colour represents B grade, pink colour represents A grade and dark blue colour represents A+ grade. This graph showed that the 3rd year postgraduates got the most number of high grades 211 (45.18%). Chi-square test was done and the association was found to be significant (p-value = 0.000). In Figure 4, X-axis represents the year of the postgraduate and y-axis represents the number of stainless steel crowns placed on each type of tooth. Blue colour represents primary upper right 1st molar, red colour represents primary upper right 2nd molar, green colour represents primary upper left 1st molar, orange colour represents primary upper left 2nd molar. This graph shows that the primary left 1st molar: 180 (38.54%) was the most treated tooth by all postgraduates. Chi-square test was done and the association was found to be not significant (p-value = 0.139).

CONCLUSION

Within the limits of the study, we can conclude that there was a significant difference in the placement of stainless steel crowns among the various postgraduates with high restorative rate at around 4 years in the boys with the most commonly restored tooth being the primary 1st molar in the maxillary arch. There was a gradual increase in the clinical performance with the 3rd years performing the best among the three years. We can conclude that clinical efficiency increases over years of practice.

Financial support and sponsorship

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

Conflicts of interest

The authors declare that there is no conflict of interest for this study.

REFERENCES

Bell, S. J., Morgan, A. G., Marshman, Z., Rodd, H. D. 2010. Child and parental acceptance of preformed

metal crowns. *European Archives of Paediatric Dentistry*, 11(5):218-224.

Chadwick, B. L., Gash, C., Stewart, K. 2007. Preformed Metal Crowns: Views of a Group of Dental Practitioners in North Wales. *Primary Dental Care*, 14(4):140-144.

Christabel, S. L. 2015. Prevalence of Type of Frenal Attachment and Morphology of Frenum in Children, Chennai, Tamil Nadu. *World Journal of Dentistry*, 6(4):203-207.

Demirci, M., Tuncer, S., Yuceokur, A. A. 2010. Prevalence of Caries on Individual Tooth Surfaces and its Distribution by Age and Gender in University Clinic Patients. *European Journal of Dentistry*, 04(03):270-279.

Durr, D. P., Ashrafi, M. H., Duncan, W. K. 1982. A study of plaque accumulation and gingival health surrounding stainless steel crowns. *ASDC Journal of Dentistry for Children*, 49(5):343-346.

Dye, B. A., Tan, S., Smith, V., Lewis, B. G., Barker, L. K., Thornton-Evans, G., Eke, P. I., Beltrán-Aguilar, E. D., Horowitz, A. M., Li, C. H. 1988. Trends in oral health status: United States. 11:1-92. Data from the National Health Survey.

Erdemci, Z. Y., Cehreli, S. B., Tirali, R. E. 2014. Hall versus conventional stainless steel crown techniques: in vitro investigation of marginal fit and microleakage using three different luting agents. *Pediatric Dentistry*, 36(4):286-290.

Govindaraju, L., Gurunathan, D. 2017. Effectiveness of Chewable Tooth Brush in Children-A Prospective Clinical Study. *Journal of clinical and diagnostic research: JCDR*, 11(3):31-34.

Govindaraju, L., Jeevanandan, G., Subramanian, E. M. G. 2017a. 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):55-58.

Govindaraju, L., Jeevanandan, G., Subramanian, E. M. G. 2017b. 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*, 11(03):376-379.

Govindaraju, L., Jeevanandan, G., Subramanian, E. M. G. 2017c. Knowledge and practice of rotary instrumentation in primary teeth among indian dentists: A questionnaire survey. *Journal of International Oral Health*, 9(2):45-45.

Gurunathan, D., Shanmugaavel, A. K. 2016. Dental neglect among children in Chennai. *Journal of Indian Society of Pedodontics and Preventive Den-*

- tistry*, 34(4):364.
- Harrison, R. L., Davis, D. W. 1980. Caries experience of Native children of British Columbia, Canada. *Community Dentistry and Oral Epidemiology*, 21(2):102-107.
- Innes, N. P., Ricketts, D., Chong, L. Y., Keightley, A. J., Lamont, T., Santamaria, R. M. 2015. Preformed crowns for decayed primary molar teeth. *Cochrane Database of Systematic Reviews*, 12.
- 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).
- Jeevanandan, G., 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*, 19(4):273-278.
- Kanatami, I. T. 2008. Inuit oral health survey report. Health Canada.
- Lakshmanan, L., et al. 2020. Assessing the quality of obturation and instrumentation time using Kedo-S files, Reciprocating files and Hand K-files. *Brazilian Dental Science*.
- Leake, J. L. 1992. Oral health survey of Canada's Aboriginal children aged 6 and 12, 1990-1. Department of Community Dentistry, University of Toronto and National School of Dental Therapy.
- Mcknight-Hanes, C., Myers, D. R., Davis, H. C. 1994. Dentists' perceptions of the variety of dental services provided for children. *ASDC Journal of Dentistry for Children*, 61(4):282-284.
- Nair, M., Jeevanandan, G., R, V., EMG, S. 2018. 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*, 21(4):411.
- Packiri, S. 2017. Management of Paediatric Oral Rantula: A Systematic Review. *Journal of Clinical and Diagnostic Research: Jcdr*, 11(9):6-09.
- Panchal, V., Jeevanandan, G., Subramanian, E. 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*, 37(1):75.
- Pediatric Dentistry 2018. Policy on Early Childhood Caries (ECC): Classifications, Consequences, and Preventive Strategies. 40(6):60-62.
- Peressini, S., Leake, J. L., Mayhall, J. T., Maar, M., Trudeau, R. 2004. Prevalence of dental caries among 7- and 13-year-old First Nations children, District of Manitoulin, Ontario. *Journal-Canadian Dental Association*, 70(6):382-383.
- Ramakrishnan, M., Bhukri, M. 2018. Fluoride, Fluoridated Toothpaste Efficacy And Its Safety In Children Review. *International Journal of Pharmaceutical Research*, 10(4):109-114.
- Ramazani, M., Ramazani, N., Honarmand, M., Ahmadi, R., Daryaeen, M., Hoseini, M. 2010. Gingival evaluation of primary molar teeth restored with stainless steel crowns in Pediatric Department of Zahedan-Iran Dental School-a retrospective study. *Journal of Mashhad Dental School*, 34(2):125-134.
- Ramos-Gomez, F., Weintraub, J., Gansky, S., Hoover, C., Featherstone, J. 2003. Bacterial, behavioral and environmental factors associated with early childhood caries. *Journal of Clinical Pediatric Dentistry*, 26(2):165-173.
- Randall, R. C. 2002. Preformed metal crowns for primary and permanent molar teeth: review of the literature. *Pediatric Dentistry*, 24(5):489-500.
- Ranly, D. M., Garcia-Godoy, F. 2000. Current and potential pulp therapies for primary and young permanent teeth. *Journal of Dentistry*, 28(3):153-161.
- Ravikumar, D., Jeevanandan, G., 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(02):232-237.
- Rodd, H. D., Barker, C., Baker, S. R., Marshman, Z., Robinson, P. G. 2010. Social judgements made by children in relation to visible incisor trauma. *Dental Traumatology*, 26(1):2-8.
- Rodd, H. D., Waterhouse, P. J., Fuks, A. B., Fayle, S. A., Moffat, M. A. 2006. Pulp therapy for primary molars. *International Journal of Paediatric Dentistry*, 16(s1):15-23.
- Rowan-Legg, A. 2013. Oral health care for children – a call for action. *Paediatrics & Child Health*, 18(1):37-43.
- Seale, N. S. 2002. The use of stainless steel crowns. *Pediatric Dentistry*, 24(5):501-505.
- Somasundaram, S., Ravi, K., Rajapandian, K., Gurunathan, D. 2015. Fluoride content of bottled drinking water in Chennai. *Tamilnadu. Journal of Clinical and Diagnostic Research: JCDR*, 9(10):32-34.
- Subramanyam, D., Gurunathan, D., Gaayathri, R.,

- Priya, V. V. 2018. Comparative evaluation of salivary malondialdehyde levels as a marker of lipid peroxidation in early childhood caries. *European Journal of Dentistry*, 12(01):067-070.
- Webber, D. L. 1974. Gingival health following placement of stainless steel crowns. *ASDC Journal of Dentistry for Children*, 41(3):186-189.
- Zimmerman, J. A., Feigal, R. J., Till, M. J., Hodges, J. S. 2009. Parental attitudes on restorative materials as factors influencing current use in pediatric dentistry. *Pediatric Dentistry*, 31(1):63-70.