

PREVALENCE OF CLINICALLY MISSING PERMANENT TEETH DUE TO AGENESIS AND SECONDARY FACTORS AMONG PATIENTS BETWEEN 8-17 AGE GROUP VISITING A PRIVATE DENTAL HOSPITAL - AN INSTITUTIONAL STUDY

Running Title: Prevalence of missing permanent teeth in paediatric patients in 8-17 age group

ABSTRACT:

Introduction: Congenitally missing teeth or hypodontia is a condition where some of the adult teeth fail to develop. There have been theories involving genetic and environmental factors which lead to prevalence of permanent missing teeth. Missing teeth can affect the patients and cause many other problems such as malocclusion, periodontal damage, delay in bone growth, reduced mastication and unfavourable skeletal appearance. Thus having awareness about missing teeth and the eruption sequence dentists will be able to identify the missing teeth and correct the same.

Aim: The aim of this study is to analyse the prevalence of missing in the paediatric population between 8-17 years of age.

Materials and methods: The data for the study n=4453 patients was collected by analysing the case sheets of patients who visited Saveetha Dental college from June 2019- February 2021. The collected data was analysed and subjected to statistical analysis using the SPSS software by IBM of version 23.

Results: From the results of the study, missing teeth in the 8 to 10 age group was highest in the second quadrant at 27.27% with most common missing teeth being left maxillary lateral incisor 15.76%, in the 11-13 age group it was highest in the third quadrant at 32.39% with most common missing teeth being left mandibular lateral incisor 16.37% and in the 14-17 age group it was highest in first quadrant at 40.87% with the most common missing teeth being right maxillary first premolar 15.08%. It is also observed that the most common cause of missing teeth in 8-10 age group is due to congenital absence at 16.46%, in 11-13 age group due to trauma at 16.46% and in 14-17 age group due to caries at 18.90%.

Conclusion: Missing teeth is a very common dental anomaly encountered these days. From the present study it can be concluded that the most common cause of missing teeth was congenital absence of it. Larger community based studies should be conducted to estimate more

precisely the causes for missing teeth. They are very important to be analysed so that they can prevent complications that can occur. In our study missing teeth is being analysed at an earlier age group of 8-17 reducing the chances of future complications.

Keywords: Missing teeth, Congenital missing teeth, Quadrants, Aesthetic correction,,innovative technology, novel method.

INTRODUCTION:

Oral health is very important in a person's health regimen. Dental treatments become costly when it warrants treatment by combination of different specialisations such as orthodontic, prosthodontic and surgical procedures. Some dental anomalies require treatments which could be expensive from the patient's angle. One of the dental treatments which requires multi speciality services is treatment of missing teeth. Congenitally missing teeth or hypodontia is a condition where some of the adult teeth fail to develop. It is one of the most common dental anomalies(1). Missing teeth can also affect an individual both functionally as well as psychologically. It can reduce the patient's self esteem due to aesthetic reasons(2). Missing teeth can also affect the patients and cause many other problems such as malocclusion , periodontal damage, delay in bone growth, reduced mastication and unfavourable skeletal appearance (3,4).

One of the important reasons for clinically missing teeth can be congenitally missing teeth. Genetics play an important role in this regard(5). Multifactorial causes along with environmental and genetic factors can cause dental agenesis. There are many factors like infections, trauma and drugs which along with genetics can cause missing teeth(6,7). Congenitally missing teeth is a very rare condition but is of prime importance in dentistry (8). Apart from congenital missing teeth there are many other reasons why patients lose their teeth.

Secondary factors like caries and trauma can cause missing teeth. Poor dental hygiene when untreated and uncleaned can lead to circumstances which ultimately end up in tooth loss. Maintaining better oral hygiene can prevent caries and to some extent can avoid occurrence of missing teeth. Teeth grinding(bruxism) accompanied with poor dental hygiene and nutritional deficiencies can also lead to weak teeth and end in tooth loss(9).

Missing teeth can cause speech problems and may also lead to oral infection. Missing teeth should be observed to analyse the reason such as trauma, congenitally missing teeth, delay in eruption and impacted teeth. Missing teeth is of utmost concern at this age-bandwidth because if they are neglected at this stage then they may lead to bigger problems in future.

There have been studies which show the prevalence of cancer through an early sign of teeth loss .There could be periodontal damage occurring due to cancer (10–21). Certain studies have shed light in the area where periodontal disease or significant quantum of missing teeth as an indication for prevalence of cancer. Also empirical studies have shown the presence of missing

teeth as a new find in case of Type 2 diabetes. Nowadays diabetic patients are seen to have tooth loss which is twice that of other normal individuals. Sometimes hereditary inheritance of diabetes in children could also lead to early loss of teeth (22).

With this background, the present study aims to assess the prevalence of missing permanent teeth aged between 8-17 years in patients visiting private dental hospital June 2019 to February 2021. It is necessary to assess the missing teeth prevalence as they may help in early diagnosis of variety of conditions like for eg : cancer and which is why the age group 8-17 years can help in better diagnosis and aid in managing the condition if any present

MATERIALS AND METHODS:

The data for the present study were collected by analysing the case sheets of patients visiting Saveetha Dental College from June 2020- February 2021, the case sheets were reviewed and analysed individually. The studies was analysed using the X- ray taken like orthopentamogram and study casts which were available for the patient. There were around 47% of female and 53% of male which were analysed in our study. Ethical approval was obtained from the institutional ethical committee. The inclusion criteria for the study were mainly the patients who had missing permanent teeth and who belonged to the age group of 8-17 years. They were categorised as missing teeth taking in to consideration only the teeth which were found to be missing beyond the eruption period and included the clinically absent teeth. Patients with any physical /mental retardation/ syndromes / anomalies(Cleft lip and palate) were not included which is the exclusion criteria. Based on the inclusion and exclusion criteria 4453 samples were obtained. Parameters like age, gender and quadrant was analysed for each of these patients and tabulated.. The case sheet verification was done using the photographic method. To minimise the sampling bias random sampling was done. The collected data was subjected to statistical analysis using the SPSS software by IBM of version 23. The dependent variables were missing teeth and independent variables were age, gender.

RESULTS:

From the data collected n=4453 patients had permanent missing teeth. The most common cause for missing teeth is due to congenital absence of tooth (47.54%) followed by trauma (41.53%) and caries (10.83%) (Fig 1). Also in the results we can infer that congenital cause or delay in the eruption, is the reason for missing teeth in 8-10 age group at 16.46%, trauma is the highest in 11-13 age group at 16.46% and caries is the reason in 14-17 age group at 18.90% (Fig 2). Permanent missing teeth in the 8 to 10 age group were highest in the second quadrant at 27.27% with most common permanent missing teeth to be left maxillary lateral incisor 15.76% and the P value was 0.000 and was statistically significant(Fig 3). In the 11-13 age group, permanent missing teeth were highest in the third quadrant at 32.39% with most common permanent

missing teeth to be left mandibular lateral incisor 16.37% and the P value to be 0.000 and was statistically significant(Fig 4). In the 14 -17 age group permanent missing teeth was highest in the first quadrant at 40.87% with the most common permanent missing teeth to be right maxillary first premolar and the P value to be 0.000 and was statistically significant (Fig5). From the above results the overall permanent missing tooth in this study was found to be left mandibular lateral incisor -32 with 16.37%.

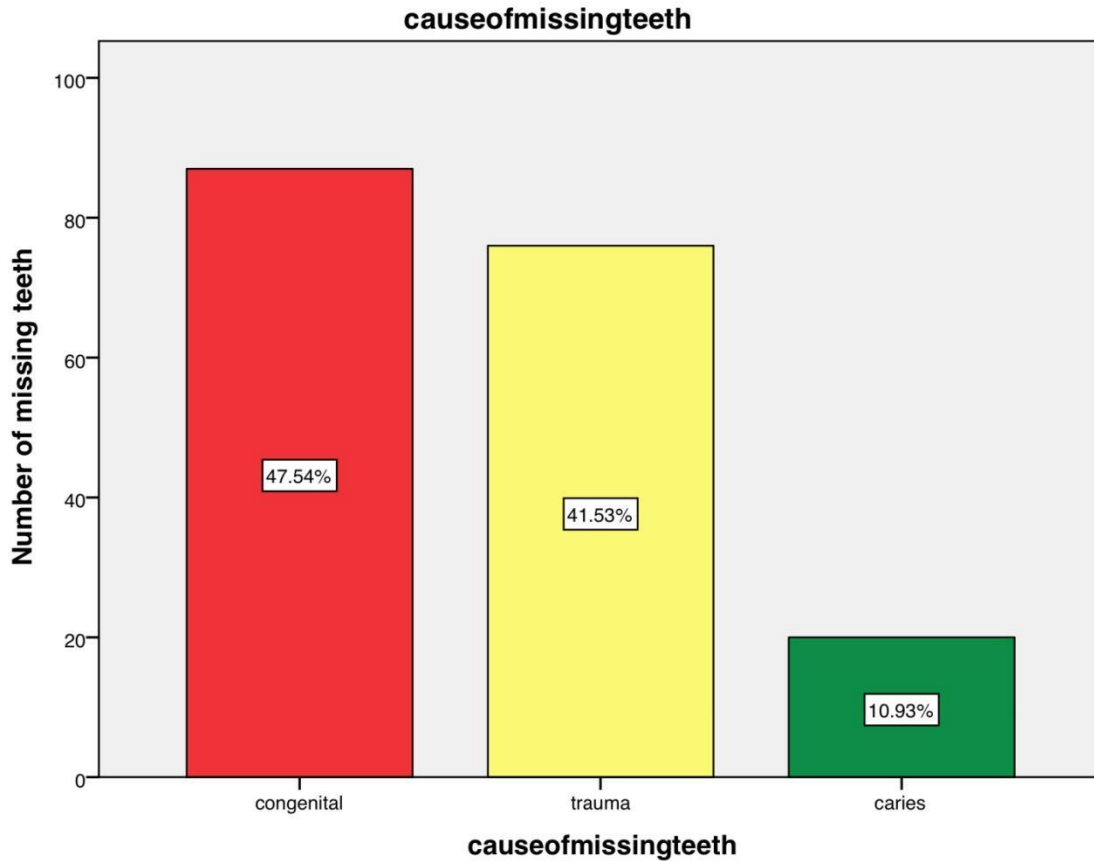


Figure 1: Bar graph shows the causes is missing teeth. The X axis shows the causes of missing teeth and Y axis shows the prevalence of missing teeth. The red colour denotes the congenital cause, yellow for traumatic cause and green for caries cause. The congenital absence is found to be the most common cause of permanent missing teeth 47.54%.

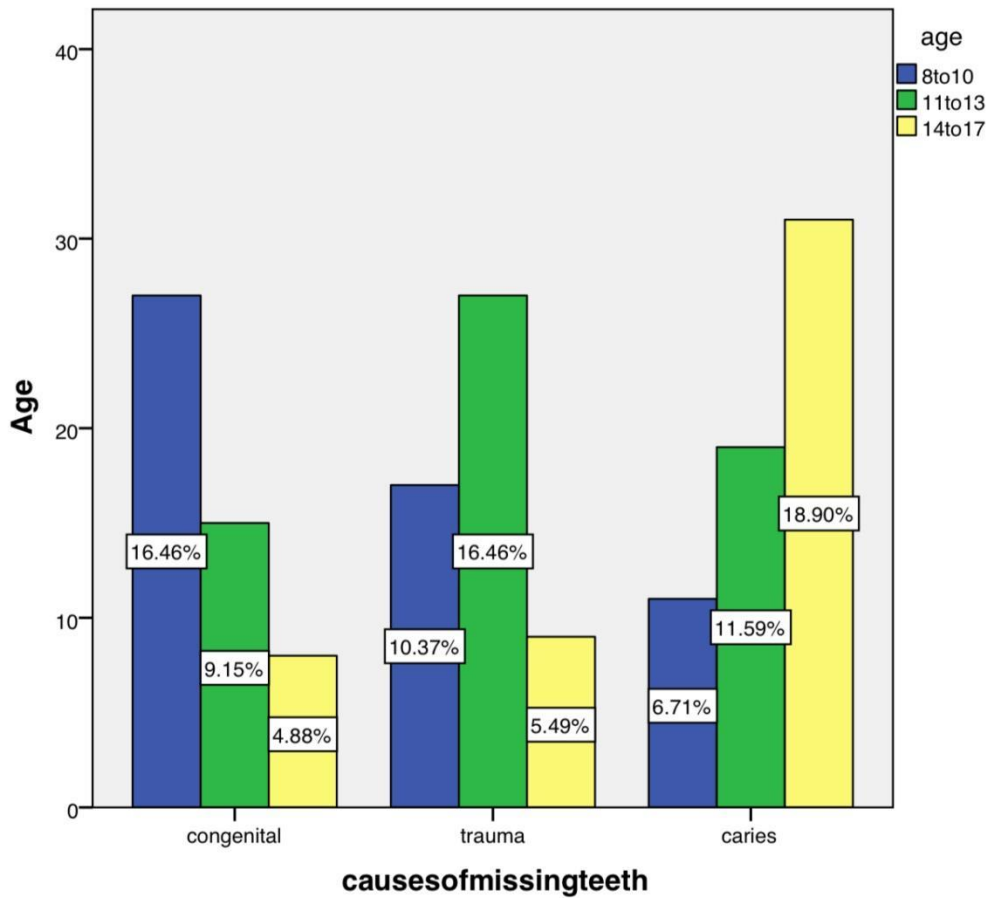


Figure 2: Bar graph shows the association between the causes of permanent missing teeth and age. The X axis shows the causes of missing teeth and Y axis shows the age. Blue colour denotes the age group of 8-10 , green colour age group of 11-13 and yellow colour the age group of 14-17. It is inferred from the graph that congenital cause is the reason for missing teeth in 8-10 age group at 16,46%, trauma is the highest in 11-13 age group at 16.46% and caries is the reason in 14-17 age group at 18.90%. P value was 0.000($p < 0.05$). Hence the association is statistically significant proving that cause of missing teeth has a significant association with age group.

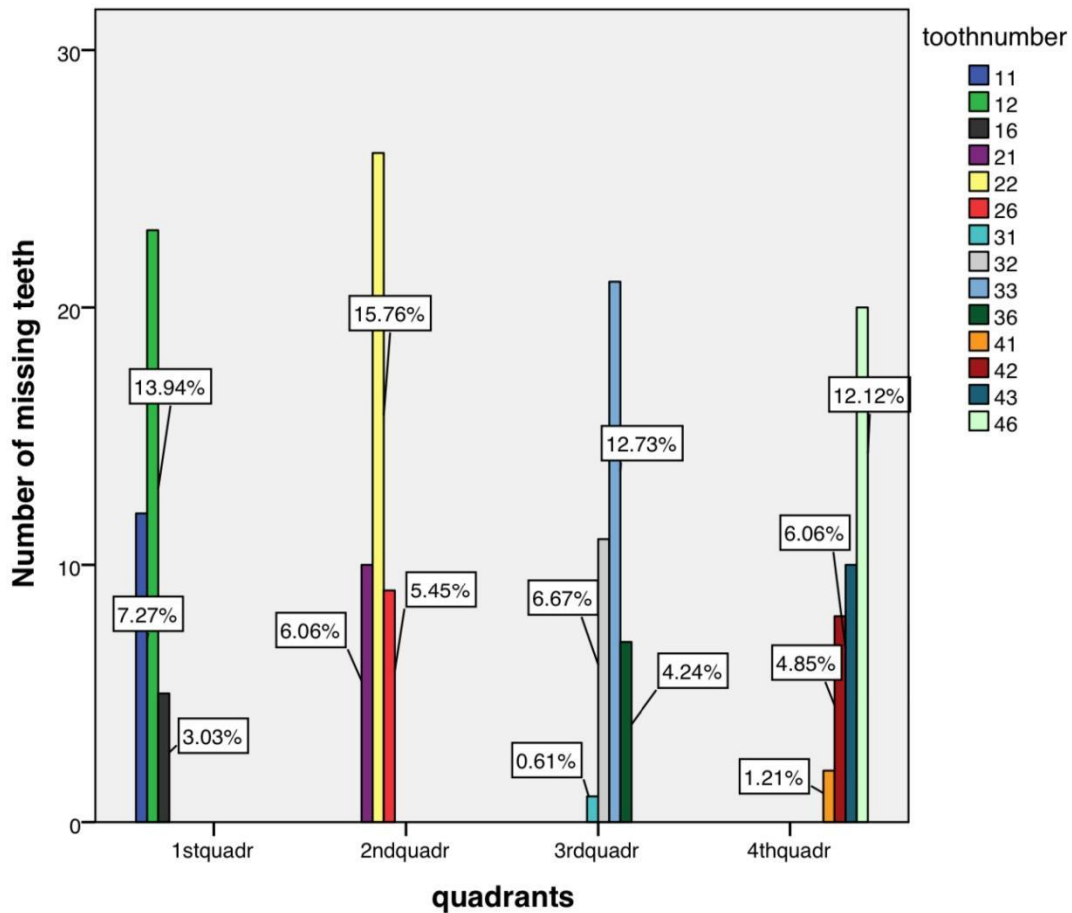


Figure 3: Bar graph depicts the association between the quadrants and the number of permanent missing teeth in the 8-10 year age group. The X axis shows the quadrants and Y axis shows the number of permanent missing teeth. The yellow colour in second quadrant depicts the most common permanent missing teeth in second quadrant which is 22. It is inferred from the graph that the highest number of permanent missing teeth was found in the second quadrant (27.27%) and the most common permanent missing teeth was found to be left maxillary lateral incisor (15.76%). P value was found to be 0.000 ($p < 0.05$). The association is statistically significant hence proving that among 8-10 year old, maximum permanent teeth are missing from second quadrant.

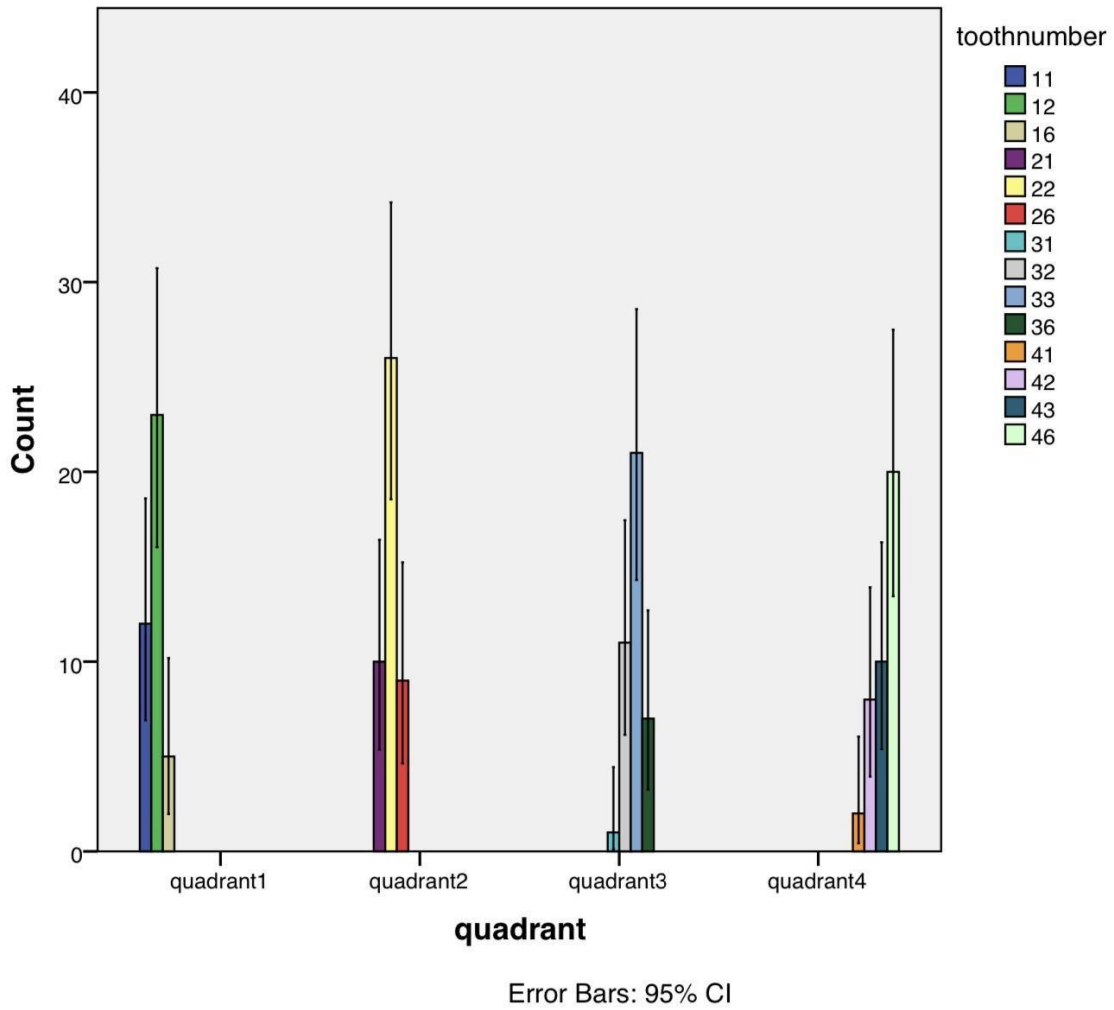


Figure 4: The error bar graph depicts the association between the quadrants and the number of permanent missing teeth in the 8-10 year age group. The X axis shows the quadrants and Y axis shows the number of permanent missing teeth. The yellow colour in second quadrant depicts the most common permanent missing teeth in second quadrant which is 22.

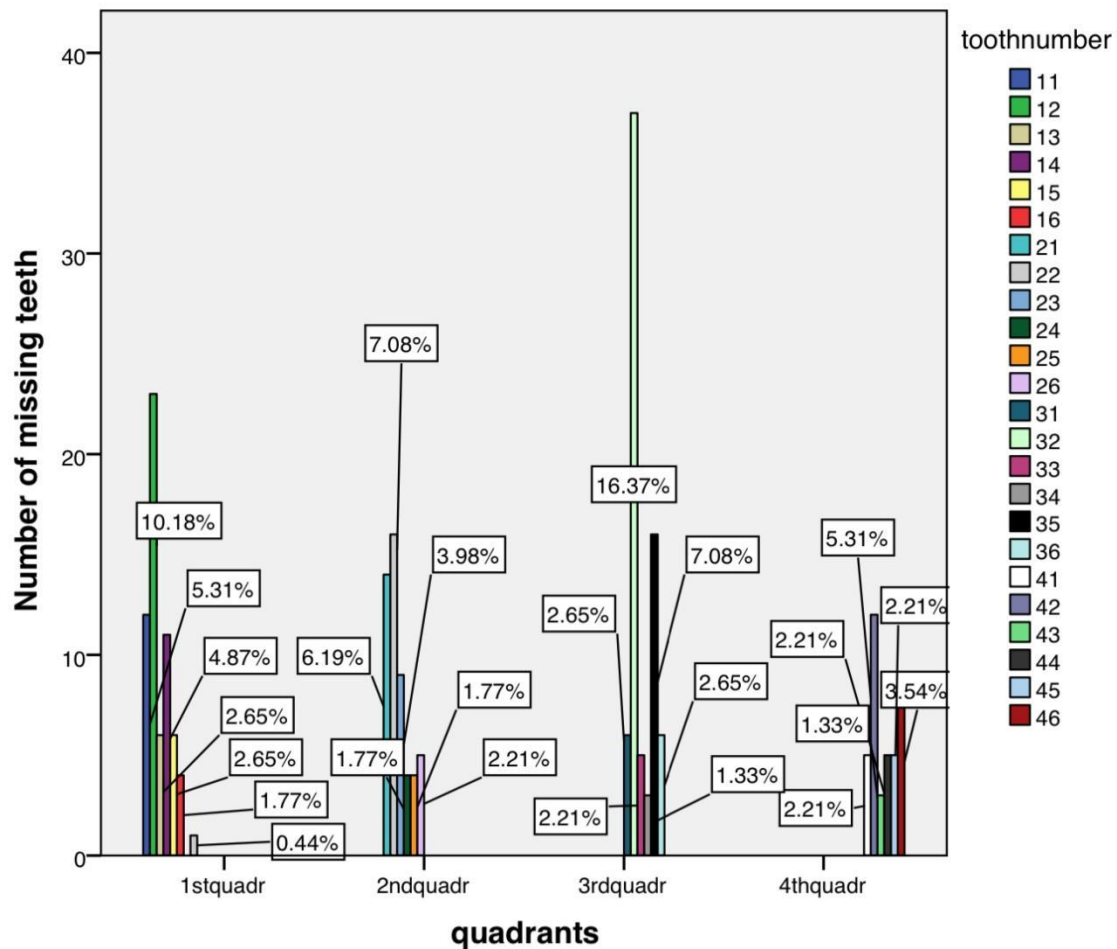


Figure 5: Bar graph depicts the association between the quadrants and the number of missing teeth in the 11-13 year age group. The X axis shows the quadrants and Y axis shows the number of missing teeth. The green colour in third quadrant depicts the most common missing teeth which is 32. It is inferred from the graph that the number of missing teeth is highest in the third quadrant (32.29%) and the most common missing teeth is left mandibular lateral incisor (16.37%). P value was found to be 0.000 ($p < 0.05$). Hence the association is statistically significant and proving that among 11-13 year old the maximum teeth are missing from the third quadrant.

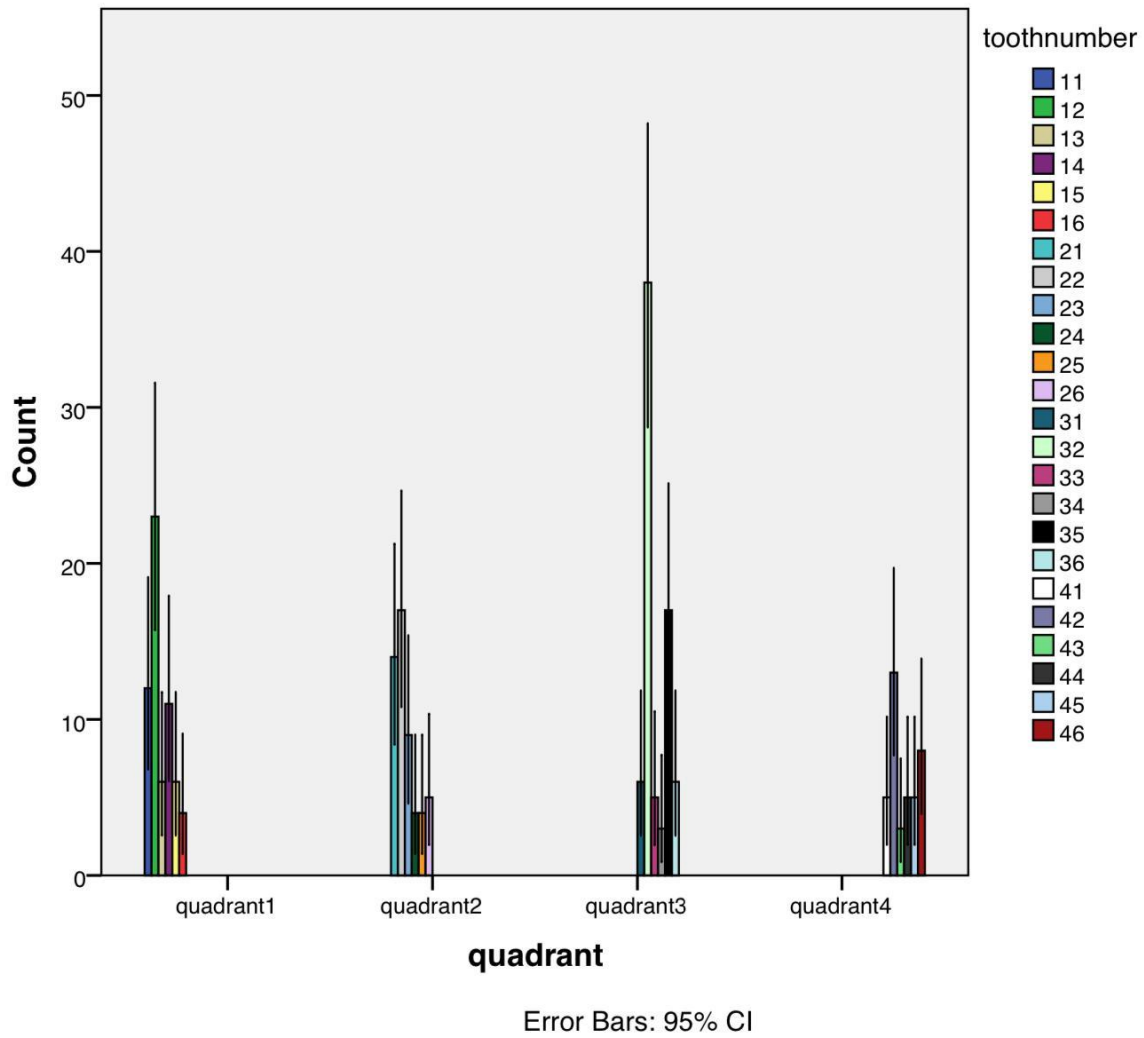


Figure 6: The error bar graph depicts the association between the quadrants and the number of missing teeth in the 11-13 year age group. The X axis shows the quadrants and Y axis shows the number of missing teeth. The green colour in third quadrant depicts the most common missing teeth which is 32

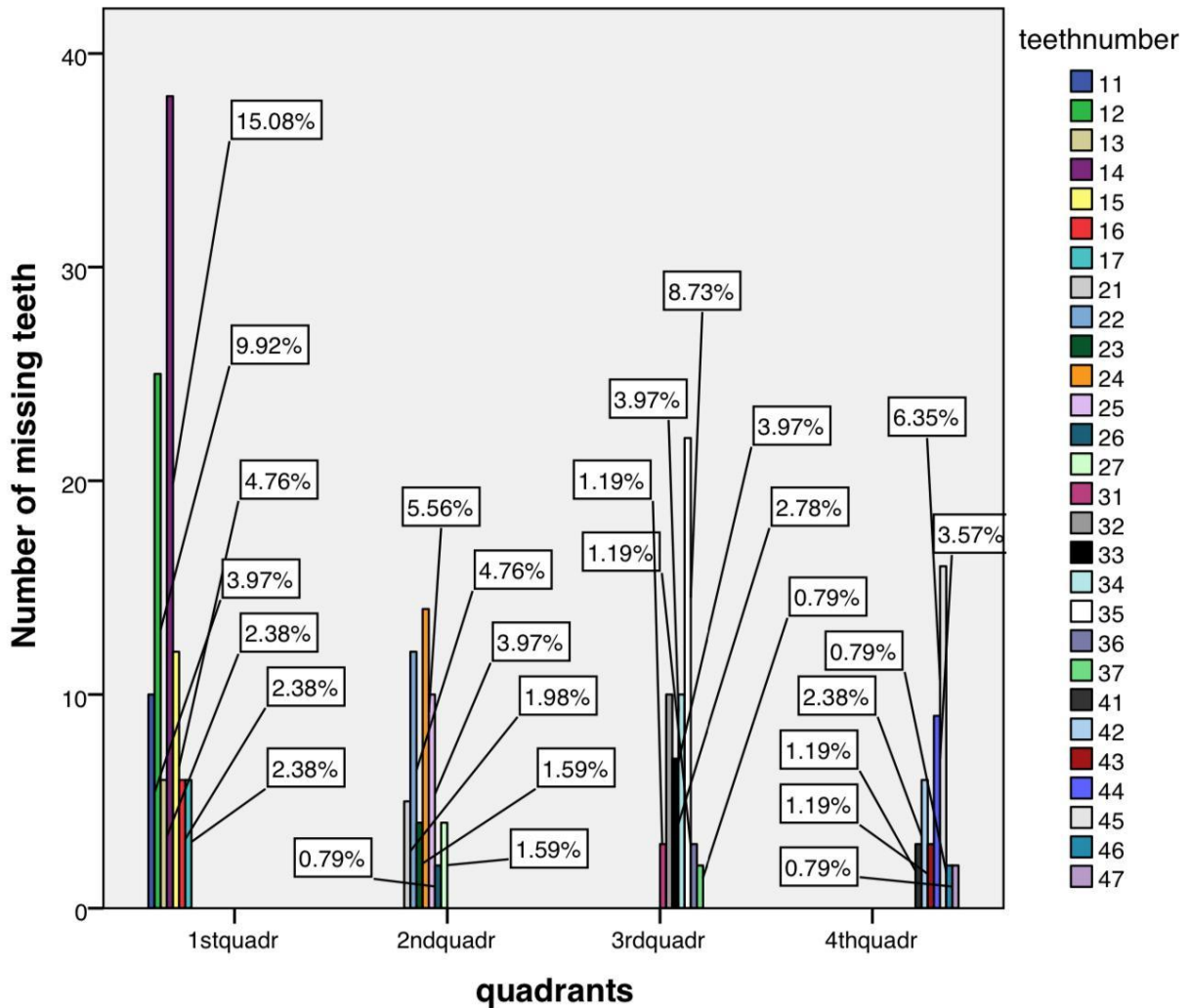


Figure 7: Bar graph depicts the association between the quadrants and the number of permanent missing teeth in 14-17 year age group. The X axis shows the quadrants and the Y axis shows the number of permanent missing teeth. The purple colour in first quadrant depicts the most common permanent missing teeth which is 14. It is inferred from the graph that the most common permanent missing teeth was found to be in the first quadrant (40.87%) and most common permanent teeth was the right maxillary first premolar (15.08%). The P value was found to be 0.000 ($p < 0.05$). The association is statistically significant hence proving that among 14-17 year old maximum permanent teeth are missing from first quadrant

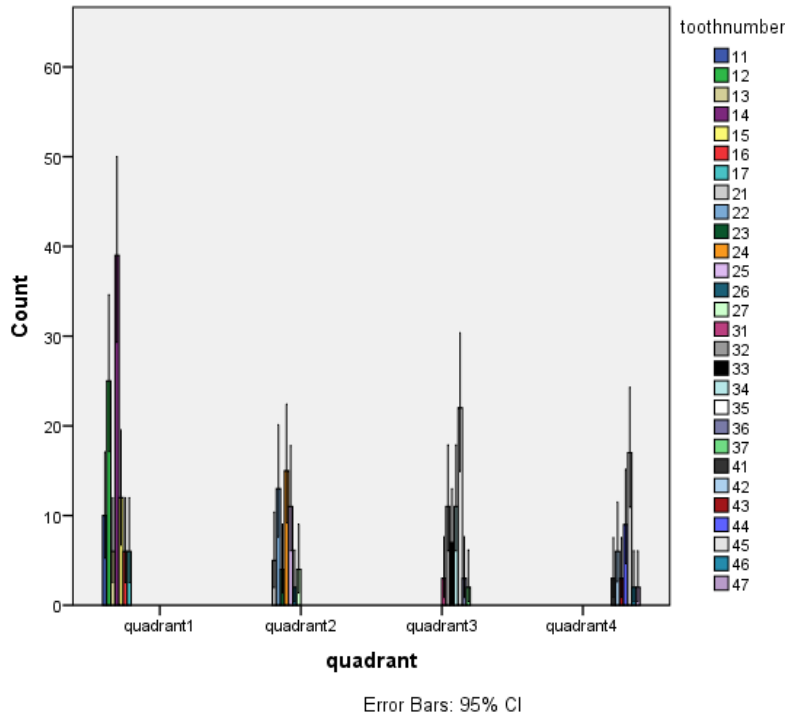


Figure 8: The error bar graph depicts the association between the quadrants and the number of permanent missing teeth in 14-17 year age group. The X axis shows the quadrants and the Y axis shows the number of permanent missing teeth. The purple colour in first quadrant depicts the most common permanent missing teeth which is 14

DISCUSSION:

Missing teeth is commonly seen. It can lead to bone loss and bone resorption. They can lead to structural imbalance and unaesthetic appearance which affects an individuals personality. It can lead to difficulty in the process of mastication ultimately end up the patients with nutritional deficiencies((23)). Nowadays the prevalence of missing teeth is also increasing which is becoming an increase in concern. The prevalence of permanent missing teeth in our study is around an average of 15% which is in accordance with the results obtained from another previous study where it was found to be ranging from 0.5% to 16.82% (8). In yet another study,

the average of permanent missing teeth was found at 6.7% while in our study it was around 15% which exhibits higher prevalence (24). In our study we have considered normal individuals but according to previous studies conducted, patients with syndromes like Down syndrome and defects like cleft lip and palate, ectodermal dysplasia have more chances of having missing teeth(8).The most common cause of missing teeth in our study is the congenital absence at 47.54%(Fig 1).

In another study conducted in Chidambaram town, the most common age group to have missing teeth was found to be from 8 to 10 year old and the highest frequency was in the 8 year old children and the most common tooth to be missing was found to be the permanent right lower first molar due to caries(25)). Contrasting result was observed in our study where the most common permanent missing teeth in age group of 8 to 10 year old was found to be permanent maxillary lateral incisor (Fig 3). The eruption timing for lateral incisor is 8-9 years but even in 10 year old children of our study it's been found missing. The reason can be delay or the lateral incisor was just then erupting or congenital absence. **The results were confirmed radiographically and if the teeth was erupting was included as present and if absent in the radiograph was considered to be congenitally absent.**According to our study the most common reason is congenital absence of them at 16.46%. The most commonly found reason for this has been found to be the susceptibility of the dental agenesis in maxillary lateral incisors has been associated with their anatomical position in the maxillary arch and also that they are the last teeth to develop in their respective classes .Mostly maxillary lateral incisor experience agenesis due to genetic mutations which makes these missing teeth to be missing due to the congenital defect in our study at 16.46%(Fig 2).As mentioned earlier, certain syndromes like ectodermal dysplasia, cleft lip and palate have led to congenital defect of lateral incisors (26).

Apart from congenital absence, children are mostly subjected to trauma which is also one of the reasons for permanent missing teeth , and according to a previous study by **Shalan et al, around 13.6% of the children in the age group of 11 to 14 are affected with traumatic dental injuries and rate of avulsion 2.2%(27)**. In accordance to previous study the most common cause for missing permanent teeth in 11-13 age group was found to be trauma at 16.46%(Fig 2).In our study in the 11-13 age group of children it was observed that the most common missing permanent teeth was mandibular lateral incisor (Fig5). In 11-13 year children tend to be more active and mostly subjected to traumatic incidents which may lead to missing tooth but certain studies tend to differ from this by stating that they can be missing even due to mandibular symphysis anomalies (28),(29), and can also be absent due to congenital defect according to another study by Satish et al.(30).Maxillary first permanent premolars are having incidence of congenital absence according to a study by Padmanabh Jha et al.(31),(32,33)). In our study also, the most common missing tooth is the permanent right maxillary first premolar in the age group of 14-17 year old children (Fig 7) which correlated with the results of yet another previous study(34). Teenagers tend to have improper dietary habits which leads to the prevalence of caries and lead to missing teeth which is supported by certain studies where the absence of permanent maxillary first premolar is attributed to prevalence of caries that may have led to the condition of clinically

missing premolar(35),(36). In our study also it has been observed that the most possible reason for missing teeth in 14-17 age group was due to presence of caries at 18.90% (Fig 2).

The advantages of the present study is available data while similar ethnicity and geographical locations could be the limitations of our study along with minimum external validity and also the validity can be extended by including the subjects from a broader horizon of geographical range.It can be concluded that early diagnosis in our study population can prevent future complications.

Our study is important in analysing the missing teeth because their prevalence is increasing nowadays and people need to be aware of the importance of missing teeth because they have many complications. Missing teeth can deteriorate the jawbone volume and density, can cause unstable bite leading to jaw pain and headaches and can increase the probability of gum disease. In our study we have done the analysis at an earlier stage which helps in better control of complications due to missing teeth and can help in avoiding the recurrence of the same.Further more studies are needed to shed light in this area so that the prevalence of missing teeth can be controlled in the future.

CONCLUSION:

Missing teeth is a very commonly encountered dental problem these days. From the present study it can be concluded that the most common cause of missing teeth was congenital absence of it. Larger community based studies should be conducted to estimate more precisely the causes for missing teeth.They are very important to be analysed so that they can prevent complications that can occur. In our study missing teeth is being analysed at an earlier age group reducing the chances of future complications.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

1. Altug-Atac AT, Erdem D. Prevalence and distribution of dental anomalies in orthodontic

- patients [Internet]. Vol. 131, American Journal of Orthodontics and Dentofacial Orthopedics. 2007. p. 510–4. Available from: <http://dx.doi.org/10.1016/j.ajodo.2005.06.027>
2. Goya HA, Tanaka S, Maeda T, Akimoto Y. An orthopantomographic study of hypodontia in permanent teeth of Japanese pediatric patients. *J Oral Sci.* 2008 Jun;50(2):143–50.
 3. Behr M, Proff P, Leitzmann M, Pretzel M, Handel G, Schmalz G, et al. Survey of congenitally missing teeth in orthodontic patients in Eastern Bavaria. *Eur J Orthod.* 2011 Feb;33(1):32–6.
 4. Aktan AM, Kara IM, Şener İ, Bereket C, Ay S, Çiftçi ME. Radiographic study of tooth agenesis in the Turkish population. *Oral Radiol.* 2010 Dec 1;26(2):95–100.
 5. Militi D, Militi A, Cutrupi MC, Portelli M, Rigoli L, Matarese G, et al. Genetic basis of non syndromic hypodontia: a DNA investigation performed on three couples of monozygotic twins about PAX9 mutation. *Eur J Paediatr Dent.* 2011 Mar;12(1):21–4.
 6. Fekonja A. Hypodontia in orthodontically treated children. *Eur J Orthod.* 2005 Oct;27(5):457–60.
 7. Shapira Y, Lubit E, Kuftinec MM. Hypodontia in children with various types of clefts. *Angle Orthod.* 2000 Feb;70(1):16–21.
 8. Rakhshan V. Congenitally missing teeth (hypodontia): A review of the literature concerning the etiology, prevalence, risk factors, patterns and treatment. *Dent Res J.* 2015 Jan;12(1):1–13.
 9. Polder BJ, Van't Hof MA, Van der Linden FPGM, Kuijpers-Jagtman AM. A meta-analysis of the prevalence of dental agenesis of permanent teeth. *Community Dent Oral Epidemiol.* 2004 Jun;32(3):217–26.
 10. Antony JVM, Ramani P, Ramasubramanian A, Sukumaran G. Particle size penetration rate and effects of smoke and smokeless tobacco products - An invitro analysis. *Heliyon.* 2021 Mar;7(3):e06455.
 11. R H, Ramani P, Ramanathan A, R JM, S G, Ramasubramanian A, et al. CYP2 C9 polymorphism among patients with oral squamous cell carcinoma and its role in altering the metabolism of benzo[a]pyrene. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2020 Sep;130(3):306–12.
 12. Suvarna K, Abilasha R, Gheena S. Analysis of Prevalence of Oral Squamous Cell Carcinoma in Patients with History of Chronic Irritation of Oral Tissues-A Retrospective Study. *Indian Journal of [Internet].* 2020; Available from: <http://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=09739122&AN=148410023&h=XY1wRUZ0p54Y6mZHESI7LVi228pkq%2FRhoPO4Jt4231oGPh6KuqA4bM6e9ZslMs9HCBZY6ZF8tl2TIR3cgyExXQ%3D%3D&crl=c>

13. Monica K, Gheena S, Ramani P, Abhilasha R, Hannah R, Others. IN SILICO GENE EXPRESSION ANALYSIS OF CRUCIAL CELL CYCLE CONTROL GENE CDKN2A AND CDKN2B IN HEAD AND NECK SQUAMOUS CELL CARCINOMA. *Annals of Tropical Medicine and Health*. 2020;23:232–323.
14. Sinduja P, Ramani P, Gheena S, Ramasubramanian A. Expression of metallothionein in oral squamous cell carcinoma: A systematic review. *J Oral Maxillofac Pathol*. 2020 Jan;24(1):143–7.
15. Ramani P, Krishnan RP, Karunagaran M, Muthusekhar MR. Odontogenic sarcoma: First report after new who nomenclature with systematic review. *J Oral Maxillofac Pathol*. 2020 Jan;24(1):157–63.
16. Ramani P, Gheena S, Karunagaran M, Hannah R. Clear-cell variant of oral squamous cell carcinoma: A rare entity. *J Oral Maxillofac Pathol*. 2021 Mar 1;25(4):22.
17. Ramasubramanian A, Ramani P, Sherlin HJ, Premkumar P, Natesan A, Thiruvengadam C. Immunohistochemical evaluation of oral epithelial dysplasia using cyclin-D1, p27 and p63 expression as predictors of malignant transformation. *J Nat Sci Biol Med*. 2013 Jul;4(2):349–58.
18. E A, Aswani E, Gheena S, Pratibha R, Abilasha R, Hannah R, et al. Overexpression of HNRNPA2B1 is Associated with Poor Prognosis in Head and Neck Squamous Cell Carcinoma [Internet]. *International Journal of Current Research and Review*. 2020. p. 15–8. Available from: <http://dx.doi.org/10.31782/ijcrr.2020.122502>
19. Behera A, Hannah R, Ramasubramanian A, Ramani P. Association of the Depth of Invasion with Lymph Node Metastasis in Oral Squamous Cell Carcinoma Patients-A Retrospective Study. *Indian J Forensic Med Toxicol* [Internet]. 2020;14(4). Available from: <http://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=09739122&AN=148410053&h=nwnHkKvd5DGQXazZu6t5p6l8D0PbUqebPTLzhmdSl6FyXTWwsSzGTNdBhQxTZUG9F%2BD8YcgHrW%2FSaXuV%2BCg9vCA%3D%3D&crl=c>
20. [No title] [Internet]. [cited 2021 May 18]. Available from: https://www.researchgate.net/profile/DrAbilasha_Ramasubramanian/publication/339048652_Implantation_Dermoid_Cyst/links/5fb254b4299bf10c36833e88/Implantation-Dermoid-Cyst.pdf
21. Thamilselvan S, Abilasha R, Ramani P, Gheena S, Hannah R. Evaluation of Accuracy between Habit History and Incidence of Oral Squamous Cell Carcinoma [Internet]. *International Journal of Current Research and Review*. 2020. p. 30–5. Available from: <http://dx.doi.org/10.31782/ijcrr.2020.122503>
22. Yamunadevi A, Pratibha R, Rajmohan M, Ganapathy N, Porkodisudha J, Pavithrah D, et al. Molecular Insight into Odontogenesis in Hyperglycemic Environment: A Systematic Review. *J Pharm Bioallied Sci*. 2020 Aug;12(Suppl 1):S49–56.

23. Africa CWJ, Reddy J. The association between gender and tooth loss in a small rural population of South Africa. 2013; Available from: <https://freecourseware.uwc.ac.za/handle/10566/926>
24. Bozga A, Stanciu RP, Mănuc D. A study of prevalence and distribution of tooth agenesis. *J Med Life*. 2014 Oct;7(4):551–4.
25. Ahamed SSS, Reddy VN, Krishnakumar R, Mohan MG, Sugumaran DK, Rao AP. Prevalence of early loss of primary teeth in 5-10-year-old school children in Chidambaram town. *Contemp Clin Dent*. 2012 Jan;3(1):27–30.
26. Gupta SP, Rauniyar S. Orthodontic Space Closure of a Missing Maxillary Lateral Incisor Followed by Canine Lateralization. *Case Rep Dent*. 2020 Nov 14;2020:8820711.
27. Shalan H, El-Kalla I, Bakr R. Impact of dental trauma on quality of life among 11–14 years schoolchildren [Internet]. Vol. 8, *Contemporary Clinical Dentistry*. 2017. p. 538. Available from: http://dx.doi.org/10.4103/ccd.ccd_428_17
28. Huang Y-T, Chao C-W, Yang P-Y, Kao C-T. Management of Congenital Missing in Bilateral Mandibular Incisors. *Taiwanese Journal of Orthodontics*. 2020;31(1):4.
29. Gracco ALT, Zanatta S, Forin Valvecchi F, Bignotti D, Perri A, Baciliero F. Prevalence of dental agenesis in a sample of Italian orthodontic patients: an epidemiological study. *Prog Orthod*. 2017 Oct 16;18(1):33.
30. Celikoglu M, Kazanci F, Miloglu O, Oztek O, Kamak H, Ceylan I. Frequency and characteristics of tooth agenesis among an orthodontic patient population. *Med Oral Patol Oral Cir Bucal*. 2010 Sep 1;15(5):e797–801.
31. Jha P, Jha M. Management of congenitally missing second premolars in a growing child. *J Conserv Dent*. 2012 Apr;15(2):187–90.
32. Vahid-Dastjerdi E, Borzabadi-Farahani A, Mahdian M, Amini N. Non-syndromic hypodontia in an Iranian orthodontic population. *J Oral Sci*. 2010 Sep;52(3):455–61.
33. Endo T, Ozoe R, Kubota M, Akiyama M, Shimooka S. A survey of hypodontia in Japanese orthodontic patients. *Am J Orthod Dentofacial Orthop*. 2006 Jan;129(1):29–35.
34. Sisman Y, Uysal T, Gelgor IE. Hypodontia. Does the prevalence and distribution pattern differ in orthodontic patients? *Eur J Dent*. 2007 Jul;1(3):167–73.
35. Murshid SA, Al-Labani MA, Aldhorae KA, Rodis OMM. Prevalence of prematurely lost primary teeth in 5-10-year-old children in Thamar city, Yemen: A cross-sectional study. *J Int Soc Prev Community Dent*. 2016 Aug;6(Suppl 2):S126–30.
36. Amini F, Rakhshan V, Babaei P. Prevalence and pattern of hypodontia in the permanent dentition of 3374 Iranian orthodontic patients. *Dent Res J*. 2012 May;9(3):245–50.

