Type of Study: Retrospective Study

Analysis of the Cost Associated with the Treatment of Early Childhood Caries in Children Aged 2-6 Years

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Abstract

One cannot deny that cost factor plays an important role in the treatment phase of any disease and thus can widely affect the patient's acceptance to treatment. Overall cost of treatment gives an idea of the approximate cost differences that can be expected by patients. In this given study we aim to analyse the overall cost for treatment procedures done for children suffering from early childhood caries in the state of Tamil Nadu. This is a hospital based retrospective study. All data of the patients visiting Saveetha Dental College and hospitals from June 2019 to March 2020 located in Chennai were retrieved manually. Children who were diagnosed with early childhood caries between 2-6 years who had at least one procedure done were included. A total of 1210 patients were included in the study out of which 660 were males (54.55%), and 550 were females (46.45%). Out of 1210 patients: average costs for 1 to 5 procedures: Rs 231/-, 6 to 10 procedures: Rs 698/-, 11 to 15 procedures: Rs 1222/-, 16 to 20 procedures: Rs 1783/-, 21 to 25 procedures: Rs 2419/-, 26 to 30 procedures: Rs 2765/-, 31 to 35 procedures: Rs 3261/-, 36 to 40 procedures: Rs 3713/-, 41 to 45 procedures: Rs 3893/-. Out of total procedures the patient count for 1 to 5 procedures: 715, 6 to 10 procedures: 232, 11 to 15 procedures: 98, 16 to 20 procedures: 47, 21 to 25 procedures: 40, 26 to 30 procedures: 30, 31 to 35 procedures: 25, 36 to 40 procedures: 12, 41 to 45 procedures: 4. We can conclude that the most of the patients required 1 - 5 dental procedures with the frequency being highest at 5 years and mostly in male children and the overall cost had a gradual linear increase with the increase in the number of procedures.

Keywords: *dental extractions; primary teeth; early childhood caries; treatment cost*

Introduction

Dental caries is a global oral health problem with distinctive variations in its distribution. It continues to be the most common infectious disease. ECC is one of the most serious public health problems in children in developed as well as developing nations and a commonly neglected disease among children in India [1]. Early childhood caries is defined by the American Academy of Pediatric Dentistry (AAPD) as the presence of one or more decayed (cavitated or non-cavitated), missing due to caries or filled tooth surfaces in any primary tooth in a child of age 71 months or younger [2]. In rural south India, the prevalence of ECC has been reported as 40.6% among 0 to 3-y-old children, of whom 50.3% had non-cavitated surfaces and 49.7% had cavitated surfaces [3]. A high prevalence of ECC has been reported in India, with none of the states having prevalence below 40% [4] with Tamil Nadu having a prevalence of 55.73%[4–10]. Any disease having 40% prevalence is a serious health issue and requires focused attention [4]. This trend continues in young children in spite of major progress in the field of caries control over the past few decades [4,11–14].

A latest survey of National consumer usage and attitudes towards dental education in the population conducted along 150 cities in India, the dental problems seem to be due to low dental awareness and poor oral hygiene habits. Most of the rural population still used non dentifrice products like Neemstick, charcoal and ash. Many patients defer from treatment due to dental pain and also due to increase in treatment costs [13]. Few of the

barriers for seeking dental services as classified by FDI are individuals (lack of perceived need, financial issues, lack of access), dental profession (uneven distribution, not sensitive to patient's attitudes and needs), and society (insufficient support for research, ineffective support of public attitudes) [13].

Early childhood caries can give rise to sensitivity, pain and infection, difficulty in mastication, leading to systemic effects like overall malnutrition, gastrointestinal problems. Hence treatment plays a critical role in oral and overall health [15].

Treatment ranges from oral prophylaxis[16], restorations, pulp therapies[17–23]in the oral cavity [24,25] and management of trauma to the dentition[26] etc. Usage of multiple medications, laser, ultrasound equipment, radiation therapy, multiple imaging(CBCT, CT, MRI) and procedures in general anaesthesia can also significantly increase the cost.

One very important factor for the increase in cost is due to dental neglect. Dental neglect is defined as parents' persistent failure to take precautions and provide necessary dental treatment to maintain the child's oral health and to ensure their freedom from pain and infection. It is the responsibility of parents to pursue health-related necessities for their children. In this regard, the lack of parent's or guardian's attention will have a negative influence on the child's oral status. Thus, the interventions that are directed toward parents' beliefs and attitudes about oral health may be beneficial in the prevention of oral problems such as dental caries [27].

One cannot deny that cost factor plays an important role in the treatment phase of any disease and thus can widely affect the patient's acceptance to treatment. The results of the present study showed that the parents having income less than Rs15,000 and who have done secondary education showed lesser levels of positive dental attitudes which is similar to studies done by Freeman et al. and Williams et al[28,29]. Hence, there is a greater probability for the occurrence of oral diseases among children of low-income mothers[30], which is in contrast to the result of Al Gahnim et al.,[31] where it was stated that income does not play a role in attitude toward oral health.

Overall cost of treatment gives an idea of the approximate cost differences that can be expected by patients, so in this given study we aim to analyse the overall cost for treatment procedures done for children suffering from early childhood caries in the state of Tamil Nadu [32].

Materials and Methods

This is a hospital based retrospective study. It was done by two examiners. Simple random sampling was done to reduce sampling bias. Dental records of 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. All information including patient ID, treatment done, bill number, cost of procedure, total number of procedures, age, and gender were retrieved.

A total 1210 case sheets were retrieved manually and compiled and tabulated in Excel. Children who were diagnosed with early childhood caries between 2-6 years who had at least one procedure done were included and children with systemic disorders, special children and children devoid of caries were excluded.

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 treatment was taken before the start of the clinical procedure. After confirmation of the diagnosis a parental consent in writing and video consent was obtained and then the required treatment procedures were done by adhering to strict treatment protocols.

Cross verification for incomplete and inaccurate data was cross checked with treatment bills and intraoral photographs and verified. The internal validation was achieved by making the sample representative. This was further extended to external validity due to a large sample generalized but only to the South Indian population.

Ethical aspect:

This study was conducted with ethical approval obtained 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 datasheet transferred to SPSS version 26.0 software (SPSS software Chicago, IL, USA) for statistical analysis. They were put to descriptive analysis

and chi square test was done to assess the significance of association between the categorical variables.

The independent variables: gender, age. The independent variables: total number of procedures, cost of procedures, treatment done.

Results and Discussion

A total of 1210 patients were included in the study out of which 660 were males (54.55%), and 550 were females (46.45%) [Figure 2].

The total number of patients across various age groups 1 year: 1.08%, 2 years: 3.39%, 3 years: 12.73%, 4 years: 23.97%, 5 years: 30.99%, 6 years: 28.84% [Figure 1].

Out of total procedures the patient count for 1 to 5 procedures: 715, 6 to 10 procedures: 232, 11 to 15 procedures: 98, 16 to 20 procedures: 47, 21 to 25 procedures: 40, 26 to 30 procedures: 30, 31 to 35 procedures: 25, 36 to 40 procedures: 12, 41 to 45 procedures: 4 [Figure 3].

Out of 1210 patients: average costs for 1 to 5 procedures: Rs 231/-, 6 to 10 procedures: Rs 698/-, 11 to 15 procedures: Rs 1222/-, 16 to 20 procedures: Rs 1783/-, 21 to 25 procedures: Rs 2419/-, 26 to 30 procedures: Rs 2765/-, 31 to 35 procedures: Rs 3261/-, 36 to 40 procedures: Rs 3713/-, 41 to 45 procedures: Rs 3893/-. Chi square test was done and the association was found to be significant (p value = 0.045) [Figure 4].

The distribution of the total number of procedures for the various age groups included in the study for the various types of treatment procedures done. Chi square test was done and the association was found to be not significant (p value = 0.000) [Figure 5].

Based on gender, males underwent more treatment procedures, on an average underwent 1-5 procedures – 715 patients (59.09%) with this having the highest frequency at 5 years – 243 patients (30.99%). Overall the base minimum cost ranged from Rs.30/- to the bare maximum of Rs.3893/-.

One cannot deny the fact that early childhood caries can lead to several other problems affecting even the permanent dentition like malocclusion so the expense of treating the disease continues even after initial treatment [32,33]. This study in Alaska stated that all interventions were shown to generate a cost saving to the health care payers [34].

We see that there is a gradual increase in the cost of the overall treatment as the number of procedures increase. This can be attributed to the increase in the complexity of the treatment leading to the increase in cost. This was consistent with previous literature [34,35], it is also seen that the cost of chair side treatment was far less as compared to general anaesthesia [36–38]. At the same time we can deny that general anaesthesia was more effective than chairside treatment [36,37] and it gave an additional 4 caries free months [36].

In this study there is a gradual decrease in the number of patients as the average number of procedures increase. The most frequent type of treatment required were one surface restorations followed by extractions, pit and fissure sealants and pulp therapy [35]. In figure 3 there is a huge difference in the number of patients undergoing 1-5 procedures and 6-10 procedures. This could be due to the treatment being carried out for a temporary solution on emergency management. The increase in fallout rate also is caused due to the ability of parents to come during working hours and for children to take off from schools. Most of the patients faced severe stages of the disease mostly due to delay in proper treatment [35].

It was also observed that all sections of society lacked awareness with respect to treatment of primary teeth and had the similar misconception that primary teeth would fall off and hence do not require treatment. This leads to failure to seek or delay in seeking dental treatment, to comply with treatment plan, and failure to implement basic oral care.

We see that though in 1-5 procedures the number of patients keeps increasing, for all other procedure groups there is an increase in trend till 4-5 years and then there starts a gradual decrease. We can explain this trend as once a child enters school, proper meal times, decrease in snacking, increased school dental programmes and overall growth and development of the child further leads to better care of the oral cavity and increase in oral hygiene practices leading to a decrease in the severity of the disease, but a study by Kastenborn et al states that treatment cos of the patient is high irrespective of the age [39].

These excessive costs can be decreased by the means of early detection and practicing preventive approaches to management of dental caries [35]. Regular dental checkups must be promoted. The overall cost of all the

procedures eventually points to only one main strategy: 'prevention'. Early intervention can lead to avoidance of extensive pulp therapy and can be limited to restoration. Effective plaque control measures can significantly contribute to the prevention of dental caries. In the present day, various chemical and mechanical methods are available, of which tooth brushing persists to be the most effective method[40]. Patients who do not suffer from severe symptoms like non cavitated lesions can be treated by minimally invasive techniques to preserve tooth structure. One of the most common preventive methods range from maintenance of proper oral hygiene[40] to incorporation of fluoride in daily life in form of fluoride toothpastes, fluoridated water, topical fluoride gels, varnishes etc[41]. The World Health Organisation has recommended adding fluoride to drinking water as it has less than optimal fluoride levels [42].

Limitations of the study included retrieval and use of data from a single hospital setup which could have led to difference in costs in other hospitals/clinics. Since this study is done in a university dental setup the costs are lesser .Hence these costs of treatment to be extrapolated to the market value.The restrictions in the geographic location will not give a generalized result for the given data. Many lower sections of the society would prefer a government hospital compared to a private hospital leading to a disproportion in representation of the population.

Proper dental examination, oral hygiene maintenance and routine restorative procedures must be performed to prevent development of more serious damaging and expensive conditions. Further studies focusing on cost saving treatment of timely management of dental caries and implementation of preventive measures are necessary.

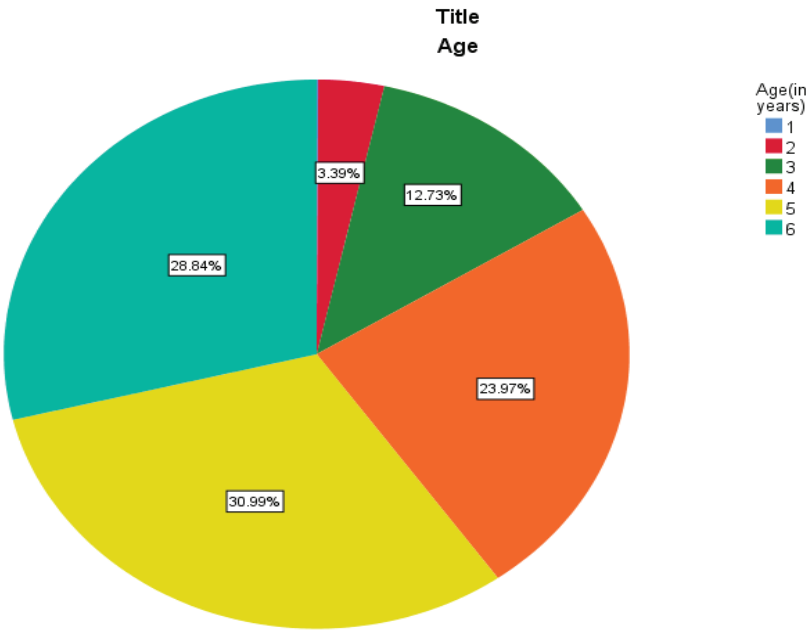

Figure 1: Pie chart showing the distribution of patients across various age groups. Blue color represents 1year olds, red color represents 2 year olds, green color represents 3 year olds, orange color represents 4 year olds, yellow color represents 5 year olds, pale green color represents 6 year olds. From this chart it is seen that the 4 year olds were the most treated (30.99%).

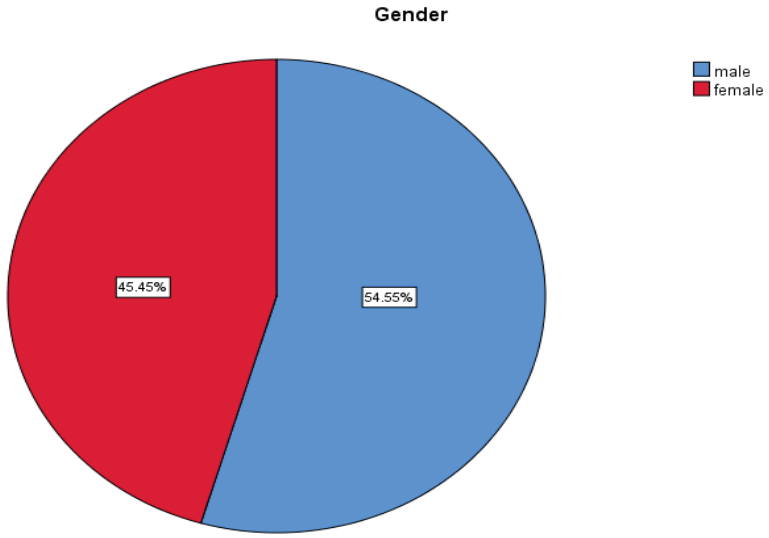

Figure 2: Pie chart showing the distribution of patients based on gender. Red color represents females and blue color represents males, The distribution of patients based on gender was 660 were males (54.55%), and 550 were females (46.45%) with the number of males being treated higher.

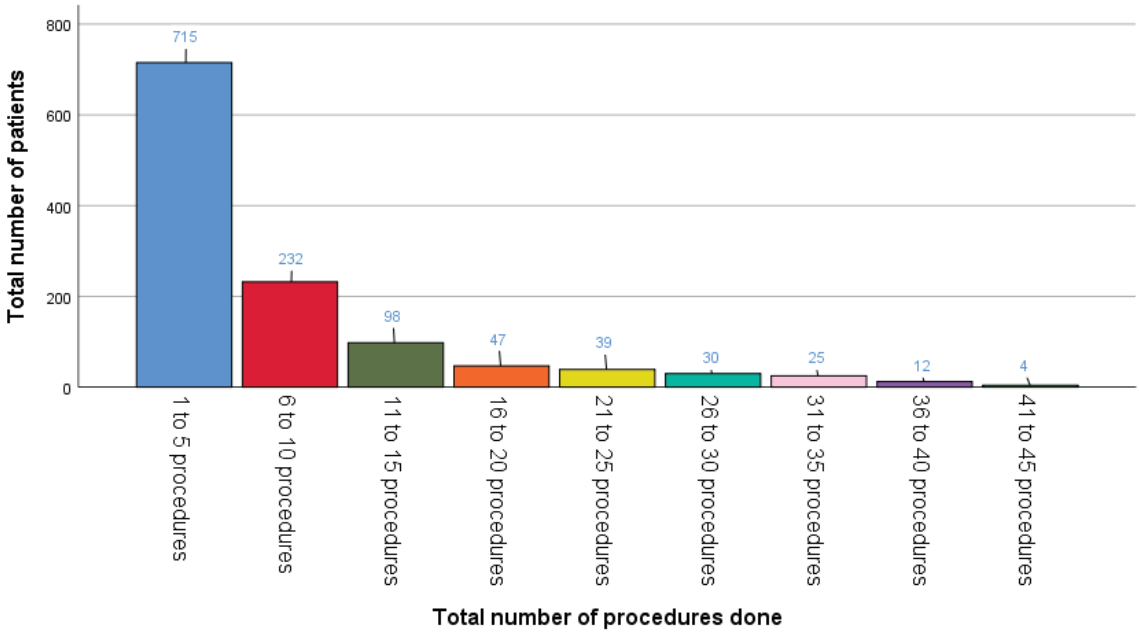

Figure 3: Bar graph showing the distribution of average number of procedures underwent by patients. X - axis represents the total number of procedures done and y axis represents the number of patients. This graph shows that most of the patients underwent only 1 to 5 treatment procedures (715).

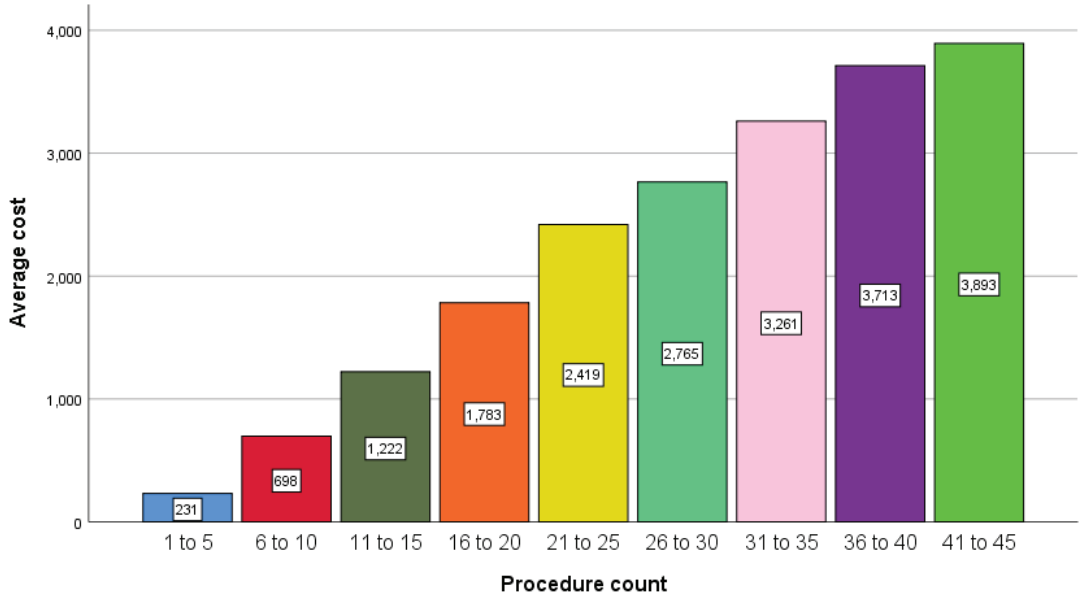

Figure 4: Bar graph showing distribution of average costs for overall treatment for all the patients according to the total number of procedures undergone by the patients. X - axis represents the total number of procedures and the y - axis represents the average cost. This graph shows that as the number of procedures increases the cost increases with the cost being highest (Rs.3893) for children in the 41 to 45 procedures group . Chi-square test was done and the association was found to be significant (p value = 0.045).

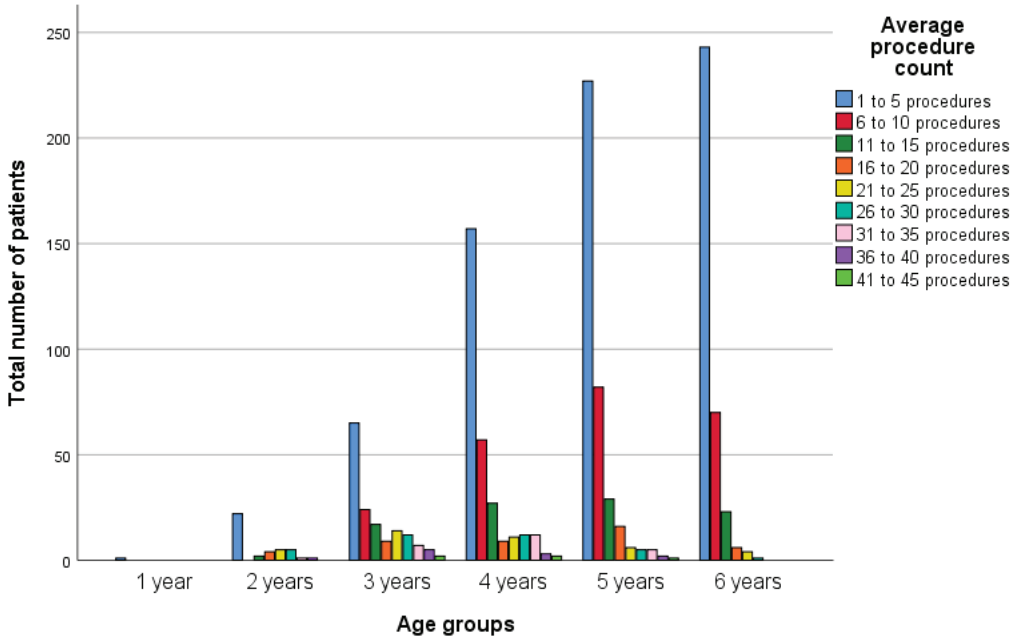

Figure 5: Bar graph showing the distribution of number of procedures for the various age groups included in the study. X - axis represents the various age groups and y - axis represents the total number of patients for the various treatment procedures. From this graph we can infer that the number of patients requiring treatment procedures decreased with an increase in age with patients requiring a minimum of 1 - 5 procedures being constantly high across all age groups. Chi-square test was done and the association was found to be not significant (p value = 0.000).

Conclusion

Within the limits of the study we can conclude that the most of the patients required one to five dental procedures with an increase in frequency with increase in age. The overall cost for a patient showed a gradual linear increase in cost with the increase in the number of procedures. This is with respect to one dental university where the charges were minimal compared to private clinic setups.

Conflict of Interest: There are no conflicts of interest.

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Source of Funding: Self

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

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