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Acceptance towards space maintainer in paediatric population with premature primary tooth loss- an institutional study

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Abstract: Space maintainers are the most commonly used appliance for interceptive orthodontics. Space maintainer is mainly used when there is premature loss of deciduous molar to eliminate or reduce the severity of developing malocclusion.The aim of this study was to evaluate the acceptance of space maintainer in paediatric patients undergoing extraction of early loss of primary teeth. This study included children below the age of 9 years, both male and female, reported to Saveetha Dental College between June 2019 to March 2020 with the history of primary tooth extraction. Inclusion criteria included paediatric patients below 9 years of age who were indicated for space maintainers. Exclusion criteria included adult patients, medically-compromised patients, patients with special care needs and patients with congenital missing teeth. A total of around 1700 patient records were reviewed and analysed for the inclusion criteria and the following parameters were gathered; patients' age, gender, patients acceptance towards space maintainer and type of space maintainer given. Data was recorded in Microsoft Office Excel (2013) and analysed using SPSS Software Version 26.0. Chi-square test was done to find out correlation between variables. Significant level test was set at $p<0.05$. The results proved that a total of 702 children indicated for space maintainers. Acceptance of space maintainer was observed in 10.3% of patients.Statistically significant association was found in acceptance of space maintainer between age groups ($p<0.05$). Within the limits of this study, it is concluded that 10.3% acceptance of space maintainer was found among patients. Children with 6 years of age had a favourable acceptance towards space maintainers. The deleterious effect in non acceptance space maintainer and awareness about the preventive orthodontics should be instilled among parents and children.

Keywords: Innovation; Interceptive orthodontics; premature tooth loss; primary tooth; space maintainer

INTRODUCTION

The primary dentition plays a very significant role in growth and development of a child as it not only allows proper mastication, speech and appearance of a child but also acts as a guide for the eruption of permanent teeth (Barbería et al., 2006). Shedding of primary teeth followed by eruption of permanent teeth is a normal physiological process that takes place as a child grows (Rao and Sarkar, 1999). If this normal physiological process were ro be disrupted due to factors such as carious lesions, premature loss of primary teeth, delayed eruption and such, it may lead to mesial migration of adjacent teeth which results in loss of arch length that will manifest as malocclusion in permanent dentition (Qudeimat and Fayle, 1998). In other words, one of the most common causes for malocclusion is tooth material arch length discrepancy. When there is an excess in the arch length or space compared to the tooth material, spacing will occur and deficient arch or space compared to tooth material results in crowding in the dentition. When there is premature loss of the primary tooth, the adjacent teeth to the space are more likely to drift towards the space. This results in loss of space for the eruption and proper alignment of succedaneous teeth into the arch and this can result in different kinds of malocclusion (Goenka et al., 2014). Hence, in order to prevent these problems from occurring , the primary teeth need to be preserved in the arch until its normal time of shedding (Krzolu and Özay Ertürk, 2004). It can be said that the primary teeth serves as the best space maintainer for its succedaneous teeth. However, despite efforts to retain primary teeth, premature loss of tooth or extraction can be unavoidable due to extensive carious lesions and other reasons (Setia et al., 2013). The safest way to maintain space in the arch and prevent malocclusion is by placement of a space maintainer (Mubaraki et al., 2017).

Space maintainers are the most commonly used appliance for interceptive orthodontics (Mubaraki et al., 2017). They are indicated to maintain mesiodistal relationship in the arch (Giorgio, 1973; Terlaje and Donly, 2001). Space maintainer is mainly used when there is premature loss of deciduous molar to eliminate or reduce the severity of developing malocclusion. Various types of space maintainer can be used for premature tooth loss, depending on the patient's age, dental development stage, dental arch, missing tooth involved, occlusion, child's ability to cooperate and tolerate appliances (Qudeimat and Fayle, 1998). Christensen et al reported that clinicians should be careful when managing premature tooth loss as it may influence dental development well into adolescents (Christensen and Fields, 1994).Space maintainers are initiated in the developing dentition to prevent or reduce severity of malocclusion. It's use also avoids future complexity of orthodontic treatment, overall treatment time and cost as complicated occlusions are more expensive to correct.

Al-Shahrani et al studied the prevalence of premature tooth loss of primary teeth in 307 male children aged 9 to 11 years. 51% of the children had premature loss of primary teeth (Al-Shahrani et al., 2015). Nayak et al reported 51% of premature first primary molar loss and 70% prmeature second primary molar loss resulted in loss of space and a consequence of malposition of a permanent tooth in that quadrant (Nayak et al., 2004). Given that space maintainers are indicated in children and results of appliance are not immediately visible, there is a possibility of parents or children to not accept treatment. Mubarak et al reported that the main factor affecting parents acceptance towards space maintainer is monthly income (Mubaraki et al., 2017). Another study by Yousef et al reported that 33.8% of patients' parents refuse space maintainers for their children (Al-Dlaigan, 2007). However, the reason is not studied.

Over the past 5 years, innumerable clinical trials (Christabel and Gurunathan, 2015; Somasundaram et al., 2015; Govindaraju and Gurunathan, 2017; Govindaraju, Jeevanandan and E. M. G. Subramanian, 2017a; Govindaraju, Jeevanandan and E. Subramanian, 2017; Jeevanandan, 2017; Jeevanandan and Govindaraju, 2018; Subramanyam et al., 2018; Panchal, Jeevanandan and Subramanian, 2019), surveys (Gurunathan and Shanmugaavel, 2016; Govindaraju, Jeevanandan and E. M. G. Subramanian, 2017b; Ravikumar, Jeevanandan and Subramanian, 2017; Nair et al., 2018) and article reviews (Packiri, Gurunathan and Selvarasu, 2017; 'Fluoride, Fluoridated Toothpaste Efficacy And Its Safety In Children - Review', 2018) had previously been conducted by our team. Based on previous studies, there is a lack of study and data with regards to acceptance of space maintainers among South Indian children undergoing premature primary tooth extraction. Our department is passionate about research we have published numerous high quality articles in this domain over the past years (Abraham et al., 2005; Devaki, Sathivel and BalajiRaghavendran, 2009; Neelakantan et al., 2010, 2015; Arja et al., 2013; Ramshankar et al., 2014; Sumathi et al., 2014; Surapaneni and Jainu, 2014; Surapaneni, Priya and Mallika, 2014; Ramamoorthi, Nivedhitha and Divyanand, 2015; Manivannan et al., 2017; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; J et al., 2018; Ravindiran and Praveenkumar, 2018; Malli Sureshbabu et al., 2019; Mehta et al., 2019; Krishnaswamy et al., 2020; Samuel, Acharya and Rao, 2020; Sathish and Karthick, 2020)The aim of this study was to evaluate the acceptance of space maintainers in the paediatric population.

MATERIALS AND METHODS

This case control study consisted of children in the age range of 3 to 9 years who had reported to Saveetha Dental College between June 2019 to March 2020. Both male and female children were selected for the study. This study included paediatric patients below 9 years of age who were indicated for space maintainer. Paediatric patients above 9 years, medically compromised patients and patients with congenitally missing teeth were excluded from the study. The study was done by reviewing the patients records of children who had visited Saveetha Dental College. Ethical Committee approval was obtained by the Institutional Ethical Committee Board of Saveetha Dental College. Overall 1700 case reports were received from which 702 case sheets with early loss of primary teeth which is indicated for space maintainer were selected. The data was cross verified with intraoral photographs of patients. Patients with incomplete case sheets were exempted from the study. Datas were collected from a single calibrated examiner. The following parameters were gathered and recorded: patient's age, gender, acceptance of space maintainer and type of space maintainer given.

Statistical analysis: All the data were entered into Microsoft Office Excel (2013) and analysed using SPSS Software Version 26.0. Descriptive statistics were used to report the distribution of age, gender, space maintainer acceptance and type of space maintainer given. Chi-square test was further applied to find out association between variable factors. These variables were age, gender and acceptance of space maintainer. Significant test level was set at $p<0.05$.

RESULTS AND DISCUSSION

A total of 702 children presented with early loss of primary teeth. Those children consisted of 326 female (46.4%) and 376 male (53.6%) patients (Figure 1). The distribution of early loss of primary tooth, according to age, 9 year olds were commonly seen (26.4%)(Figure 2). Among these patients, only 10.3% of children with premature loss of tooth accepted space maintainer while the remaining 89.7% did not accept the appliance (Figure 3).

Based on age of patients, patients of age 6 years showed higher acceptance of space maintainer than compared to other ages (Figure 5). Statistically significant association was found in acceptance of space maintainers between ages ($p<0.05$)(Figure 4). Based on gender, males (10.9%) contributed to higher acceptance of space maintainer compared to females (9.5%) (Figure 6). However, no statistically significant association was observed in acceptance of space maintainers between males and females ($p>0.05$)(Figure 5).It is generally accepted that malocclusion of permanent dentition was associated with premature loss of primary teeth, the arch length that is required for succeeding tooth may be reduced due to premature loss of primary teeth which results in malocclusion in the form crowding, rotation, supraeruption of opposing teeth and impaction of permanent teeth (Popovich and Thompson, 1988).

The prevalence of early loss was reported in several studies (Alamoudi, 1999; Cardoso et al., 2005). With regard to gender, this study found that males have higher prevalence of premature tooth loss compared to females. This confirms the results of previous study by Cardoso et al and Cavalcanti et al (Cardoso et al., 2005; Cavalcanti et al., 2008). Cavalcanti et al reported that the premature loss of tooth was observed more in male children (53.3%) than compared to female children (Cardoso et al., 2005).

In the present study, according to the patient's age, the higher prevalence of premature tooth loss was observed in children among 9 years of age (26.4%). This was in agreement with a previous study by Cavalcanti et al which reported the largest percentage of early dental losses occurred in the age of 9 years old (Cavalcanti et al., 2008). A few other studies also reported similar findings (Alamoudi, 1999; Farsi and Alamoudi, 2000; Cardoso et al., 2005; Karaiskos et al., 2005).. Loss of function is not the only concern of premature loss of primary teeth. There is also an increase in the possibility that the adjacent teeth may drift into the space (Lin, Lin and Lin, 2007). Therefore, space maintainers are the safest way to reduce or eliminate development of malocclusion.

The study observed that the acceptance of space maintainer in paediatric patients undergoing dental extraction is very low, with only 10.3% of patients accepting space maintainer. A similar finding was reported by Cavalcanti et al which observed that Brazilian children presented a high index of premature dental extraction without space maintenance (Cavalcanti et al., 2008). Linjawi et al also reported a similar finding in 2016 with only 12.8% of children accepting space maintainers (Linjawi et al., 2016). A study by Mubaraki et al reported a higher rate of acceptance with more than half of children accepting space maintainers (Mubaraki et al., 2017). The higher rate of space maintainer acceptance may be due to difference in geographic location and socioeconomic status.

Our findings suggested that the most common type of space maintainer accepted was the band and loop space maintainer (59.7%). Previous study by Al-Dlaigan was in agreement with this finding as his study reported the most common space maintainer given was band and loop space maintainer (Al-Dlaigan, 2007).

The low rate of space maintainer acceptance in this study may be due to a small sample size population, socioeconomic status and different geographic location from other studies.Paediatric dentists play an important role in providing awareness and education on interceptive orthodontic treatment in young patients and their parents as this will reduce or eliminate the severity of developing malocclusion, overall treatment time and cost and complexity of treatment. Moreover, such treatment will improve the quality of life and self-esteem of children in the long run. On the other hand, parents share an equally important role in providing care and decision making regarding the oral health of their children. Therefore, proper parental education as well as improving parents' awareness about the care and maintenance of primary and mixed dentition should be provided as this can greatly influence their children's behaviour in adapting preventive oral health practices.Extensive research needs to be done with a larger sample population to study the acceptance of space maintainers in paediatric patients. Future research should include other factors which may influence acceptance of space maintainers such as socioeconomic status and geographic location.

CONCLUSION

Within the limits of this study, it is concluded that 10.3% acceptance of space maintainers was found among patients with early loss of primary teeth. Children with 6 years of age had a favourable acceptance towards space maintainers. Thus it becomes the primary responsibility of the dental health care professionals to educate the patient, and create a general awareness about interceptive orthodontics and its benefits through which comprehensive orthodontic treatment can be avoided in the future.Hence deleterious effect in non acceptance space maintainer should be instilled among parents and children.

AUTHORS CONTRIBUTION

Nurul Syamimi binti Mohd Azlan Sunil contributed to the original drafting, acquisition of data, analysis and interpretation of data and writing of this research.

Dr. Jessy P. substantially contributed to improvising the research draft and revising the article critically for important intellectual content.

Dr. Revathi Duraisamy revised the final submission of the manuscript.

Conflict of interest: No conflict of interest has been declared by the authors.

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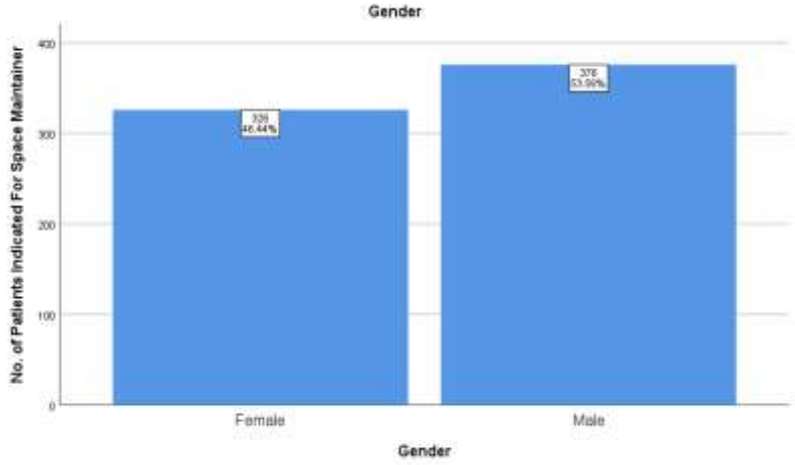

Fig.1: Bar chart shows the frequency of paediatric patients indicated for space maintainers based on gender. X-axis represents gender and Y-axis represents number of patients indicated for space maintainers. Majority of patients indicated for space maintainer were males (53.6%) when compared to females (46.4%).

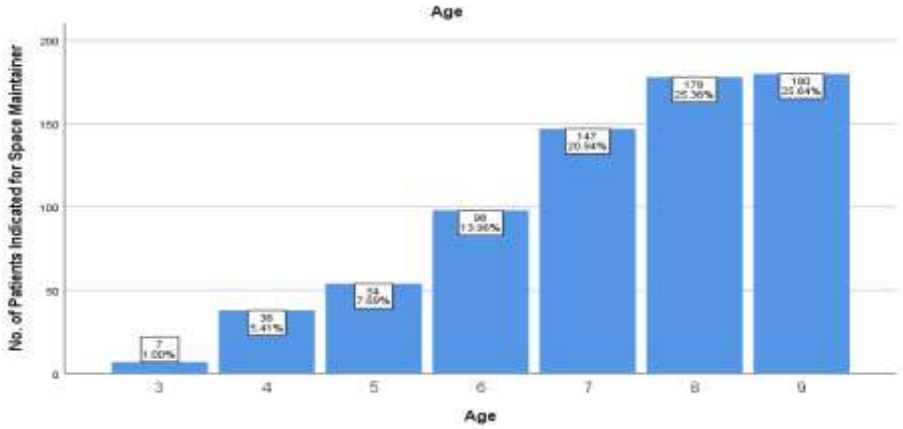

Fig.2: Bar chart shows the frequency of paediatric patients indicated for space maintainers based on the age of patients. X-axis represents age and Y-axis represents number of patients indicated for space maintainers. Majority of patients indicated for space maintainer were patients of 9 years (25.6%) when compared to other ages.

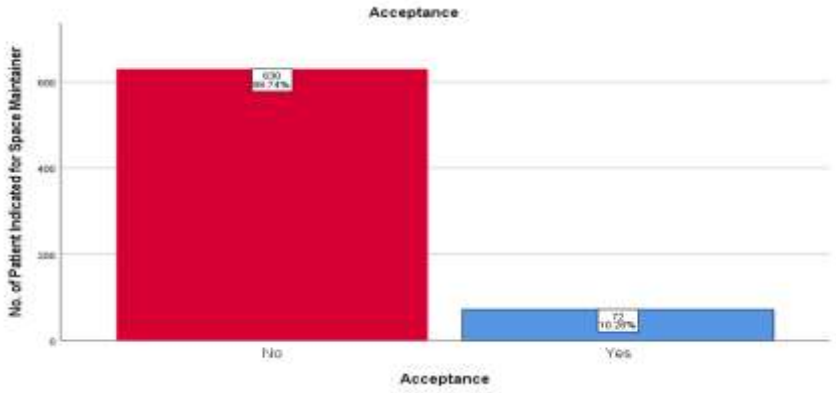

Fig.3: Bar chart shows the frequency of acceptance towards space maintainers in paediatric patients indicated for space maintainers. X-axis represents acceptance and Y-axis represents number of patients indicated for space maintainers. Majority of patients indicated for space maintainer did not accept (red) space maintainer (89.7%) and acceptance was comparatively low (10.3%).

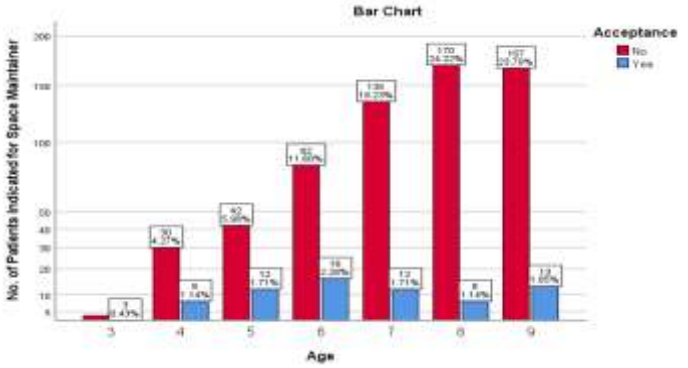

Fig.4: Bar chart showing relationship between acceptance of space maintainer and age of patients. X-axis represents the age and Y-axis represents the acceptance of space maintainers. Chi square test shows significant association between age and acceptance of space maintainer. Pearson chi square=34.13, p=0.001 shows statistical significant association. (p<0.05). Acceptance (blue) was significantly higher in age 6 years compared to other age.

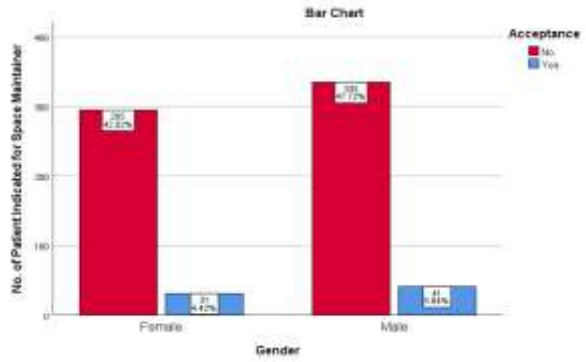

Fig.5: Bar chart showing relationship between acceptance of space maintainer and gender. X-axis represents gender and Y-represents acceptance of space maintainer. Chi-square test shows no significant association between gender and acceptance of space maintainer. Pearson chi square= 0.369, p=0.54, which shows no statistical significant association (p>0.05).Patients who did not accept space maintainers (red) were higher in males compared to females but the results were statistically not significant.