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Prevalence and distribution of dental anomalies in pediatric population belonging to Chennai- A retrospective panaromic radiographic study.

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ABSTRACT:

Introduction: Dental anomalies can affect primary or permanent teeth and include abnormalities in number (hyperdontia, hypodontia), size (microdontia, macrodontia), shape (fusion, gemination, dens invaginatus), structure (amelogenesis imperfecta, dentinogenesis imperfecta), and eruption (delayed eruption, ankylosis). Early identification is important as they can impact occlusion, esthetics, and function, often requiring multidisciplinary management if untreated.

Materials and Methods: OPGs of children aged 6–17 years from the Department of Oral Medicine and Radiology, Saveetha Dental College, were analyzed for dental anomalies based on number, size, shape, structure, and eruption. Data were statistically analyzed using SPSS version 23.

Results: The most common dental anomalies were mesiodens and supernumerary teeth (21%), followed by congenitally missing teeth (25%). Congenitally missing teeth were more prevalent in the 12–17 age group (14%) than in 6–11 years (11%), and higher in boys (16%) than girls (9%). However, the paired sample t-test showed a P value >0.05, indicating no statistical significance.

Conclusion: Dental anomalies affecting number, shape, size, and structure are common among children in Chennai, highlighting the need for early detection and management to prevent future occlusal issues and improve prevention strategies.

Key words: Dental anomalies, pediatric dentistry, orthopantomograph (OPG), hypodontia, hyperdontia, mesiodens, congenitally missing teeth, prevalence, SPSS.

INTRODUCTION:

Dental anomalies are defined as the developmental disturbances that result in permanent defect in the number, size, shape, structure, or eruption of teeth. These anomalies may involve the primary or developing permanent dentition which are caused due to genetic, environmental and other multifactorial influences during tooth development and these dental anomalies cause variations in number (hyperdontia, hypodontia, anodontia), size (microdontia, macrodontia), shape (fusion, gemination, dens invaginatus, talon cusp, dilaceration), structure (amelogenesis imperfecta, dentinogenesis imperfecta, enamel hypoplasia), and eruption (natal/neonatal teeth,

ankylosis, delayed eruption, eruption cysts)(1). These anomalies occur when the process of odontogenesis is disrupted due to mutational defects which cause changes in intricate interactions between genetic factors and local tissue signaling(2). Further syndromes like ectodermal dysplasia, Down syndrome, and cleft lip and palate are frequently associated with dental abnormalities such as hypodontia, hyperdontia, and developmental conditions such as amelogenesis imperfecta and dentinogenesis imperfecta and these inherited conditions not only affect the appearance of teeth but also their function(3).

Trauma to primary dentition can cause damage underlying permanent tooth germs, which leads to developmental deformities in crown and root.Childhood illnesses, local infections, nutritional deficiencies, and maternal health problems during pregnancy also disturb tooth mineralization leading to enamel hypoplasia or delayed tooth eruption(4)(5). Teratogenic drugs, radiation, or high fevers during the critical stages of tooth formation can also produce structural and other developmental changes cause tooth deformity and this proves environmental factors play a major role in the etiology of dental anomalies(6). Systemic conditions such as hypothyroidism, hypopituitarism, and metabolic disorders like rickets affect the normal eruption patterns and cause dental anomalies. In other cases dental anomalies arise in a combination of genetic susceptibility with environmental factors leading to a multifactorial etiology leading to the dental anomalies affecting esthetics, occlusion, and overall oral function if left undetected(7). The dental anomalies should be treated early because they also directly influence the growth and development of the jaws due to which skeletal discrepancies occur during critical developmental stages. In this way the occlusion gets affected leading to crowding,proclinationand crossbite(8).

Dental anomalies such as amelogenesis imperfecta or dentinogenesis imperfecta, can cause difficulty to bite, chew, or speak effectively and these conditions also leave teeth more prone to sensitivity, rapid wear, and early decay and these condition not only affect physically but also affect a child's confidence and social interactions during formative years(9)(10). Also early treatment also reduces the risk of secondary complications associated with untreated anomalies such as impacted or retained teeth may lead to cyst formation, resorption of adjacent roots, or chronic infection(11). Further developmental grooves or pits in teeth with structural anomalies can harbor plaque, increasing the likelihood of caries and periodontal disease(12). Identifying these conditions at an early stage can prevent progression of damaged teeth and preserves natural teeth , preventing the overall complexity and decrease in the cost of dental care in the future.

This above study highlights the importance of treatment of dental anomalies as they can enable comprehensive, multidisciplinary care during critical growth periods and data obtained through this research can help dentists and public health planners develop targeted guidelines for intervention. Aligning treatment with developmental milestones ensures that corrections are more predictable and less invasive. The main purpose of this study is not only to determine the prevalence of dental anomalies in Chennai's pediatric population but to stress the importance of early diagnosis and intervention in improving long-term oral health outcomes.

MATERIALS AND METHODS:

Study design and sample:

This study is a hospital-based study where the cross-sectional radiographic study is done using consecutively retrieved panoramic radiographs (OPGs) of pediatric patients to estimate the prevalence and pattern of dental anomalies. This sample comprises children and adolescents of age group between 6–17 years whose OPGs were obtained from the Department of Oral Medicine

and Radiology, Saveetha Dental College and Hospitals, Chennai. The radiographs were high-quality, clearly interpretable images and unreadable or artifact-compromised images were excluded. For each included case, a standardized proforma captured age, gender, and anomaly type (e.g., fusion, agenesis/hypodontia, hyperdontia, impaction), and images were reviewed with appropriate diagnostic software to aid precise identification. Institutional ethical approval was secured prior to data retrieval.

Data acquisition:

The panoramic radiographs included in this study were obtained from pediatric patients of age group 6–17 years at the Department of Oral Medicine and Radiology, Saveetha Dental College and Hospitals, Chennai. The radiographs were captured by an experienced technician using standardized methods with a Carestream CS 8100C OPG machiene (Manufacturing- Carestream Dental LLC, a U.S.-based company headquartered in Atlanta, Georgia, USA). The primary imaging software used is CS imaging version 8 and the panoramic radiographic device is set at 70.00 kV , 8.00 mA and 73.55(mGy.cm2) at 10.78s, ensuring uniform image quality with image acquisitions performed using Trophy DICOM (Trophy Radiologie S.A., Marne la Vallée, France) software and stored in a secure digital database. Details such as age and gender, were documented and were organised, further which dental anomalies were systematically recorded and categorized. After which the radiographs were evaluated under standardized lighting conditions, screen brightness, and resolution, with calibration performed using a set of 94 representative radiographs previously analyzed by an experienced imaging professional. In cases of diagnostic disagreement, further review by a senior examiner was done. This study was evaluated and criteria for identification was detailed in tabular column 1 out of which some of them were commonly seen and few were less common. Ethical approval for data acquisition was obtained from Saveetha University and its affiliated institutions prior to the commencement of the study. Statistical analysis of the recorded anomalies, stratified by age group and gender, was performed using SPSS software, Version 23.

Statistical analysis:

SPSS (Statistical Package for the Social Sciences) Version 23, developed by IBM in the United States, is widely used for accurate data processing and statistical interpretation in research. In this study, it was used to assess the prevalence of dental anomalies and compare findings across age and gender groups. Data were expressed as mean and standard deviation (SD), where the mean indicates the average value of the dataset, and SD measures how widely the data points vary from the mean, providing an understanding of data consistency. The Chi-square test was employed to evaluate whether there was a significant association between categorical variables such as age group, gender, and the type of dental anomaly. The p-value resulting from this test indicates statistical significance; if $p < 0.05$, the findings are considered statistically significant (suggesting that observed differences are unlikely due to chance), while $p > 0.05$ implies no significant association. This combination of descriptive (mean, SD) and inferential (Chi-square, p-value) statistics ensures both a clear summary of the data and a robust evaluation of relationships between variables.

	Dental Anomaly	Criteria
Size	Microdontia	Tooth smaller than its

	(Peg lateral)	contralateral pair or insufficiently fills the space.
	Macrodontia	Tooth larger than its contralateral pair or of exaggerated size/shape.
Number	Hypodontia	Absence of tooth development according to dental eruption age.
	Hyperdontia (supernumerary tooth)	Extra tooth beyond the normal complement, regardless of where it appears.
Shape	Fusion	Union of two tooth germs forming a double tooth that may share dentin.
	Dilaceration	Sharp bend or curve in the tooth root visible on radiographs.
	Supernumerary root	Extra tooth beyond the normal complement, regardless of where it appears.
	Hypercementosis	Excessive cementum deposition along the tooth root.

	Taurodontism	Enlarged pulp chamber with apically displaced furcation and short roots.
	Enamel pearl	Well-defined enamel nodules seen along root surfaces on radiographs.
	Gemination	Partial division of a single tooth germ producing a bifid crown without full separation.
	Concrescence	Union of two adjacent teeth by cementum without involving dentin.
Structural	Amelogenesis imperfecta	Developmental enamel defect with abnormal thickness or quality.
	Dentinogenesis imperfecta	Developmental dentin defect with bulbous crowns and obliterated pulp chambers.

Table 1: Dental anomalies evaluated and classification criteria used.

RESULTS:

Sample:

A total of 61 panoramic radiographs of children aged 6-17 years were examined, comprising 33 boys (54.1%) and 28 girls (45.9%). The mean age of the sample was 10.7 years**.**

Dental Anomalies distribution:

According to the study, the most frequent dental anomalies found were congenitally missing teeth (25%) ,mesiodens (21%) and supernumerary teeth (21%).In terms of age group comparison, the

age group between 12 and 17 has a higher percentage of congenitally missing teeth (14%) than the age group between 6 and 11 (11%). In addition, compared to girls (9%), boys have a higher percentage of congenitally missing teeth (16%).

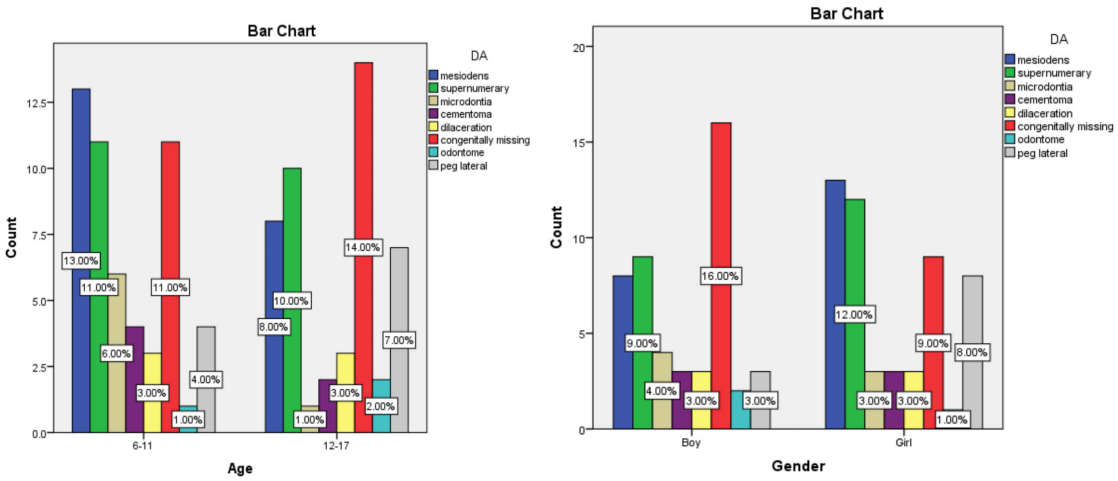

Figure1 and 2: Distribution of dental anomalies based on age and gender.

Paired sample t test :

The tabular column presents the paired sample correlations and t-test results between age, gender, and dental anomalies. The correlation between age and dental anomalies is weakly positive (r = 0.177) with a significance value of 0.079, while the correlation between gender and dental anomalies is weakly negative (r = -0.070) with a significance value of 0.491. Since both p-values are greater than 0.05, the results are statistically insignificant, indicating that there is no strong or reliable association between age or gender and the occurrence of dental anomalies in this study.

		N	Correlation	Sig
Pair 1	Age and dental anomalies	100	0.177	0.079
Pair 2	Gender and dental anomalies	100	-0.070	0.491

Table 2: Paired sample t test

DISCUSSION AND CONCLUSION:

In this cohort of 61 children (33 boys, 28 girls) from Chennai, we observed a strikingly high prevalence of developmental dental anomalies, notably congenitally missing teeth (25%) ,mesiodens (21%) and supernumerary teeth (21%) while other anomalies such as peg laterals,microdontia were comparatively rare, and there were no cases of fusion ,dens evaginatus and dens invaginatus were detected. Most of the anomalies affecting just one or two teeth per individual , indicates a largely localized pattern, that aligns with observations from pediatric radiographic surveys and this was noted by Altug-Atac & Erdem, 2007 and Vani et al., 2016(13)(14). This distribution shows the importance of panoramic radiography in detecting subtle anomalies that may otherwise be overlooked in clinical exams and draws attention to

potential occlusal and aesthetic consequences, reinforcing the clinical relevance noted by Mukhopadhyay S & Mitra S (2014) regarding size- and number-related dental anomalies(15).
While comparing our findings to Wagner et al.'s European investigation (PMID: 33337905), the differences have become very clear and their reported anomaly prevalence of 61.3% was dominated by radicular dilacerations (38.1%) and hypodontia (29.3%), whereas our cohort study showed minimal root anomalies but a higher incidence of supernumerary teeth and these differences likely reflect on the varied diagnostic criteria such as Wagner's inclusion of root dilacerations and third-molar agenesis markedly inflated totals whereas our number-anomaly focus captured more crown-related disturbances(16). Similarly, there is an Iranian study by Shokri et al. (2014) which reports dental anomalies in 68% of children having peg laterals and hypodontia being most common; however, mesiodens were less frequent compared to our sample which suggests that ethnic and methodological influences on anomaly spectra(17).
The Brazilian study by Gomes et al. (2018) reported supernumerary teeth and microdontia as the most common anomalies (~70% total anomaly rate), but our cohort exhibited markedly fewer microdontia cases, further demonstrating geographic and population-specific differences in anomaly patterns(18).Despite these valuable insights, our study is not without significant limitations. The hospital-based sample introduces referral bias, restricting representativeness of the broader Indian pediatric population and possibly inflating anomaly prevalence. The modest sample size reduces statistical power for age- and gender-specific comparisons. Diagnostic reliance on two-dimensional panoramic radiographs may underdiagnose root or positional anomalies, while the lack of CBCT confirmation and absence of genetic analysis leaves hereditary influences speculative. Inter-examiner variability, despite calibration, cannot be entirely excluded as a source of error(19). Furthermore, the cross-sectional nature prevents evaluation of how anomalies affect eruption timing, occlusion, or the need for long-term orthodontic intervention. Limited data on environmental exposures (e.g., fluorosis, nutritional deficiencies, teratogenic influences) also constrains interpretation of potential etiologic factors.
In conclusion, this Chennai based cohort reaffirms that hypodontia is a reliably common developmental anomaly across populations, while supernumerary teeth appear more frequent in referral settings. The study highlights the diagnostic value of panoramic screening in mixed dentition, supporting early detection for interceptive treatment planning. However, to establish accurate and generalizable prevalence estimates, future research must adopt standardized anomaly definitions, larger multicenter cohorts, community-based sampling to reduce referral bias, and integrate advanced imaging (CBCT) alongside molecular or genetic profiling to clarify etiologies. Longitudinal studies should also track functional and occlusal outcomes of untreated anomalies. Additionally, cost-benefit analyses of routine radiographic screening programs, particularly in resource-limited settings, would help guide policy. Overall, these findings underscore both the clinical relevance of early anomaly detection and the pressing need for harmonized global research efforts to inform prevention, early intervention, and treatment strategies.

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