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Nature and Pattern Of Primary Teeth Extraction Among Children In Chennai City With Early Childhood Caries

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Abstract: Early childhood caries still remains as one of the main reasons for extractions in children. Many studies have been carried out on the extraction pattern of primary teeth in children, not much information is available regarding its outcome in the Indian population. So this study was aimed at investigating the frequency and type of the primary tooth extracted and the pattern of extraction in the South Indian population. This was a private hospital based 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 extraction of at least one primary tooth under local or general anesthesia were included in the study. Out of the total of 652 teeth extraction, 351 were of males and 301 females with the most common tooth extracted being the primary upper central incisor (35.53%) at 6 years (43.23%). Chi square test was done to assess the significance of association and there was a significant difference in the tooth extracted with age ($p=0.00$) and gender ($p<0.002$) and with arch type ($p=0.00$) and in the 1st quadrant ($p<0.035$). Within the limits of the study the most commonly extracted teeth was the primary upper central incisor high frequency in the maxillary arch. Boys were more affected than girls and most of the extractions were done at 5 years of age.

Keywords: Dental extractions; Primary teeth; Early childhood caries; Pattern of extraction; Children

INTRODUCTION

A global oral health problem that we are facing today is dental caries with distinctive variations in its distribution. It continues to be the most common infectious disease in children. It is a multifactorial disease with Streptococcus mutans being the major contributor in its development (Fejerskov and Thylstrup, 1999).

Early Childhood Caries specific type of dental caries is defined as the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries) or filled tooth surfaces in any primary tooth in preschool children between birth and 71 months of age (Association and Others, 2000). So this type of caries is present only in children of years 6 and below. Evidence suggests that dental diseases like trauma, caries, periodontal diseases are the major reasons for early loss of tooth in all age groups (Alsheneifi and Hughes, 2001; Subramanyam et al., 2018). Caries is the most common reason for early loss in younger age groups (Richards et al., 2005; Al-Shammari et al., 2006; Mansour Ockell and Bågesund, 2010).

Though there is an increase in awareness and numerous preventive measures are becoming available, dental caries remain to persist as a serious oral health problem. Various studies have shown that dental caries are more prevalent in children. This can be contributed by factors such as inability of the young children to brush their teeth properly (Govindaraju and Gurunathan, 2017). This causes the bacterial cells of S.mutans to colonize the tooth and form a biofilm called dental plaque (Fejerskov and Thylstrup, 1999). Other reasons include high intake of sugars and lack of oral health education (Govindaraju and Gurunathan, 2017) and thereby leading to the presence of a high level of dental neglect by parents (Gurunathan and Shanmugaavel, 2016). The primary dentition is important to guide the eruption of permanent teeth and traumatic dental injuries may affect this balance (Fymbo, 1936; Koroluk and Riekman, 1991; Jesus et al., 2010; Ravikumar, Jeevanandan and

Subramanian, 2017). Efficient plaque control is essential for maintaining good gingival and periodontal health, prevention of dental caries and to preserve oral health (Cugini and Warren, 2006; Claydon, 2008).

Primary teeth can be saved through treatments such as sealants, restorations, pulp capping, pulpotomy, and lastly pulpectomy. Pulpectomy is the choice of treatment for primary teeth with chronic inflammation or necrosis in the radicular pulp, thereby retaining the primary teeth in the oral cavity until its physiological exfoliation and as an alternative to extraction and space maintenance (Pinkham et al., 2005; Govindaraju, Jeevanandan and E. M. G. Subramanian, 2017b; Jeevanandan, 2017; Nair et al., 2018; Lakshmanan et al., 2020).

The major concern in the field of paediatric dentistry is the loss of primary teeth despite various efforts available 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 (Pinkham et al., 2005; Govindaraju, Jeevanandan and E. M. G. Subramanian, 2017a; Govindaraju, Jeevanandan and E. Subramanian, 2017; Jeevanandan and Govindaraju, 2018; Veerale Panchal, Jeevanandan and Subramanian, 2019). An important issue that we face while treating primary teeth is maintenance.

Several studies have investigated the risk indicators of tooth loss and factors such as income, education, oral hygiene practices, smoking and gender are being reported as factors for tooth loss (Ak et al., 2005). So differences in characteristics of study population, cultural belief, social economic characteristics, immunological factors, genetic reasons were some of the contributory factors that can cause early exfoliation. This is the reason why the same bacterial factors did not produce similar pathological conditions (Montandon, Zuza and de Toledo, 2012). Early loss of primary teeth also predisposes to crowding due to various other anatomic factors present in the child, like high frenal attachment (Christabel and Deepa, 2015), rotation and impaction of permanent teeth (Pedersen, Stensgaard and Melsen, 1978) and pathological conditions leading to early mobility of the teeth (Packiri, Gurunathan and Selvarasu, 2017).

Although the prevalence of dental caries in children has decreased considerably in recent years, caries still continue to affect many children in the general population. The accessibility for children from rural places to oral health care is very limited. It is also believed that the primary teeth need no treatment as new teeth will erupt automatically and may be attributed towards the lack of education and attitudes towards dental treatment in primary teeth (Chhabra and Chhabra, 2012; Montandon, Zuza and de Toledo, 2012).

Though there are various reasons for extraction in children caries still seems to be a leading cause for extractions (Bansal et al., 2017), which leads us to further question if there is any similar pattern of extraction existing in various age groups and especially in children with early childhood caries and if this statement holds true in the Indian population. 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)

So this study was aimed at investigating the frequency and type of the primary tooth extracted and the pattern of extraction in the South Indian population.

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 and analysed. 7415 pediatric patients have visited the hospital out of which 1561 children were below the age of 6. Totally records of 652 patients who underwent extractions were used in the study. Patient Id, age, gender, reason for extraction and type of teeth extracted were extracted and analysed.

Children who were diagnosed with ECC till 6 years old and had at least one tooth extracted were included. The teeth that were indicated for extraction and failed despite treatment were included, and a total of 632 teeth were extracted. Extractions done for causes other than early childhood caries, children with systemic disorders and special children and children with no caries were excluded.

The children were divided by age, gender, tooth type extracted and was analysed by 2 examiners. Cross verification for incomplete and inaccurate data was cross verified with intraoral photographs and radiographs. The internal validation was achieved by making the sample representative. This was further externally validated due to a large sample size but generalisable only to the South Indian population.

The study was conducted in accordance with ethical standards with ethical approval from the Institutional ethical committee: (Ethical approval number: SDC/SIHEC/2020/DIASDATA/0619-0320 of Saveetha Institute of Medical And Technical Sciences.

Statistical Analyses:
The collected data was entered into Microsoft office Excel 2013 transferred to SPSS version 26.0 software (SPSS, Chicago, IL, USA) for statistical analysis. The independent variables: age, gender, dependent variables: arch type, tooth type were put to descriptive analysis and Chi-square test was done to assess the significance of association between the categorical variables.

RESULTS AND DISCUSSION
Out of the 652 teeth extracted, 351 (53.8%) were of males and 301 were of females (46.2%) [Figure 1]. The percentage of extractions at various ages were 1 year: 9(1.4%), 2 years: 4(6%), 3 years: 53 (8.1%), 4 years: 131(20.1%), 5 years: 174 (26.7%), 6 years: 281 (43.1%). [Table 1].
The percentage of various tooth types extracted were primary upper and lower centrals: 36%, primary upper and lower laterals: 17.7%, primary upper and lower canine: 1.2%, primary upper and lower 1st molars: 31.8%, primary upper and lower 2nd molars: 13.2% [Figure 2].
Out of the number of extractions done distribution for the various types of teeth treated were maxillary central incisors: 209, maxillary lateral incisors: 96, maxillary canines: 4, maxillary 1st molar: 114, maxillary 2nd molar: 23, mandibular central incisors: 25, mandibular lateral incisors: 19, mandibular canines: 4, mandibular 1st molar: 93, mandibular 2nd molar: 63. Chi square test was done and the association was found to be significant (p value = 0.000) [Figure 3].
The overall distribution of number of extraction for the various types of teeth treated were maxillary anteriors: 309, maxillary posteriors: 137, mandibular anteriors: 48, mandibular posteriors: 156 [Table 2].
The number of extractions for the various types of teeth treated in various quadrants namely in 1st quadrant: primary central incisors: 112, primary lateral incisors: 44, primary canine: 1, primary 1st molar: 56, primary 2nd molar: 15; in 2nd quadrant: primary central incisors: 97, primary lateral incisors: 52, primary canine: 1, primary 1st molar: 58, primary 2nd molar: 8, in 3rd quadrant: primary central incisors: 11, primary lateral incisors: 10, primary canine: 3, primary 1st molar: 45, primary 2nd molar: 29; in 4th quadrant: primary central incisors: 14, primary lateral incisors: 9, primary canine: 1, primary 1st molar: 48, primary 2nd molar: 34 . Chi square test was done and the association was found to be significant (p value = 0.000) [Table 3].
All the teeth were extracted due to caries and primary central incisors were the most extracted. Most of the extractions were done in males in the maxillary arch (53.60%).
Dental diseases seem to be a major health problem worldwide despite preventive treatment approaches in pediatric dentistry (Pedersen, Stensgaard and Melsen, 1978; Frencken et al., 2017). ECC is a multifactorial disease and commonly affects preschoolers and can progress more in those who are at a high risk. It can cause a great impact on the quality of life of young children (Prakash et al., 2012; Subramanyam et al., 2018).
This issue worsens when children with dental caries face behavior and cooperative issues that can significantly complicate treatment procedure (Casamassimo et al., 2009; Collado et al., 2017). Early loss of primary molars is a serious issue of concern in pediatric dentistry (Govindaraju, Jeevanandan and E. Subramanian, 2017). In the dental records that were analysed till 6 years of age. Statistically significant scores were present in the primary tooth type extracted due to age, gender, arch type and quadrant type.
The most common type of tooth that was extracted was the primary central incisor which was similar to some earlier studies (Alamoudi, 1999; Samuel et al., 2018; Candan and Buldur, 2020). A study on parents' perception of the esthetics of maxillary primary incisors that were grossly carious and infected or darkly discolored concluded that parents, primarily mothers, found these conditions to be unattractive and hence were more comfortable with those teeth being extracted (Woo et al., 2005). The sequelae resulting from premature loss of primary incisors can affect esthetics, quality of life, eating, speech development, arch integrity, development and eruption of the permanent successors, and development of oral habits (Holan and Needleman, 2014). Some authors suggest that the most commonly extracted tooth is the 1st molar due to the deep pits and cracks on the occlusal surface and proximal surface of molars are prone to caries due to their smooth surfaces (Alamoudi, 1999). More over second primary molars are more preferred to be saved as they show better clinical success rates for pulp treatment (Mansour Ockell and Bågesund, 2010; Candan and Buldur, 2020).
Moreover in this study most of the extractions were done for 6 years – old groups, mostly in males in the maxillary arch as compared to the mandibular arch in the 1st quadrant. The age groups of extracted teeth were consistent with the study (Alsheneifi and Hughes, 2001; Ak et al., 2005; Casamassimo et al., 2009; Mansour Ockell and Bågesund, 2010; Mukhopadhyay and Roy, 2015; Samuel et al., 2018; Candan and Buldur, 2020). It was stated that ‘children do not become aware of the loss of a primary incisor prior to age five or six. This shows that esthetics becomes a prime reason for the extraction of grossly decayed discolored teeth at this age especially due to peer group pressure from school for the child (Moss and Maccaro, 1985). The reason for maxillary extractions was due to patient negligence, early exfoliation, early eruption of anteriors and due to feeding habits (Holan and Needleman, 2014). It is seen clearly that boys are more affected in this study. Male children who have the same genotype of mutans streptococci as their mother have up to 13 times greater risk of caries development than female children who acquire the same strain of bacteria from their mother (Li and

Caufield, 1995). Also mothers play an important role in the establishment of sweetness preference in their children and that boys may be favoured with more sweets leading to increase and progression of carious lesions (Maciel et al., 2001). Extractions were more prominent in the 1st quadrant. This could be due to the improper brushing on the right sided quadrant by right handed individuals. Several studies which investigated the effects of handedness on the oral-hygiene status suggested that left handers have better oral conditions, but this finding was not statistically significant (Özgöz et al., 2010).

Early intervention can lead to avoidance of extensive invasive procedures and can be limited to restoration. Patients who do not suffer from severe symptoms like non cavitated lesions can be treated by minimally invasive techniques to preserve tooth structure. One can avoid extraction by early intervention in high risk patients and shift to preventive measures like sealants and fluoride application (Somasundaram et al., 2015; R Mahesh, 2018). This study provided an insight into the pattern of extraction prevalent in children of Chennai below six years of age, understanding this nature and pattern is of great advantage in establishing ideal preventive protocols. Implementing the results of this study for establishing ideal preventive protocols for teeth at high risk for undergoing extraction can limit occurrence of dental caries leading to better quality of life in children.

This study had a few limitations like the study is unicentric. Skill set of various dentists was involved in diagnosis and interpretation and the sample population was limited to a particular geographic location.

Table 1: Table showing the distribution of the number of extractions for each age group. From this table we can infer that most of the patients who underwent extractions were 6 years old (43%).

Age (in years)	Frequency (N)	Percentage (%)
1	9	1.4
2	4	0.6
3	53	8.1
4	131	20.1
5	174	26.6
6	281	43.0

Table 2: Table showing the distribution of number of extractions for the various types of teeth based on anatomic locations. This table showed that most of the extraction were in the maxillary arch especially in the anterior region 309 (47.07%).

Tooth Treated	Frequency (N)	Percentage (%)
Maxillary anteriors	309	47.07
Maxillary posteriors	137	21.07
Mandibular anteriors	48	7.38
Mandibular posteriors	156	24.00

Table 3: Table showing association between the various types of teeth treated extracted and different quadrants. Most of the extractions were done in the 1st quadrant with the primary maxillary central incisor being the most extracted tooth (112). Chi-square test was done and the association was found to be significant (p value = 0.000, <0.05)

	Central Incisors	Lateral Incisors	Canines	1st Molars	2nd Molars	P Value

1st Quadrant	112	44	1	56	15	P = 0.000
2nd Quadrant	97	52	1	58	8	
3rd Quadrant	11	10	3	45	29	
4th Quadrant	14	9	1	48	34	

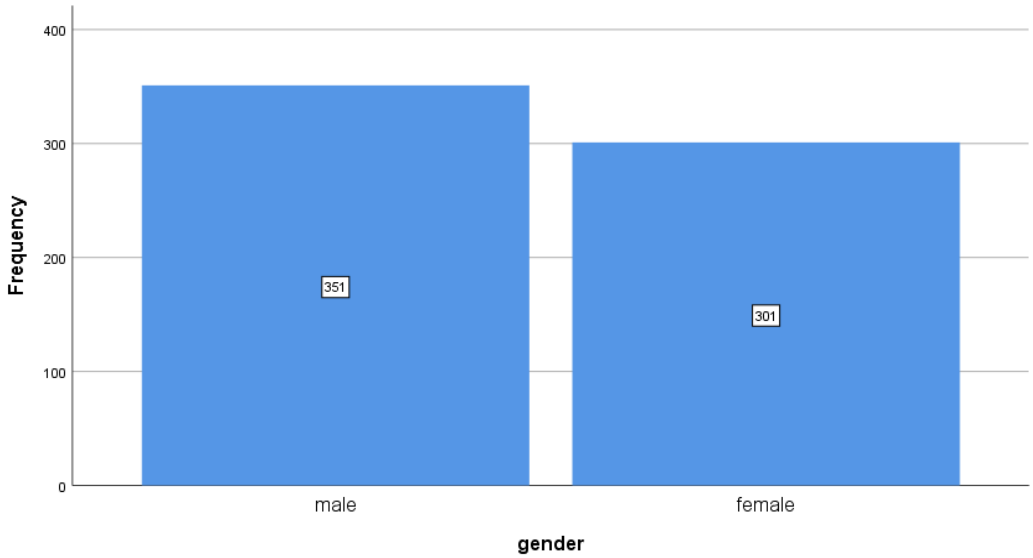

Fig.1: Bar graph showing the distribution of children undergoing extractions aged 0 to 6 years based on gender represented in blue color. X - axis represents gender and y - axis represents the frequency (number of patients).This graph shows that boys (351) were more as compared to girls (301).

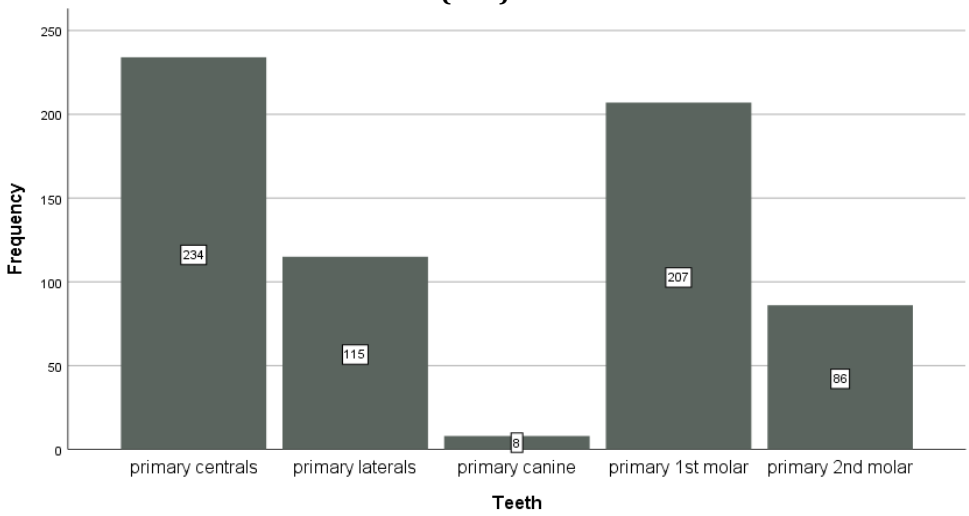

Fig.2: Bar graph showing tooth wise distribution of number of extractions among pediatric patients. X - axis represents the teeth extracted and y - axis represents the frequency (number of procedures) represented in grey color. The graph showed the primary central incisors 234 (36%) were being extracted the maximum number of times.

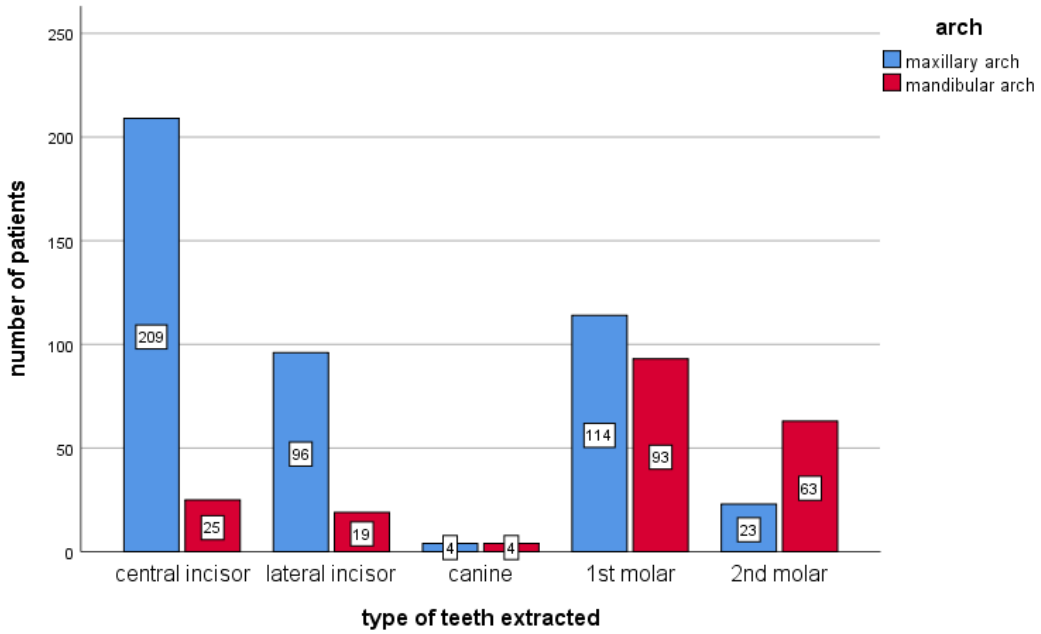

Fig.3: Bar graph showing the association between the type of tooth extracted and the arch involved in extraction. X - axis represents the type of teeth extracted and Y - axis represents the number of patients based on the various arch types (maxillary and mandibular arch). Blue color represents maxillary arch and red color represents mandibular arch. This graph reveals that there was an association between the type of teeth extracted and the arch. The tooth that was maximum extracted was the maxillary central incisor (209). Chi-square test was done and the association was found to be significant (p value = 0.000, <0.05).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)

CONCLUSION

Within the limits of the study, it can be concluded that there was an increased loss of primary teeth present due to early childhood caries which was predominant in male children. The most commonly affected arch was the maxillary arch and the common teeth that was extracted was the maxillary central incisor.

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Conflicts of interest
There are no conflicts of interest.

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