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Original Research

Prevalence and Clinical Characteristics of Supernumerary Teeth in 7.085 Turkish Children: A Retrospective Epidemiological Study

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ABSTRACT

Objective: Supernumerary teeth result from disruptions in dental lamina development during odontogenesis. This study aimed to investigate their prevalence, demographics, and clinical features (number, location, morphology, eruption, position) in children aged 5-12 years via panoramic radiograph analysis.

Methods: This retrospective cross-sectional study analyzed 7,085 anonymized panoramic radiographs (2019-2020) from Gaziantep University. Data included age, sex, supernumerary tooth number, location, morphology, eruption status, and position. Odontoma cases were excluded. SPSS 22.0 was used for descriptive statistics, Pearson's chi-square tests, and reliability analyses ($p<0.05$).

Results: Prevalence was 1.73% (123 patients) among 7,085 children. Mean patient age was 9.31±1.73 years (5-12 years), with a male-to-female ratio of 1.86:1. Most patients (82.11%) had one supernumerary tooth, 16.26% had two, and 0.81% had three or four. Teeth were mainly located in the premaxilla (89.18%). Morphologically, 66.21% were conical, 20.27% supplemental, and 13.51% tuberculate. Most were impacted (70.27%) and vertically oriented (67.56%).

Conclusion: These findings highlight the critical need for early diagnosis and personalized treatment to prevent complications and reduce future complex interventions.

Keywords: retrospective study, supernumerary teeth, tooth eruption

INTRODUCTION

Non-syndromic supernumerary teeth (NST) are a significant dental anomaly defined by the presence of extra teeth beyond the usual 32 in a complete permanent dentition [1]. These additional teeth can appear in various locations within the dental arch, with a higher frequency in the maxillary region [2,3]. NST results from disturbances in odontogenesis, specifically due to abnormalities in the dental lamina, which is crucial for tooth development. In contrast to syndromic supernumerary teeth, NST manifests in otherwise healthy individuals without systemic

connections [4,5]. The pathogenesis of NST is multifaceted, encompassing genetic predispositions, environmental influences, and developmental anomalies. Genetic research has revealed abnormalities in essential genes associated with tooth formation, suggesting a genetic impact on the prevalence of NST. Moreover, environmental factors, including early childhood trauma, infections, or systemic health conditions, can substantially influence the emergence of supernumerary teeth [6].

Supernumerary teeth are classified according to four criteria: morphology, location, eruption status, and orientation. Morphologically, they are divided into three types: conical (peg-shaped), supplemental (similar to normal teeth), and tuberculate (irregularly shaped). Supernumerary teeth predominantly occur in the maxilla and anterior regions, with a consistent male predominance across studies [7]. These additional teeth frequently lead to various complications, including delayed eruption, diastema, and displacement of adjacent teeth. In a significant study of 193 cases, median diastema occurred in 17.8% of cases, while delayed eruption and displacement were observed in 12.9% and 14.5% of cases, respectively [8]. Further complications included follicular space enlargement in 13.5% and mechanical obstructive pathology in 25.1% of cases [9]. Orientation refers to the angulation of supernumerary teeth relative to the dental arch, generally categorized as vertical, horizontal, or mesio-angular, each having distinct clinical implications [10–12]. Early diagnosis and intervention are crucial for preventing complications, with extraction being the primary management strategy [13] .Cone beam computed tomography (CBCT) has emerged as a valuable tool for providing detailed three-dimensional information, aiding in the diagnosis and treatment planning for supernumerary teeth. Early detection and appropriate management are essential to minimize potential complications associated with supernumerary teeth [3,14].

Main Points

- The prevalence of supernumerary teeth was 1.73% among 7,085 Turkish children aged 5–12 years, consistent with global and national epidemiological data.
- Supernumerary teeth showed a clear male predominance (1.9:1) and were overwhelmingly located in the maxillary premaxilla region (89.18%).
- Conical morphology was the most common form (66.21%), followed by supplemental and tuberculate types, with a high impaction rate of 70.27%.
- Vertical orientation was the predominant position (67.56%), highlighting the value of routine panoramic radiographs during mixed dentition for early diagnosis and prevention of complications.

The prevalence of non-syndromic supernumerary teeth (NST) worldwide ranges from 1% to 3%, with significant variance among populations and ethnic groups [15]. In pediatric dentistry, the prompt identification and treatment of NST are essential to prevent problems such as tooth crowding, impaction, and malocclusion. Although these frequency patterns are extensively documented worldwide, data from Turkish children—particularly those aged 5–12 years—are limited. Therefore, a significant knowledge gap remains regarding the prevalence, characteristics, and distribution patterns of supernumerary teeth in this age group. This retrospective study aims to evaluate the prevalence, clinical features, and anatomical distribution of NST among Turkish individuals by analyzing a substantial cohort using panoramic radiographic data from Gaziantep University's Department of Pediatric Dentistry.

MATERIALS AND METHODS

This study received ethical approval from the Gaziantep University Clinical Research Ethics Committee on November 4, 2020 (approval decision no: 2020/338). It was designed as a retrospective cross-sectional analysis of archived panoramic radiographs obtained in the Department of Pediatric Dentistry at Gaziantep University Faculty of Dentistry. All radiographs had been taken as part of routine clinical care with parental/legal guardian consent for diagnostic imaging, and all records were anonymized prior to data extraction and analysis. A total of 7,085 anonymized panoramic radiographs from children aged 5–12 years, acquired between January 2019 and December 2020, were reviewed.

Inclusion and Exclusion Criteria

Inclusion criteria were: (i) children aged 5–12 years who underwent panoramic radiographic examination as part of routine clinical care between January 2019 and December 2020, (ii) availability of high-quality panoramic radiographs suitable for comprehensive evaluation, and (iii) absence of syndromic conditions or systemic diseases likely to affect odontogenesis

or tooth eruption. Exclusion criteria comprised unclear or low-quality radiographs, developmental or hereditary disorders, cleft lip and/or palate, craniofacial malformations or syndromic conditions, odontoma, and any other condition potentially influencing odontogenesis or dental eruption.

Radiographic Protocol

In this retrospective study, digital panoramic radiographs were obtained using a Gendex-700 digital panoramic radiography device (Dentopix model, Gendex Dental Systems, IL, USA). Standardized exposure protocols were applied based on patient age: 64 kVp at 6 mA for children aged 4–5 years and 66 kVp at 7 mA for those aged 10–12 years. A total of 7,085 archived radiographs, originally captured between 2019 and 2020, were retrieved from the institutional database and independently evaluated by two calibrated researchers (M.S.D.R. and Z.U.G.) to ensure consistency. The images were analyzed using dedicated dental imaging software (Denta Ver 1.1.3.2, integrated with HBYS-RIS Ver. 2.0.1.32), which facilitated systematic assessment of radiographic findings. To minimize bias, inter-examiner reliability was assessed, and discrepancies were resolved through consensus or adjudication by a third expert when necessary.

Observer Reliability

Inter-observer reliability was assessed by re-evaluating 25 randomly selected radiographs two weeks after the initial assessment, resulting in a kappa correlation coefficient of 0.87. Standard conditions were maintained to optimize contrast and brightness, ensuring high image quality. Evaluations were conducted on a computer system with the following specifications: Windows 7 Professional, Intel® Core™ i3-2120 CPU (3.30 GHz), 6 GB RAM, 64-bit operating system, and a 19-inch monitor with a resolution of 1366x768.

Data Collection and Analysis

Data extracted from patient records and digital panoramic radiographs included variables such as age, sex, presence and count of supernumerary teeth, their locations within the maxilla and mandible (including mesiodens, anterior maxilla, anterior mandible, canines, premolars, and paramolars), morphologies (conical, tuberculate, supplemental), eruption statuses (erupted, impacted), and positional orientations (vertical, horizontal, inverted, mesioangular). Patients diagnosed with odontoma were excluded from the analysis.

Statistical Analysis

Data analysis was performed using SPSS Statistics version 22.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to report the prevalence and morphological characteristics of supernumerary teeth, expressed as frequencies and percentages. Reliability assessments included both intra-observer and inter-observer agreement analyses using weighted kappa statistics. The associations between supernumerary teeth occurrence and demographic variables (age and sex) were examined using Pearson's chi-square tests. Statistical significance was set at $p < 0.05$, with all analyses reported with 95% confidence intervals.

RESULTS

Analysis of digital panoramic radiographs from 7,085 patients, comprising 3,505 females and 3,580 males, revealed supernumerary teeth in 123 individuals, resulting in a prevalence rate of 1.73%. Among these patients, 80 (65.04%) were male and 43 (34.96%) were female, indicating a statistically significant higher occurrence in males ($p < 0.05$).

The mean age of patients with supernumerary teeth was 9.31 ± 1.73 years, with ages ranging from 5 to 12 years. The highest prevalence was observed in the 9-10 year age group (40.65%), followed by the 7-8 year group (27.64%), the 11-12 year group (25.20%), and the 5-6 year group (6.50%). No significant differences were noted across the age groups ($p > 0.05$). Detailed information on gender and age distribution is presented in Table 1.

A total of 148 supernumerary teeth were identified, with 98 teeth in males and 50 in females. The distribution revealed that 101 patients (82.11%) had one supernumerary tooth, 20 patients (16.26%) had two, and one patient each had three (0.81%) and four (0.81%) teeth (Figure 1). Gender and quantity distributions are further detailed in Table 2.

In terms of location, 132 supernumerary teeth (89.18%) were found in the premaxilla, including 78 teeth (59.09%) in the incisor region and 54 teeth (40.90%) at the midline (mesiodens). Regarding the dental arch, 135 teeth (91.21%) were located in the maxilla, while 13 teeth (8.78%) were identified in the mandible (Figure 1). Additional details on location and distribution are provided in Table 3.

Morphologically, 98 teeth (66.21%) were classified as conical, 30 teeth (20.27%) as supplemental, and 20 teeth (13.51%) as

tuberculate (see Figure 4.4). In terms of eruption status, 104 teeth (70.27%) were impacted, while 44 teeth (29.72%) had erupted. The orientation of the supernumerary teeth included 100 teeth (67.56%) positioned vertically, 22 (14.86%) horizontally, 12 (8.10%) inverted, and 14 (9.45%) mesioangular. A summary of the distribution by morphology, eruption status, and orientation is presented in Table 4.

Tablo 1. Distribution of Patients by Gender and Age

Age	Gender			
	Female	Male	Total	%
5-6	3	5	8	6.50
7-8	10	24	34	27.64
9-10	18	32	50	40.65
11-12	12	19	31	25.20
Total	43	80	123	
%	34.96	65.04		

Table 2. Distribution of supernumerary teeth by gender and number.

Gender	Number and percentage of supernumerary teeth			
	One	Two	Three	Four
Female	36	7	-	-
Male	65	13	1	1
Total	101	20	1	1
%	82.11	16.26	0.81	0.81

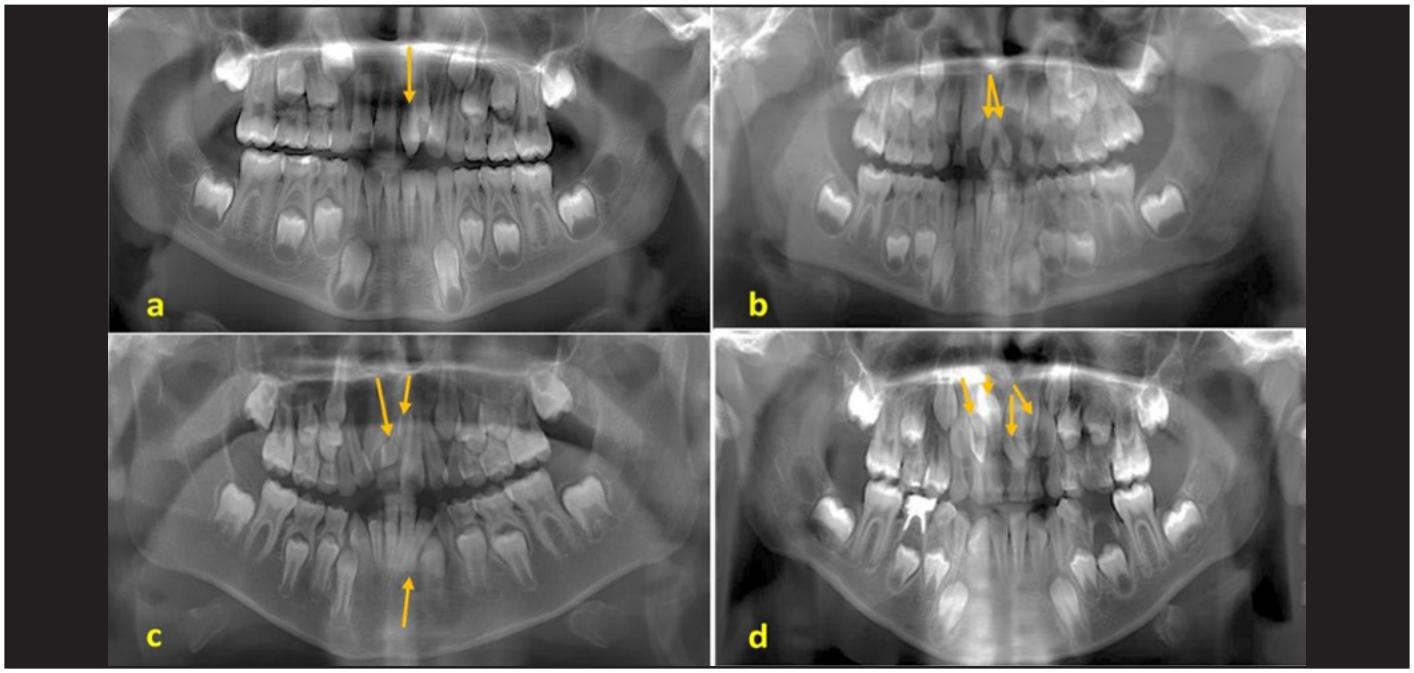

Figure 1. Radiographs of patients with supernumerary teeth: a) single tooth, b) two teeth, c) three teeth, d) four teeth.

Table 3. Distribution of supernumerary teeth according to their location

Location	Maxilla	Mandible
Midline (Mesiodens)	54	1
Incisor region	78	7
Canine region	-	3
Premolar region	3	2
Molar region	-	-
Total	135	13
%	91.21	8.78

Table 4. Distribution of supernumerary teeth according to morphology, eruption status and orientation.

Parameters		Number	%
Morphology	**Conical**	98	66.21
	Supplemental	30	20.27
	Tuberculate	20	13.51
Eruption status	**Erupted**	44	29.72
	Impacted	104	70.27
Orientation	**Normal**	100	67.56
	Horizontal	22	14.86
	Inverted	12	8.10
	Mesioanguler	14	9.45

DISCUSSION

Supernumerary teeth are additional teeth that may develop anywhere in the dental arch, either erupted or impacted, and can occur in both syndromic and non-syndromic individuals [16]. Often discovered incidentally during routine check-ups, particularly in the early mixed dentition phase, these extra teeth can lead to complications such as impaction, misalignment, and aesthetic concerns [16,17]. Our study, involving 7,085 patients, provides a comprehensive examination of the prevalence, age and gender distribution, number, location, morphology, eruption status, and orientation of supernumerary teeth. The findings underscore the significance of large sample sizes in research and highlight the need for increased awareness and proactive management to enhance dental health outcomes [18,19].

The prevalence of non-syndromic supernumerary teeth has been well-documented in the literature. For instance, Zhao et al. [20] reported a prevalence of 1.24% in a cohort of 48,700 patients, while Brinkmann et al. [9] found a rate of 1.84% among 28,114 individuals. Other studies have reported varying prevalence rates, with Hajmohammadi et al [21]. identifying 1.06% in 5,000 radiographic records and Jiang et al [3]. documenting 1.5% in 60, 104 non-syndromic adults using CBCT. Overall, prevalence rates for primary teeth range from 0.2% to 0.8%, while those for permanent teeth range from 0.5% to 5.3% [9,11,18,20,21]. Our finding of 1.73% is consistent with these studies. Variations in prevalence may arise from differences in inclusion criteria, age groups, sample sizes, and diagnostic methods, highlighting the need for standardized approaches in future research to enhance comparability. In the Turkish population, prevalence rates vary, with Esenlik et al. [23] reporting 2.7%, Çelikoğlu et al. [7] noting 1.2% and Büyükgöze-Dindar et. al. [22] reporting 0.6 %. Ezirganlı et al. [24] documented a lower rate of 0.87% in a sample of 8,955 patients. Other studies, including a multicenter analysis by Tatlı et al. [25] (0.88% in 12,735 patients) and Karayılmaz et al. [26] (1.14% in 16,720 patients aged 6-18), indicate variability in prevalence rates. Notably, Almaz et al. [27] reported a prevalence of 1.8% among pediatric patients.

Our rate of 1.73% aligns closely with these findings, particularly with those of Çelikoğlu and Almaz [7,27].

The highest prevalence of supernumerary teeth was observed in the 9-10-year age group (40.65%) in the present study, consistent with findings from Patchett and Almaz [27,28]. Prevalence rates were lower in the 7-8 year group (27.64%), the 11-12 year group (25.20%), and only 6.50% in the 5-6 year group. These results emphasize the critical role of age in the identification and management of supernumerary teeth. Notably, our findings indicate a male-to-female ratio of 1.9:1, suggesting a higher prevalence in males, which is supported by previous research [3,20]. While some studies reported significant gender differences, others have noted non-significant trends, highlighting the complexity of this aspect and the necessity for further investigation.

Research consistently shows that supernumerary teeth are primarily isolated occurrences. Montenegro et al. [29] reported that 77.5% of cases involved a single supernumerary tooth, while Anthonappa et al. [30] found this in 61.5% of patients. Similarly, Ferrés-Padró documented 65.82%, and Singh noted 82.60% with one supernumerary tooth [31,32]. Our findings align with these trends: 82.11% of our patients had one supernumerary tooth, 16.26% had two, and only one case each of three and four was observed. These results reinforce the existing literature on the prevalence and distribution of supernumerary teeth. Supernumerary teeth are predominantly found in the maxilla, as supported by numerous studies. For example, Singh et al. [32] reported a prevalence of 98.18% in the maxilla, while Gürler et al. [33] noted 74.4%. Other studies, including those by McBeain (66.9%) and Brinkmann (70.5%), corroborate this trend [9,34]. Our findings further reinforce this conclusion, with 89.18% of supernumerary teeth in our study located in the maxilla.

The distribution of supernumerary teeth varies among studies. Ezirganlı et al. [24] identified distomolars (35.80%), mesiodens (29.63%), and premolars (24.69%) as the most common locations. Dereci et al. [35] highlighted mandibular premolars, while other studies noted a predominance in the premaxillary region, particularly the anterior maxilla. Our findings align with this literature, showing that supernumerary teeth were most frequently found in incisors (54.72%), followed by mesiodens (37.16%) and canines (4.72%), with the least occurrence in premolars (3.37%). Studies consistently show that conical shapes are the most prevalent among supernumerary teeth. Montenegro et al. [29] reported 60% conical morphology, while Liu et al. [20] found 83.5%. Karayılmaz classified supernumerary teeth as 56.8% conical, 42.2% supplemental, and 2.1% tuberculate [26]. Consistent with these reports, our analysis of 148 supernumerary teeth showed that 66.21% were conical, 20.27% supplemental, and 13.51% tuberculate.

Impaction remains a common issue, as evidenced by our finding that 70.08% of supernumerary teeth were impacted. Rajab et al. [36] reported an eruption rate of 26.5%, while Çelikoğlu et al. [7] noted 20.8%, and Khandelwal [37] found 35%. In our study, 29.72% of supernumerary teeth were erupted, with 70.08% remaining impacted, aligning with these findings in the literature. Additionally, our data showed a predominance of vertical orientation among supernumerary teeth, consistent with multiple studies in the field. Tyrologou et al. [38] reported 51.3% vertical, while Çelikoğlu [7] found this figure to be 81.3%. Ezirganlı [24] and Mossaz [13] noted 68.38% and 61.4%, respectively, and Finkelstein [18] observed 86%. In our study, 67.56% of supernumerary teeth were vertical, with 14.86% horizontal, 9.45% mesioangular, and 8.10% inverted, consistent with existing literature.

Building on the findings of this study, future research should prioritize prospective, multicenter studies with standardized imaging protocols to enhance the generalizability and accuracy of supernumerary teeth assessments. Incorporating advanced imaging modalities, such as cone-beam computed tomography (CBCT), would improve the detection of small or impacted supernumerary teeth, particularly in complex cases. Further investigations should also explore the genetic and molecular mechanisms underlying supernumerary tooth development, especially in syndromic and non-syndromic populations, to better understand etiological factors. Additionally, studies with broader age ranges and diverse ethnic backgrounds are needed to validate prevalence rates and morphological variations across different demographics. Long-term follow-up studies could assess the clinical outcomes of different management strategies, including early intervention versus observational approaches, to establish evidence-based guidelines for treatment. Finally, integrating artificial intelligence (AI)-based diagnostic tools may enhance the efficiency and reliability of supernumerary teeth detection and classification in large-scale studies. Addressing these gaps will contribute to improved clinical decision-making and patient care in pediatric dentistry.

Limitations

This study has several limitations that should be acknowledged. First, its retrospective design relied on existing radiographic records, which may introduce inconsistencies in documentation and imaging quality. Second, the single-center nature of the data may limit generalizability to other populations. Third, while panoramic radiographs are practical for large-scale screening, they have lower sensitivity than CBCT for detecting small or impacted supernumerary teeth, potentially leading to underestimation. Additionally, the study focused only on children aged 5–12 years, excluding both primary dentition and older adolescents, which restricts the applicability of findings to other age groups. The exclusion of syndromic cases further narrows the scope of the analysis. Although inter-observer agreement was high (κ=0.87), minor discrepancies in classification may still exist. Finally, the study population was ethnically homogeneous (Turkish), which may not reflect prevalence rates in other ethnic groups. Despite these limitations, the large sample size (N=7,085) and alignment with existing literature support the reliability of the findings, though future studies using prospective designs, advanced imaging, and diverse cohorts could further validate these results.

CONCLUSIONS

This large-scale retrospective study provides valuable epidemiological data on the prevalence and characteristics of supernumerary teeth in Turkish pediatric patients, revealing a prevalence rate of 1.73% that aligns with previous reports in similar populations. Our findings confirm established patterns regarding age distribution (highest prevalence at 9-10 years), male predilection (1.9:1 ratio), and maxillary predominance (89.18%), while contributing new insights into the morphological features and eruption status of these teeth within this specific demographic. The predominance of conical morphology (66.21%) and vertical orientation (67.56%), along with the high rate of impaction (70.08%), reinforces existing knowledge while providing region-specific data for clinical reference.

These results underscore the importance of routine radiographic examination during the mixed dentition phase, particularly for male patients aged 9-10 years, to enable early detection and management of supernumerary teeth. The study's limitations, including its retrospective design and reliance on panoramic radiography, highlight opportunities for future research while not diminishing the clinical relevance of its findings. By documenting these characteristics in a substantial sample size (N=7,085), this research contributes to the growing body of literature that informs preventive and interceptive orthodontic strategies, ultimately aiming to optimize dental health outcomes in pediatric populations

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Informed Consent: Written informed consent was obtained from the parents/guardians of all participating children prior to data collection.

Data Availability Statement: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Ethics Committee Statement: This study was conducted in accordance with the principles of the Declaration of Helsinki and approved by the Clinical Research Ethics Committee of Gaziantep University (Decision No: 2020/338, Date: November 4, 2020).

Author Contributions: Conceptualization – M.S.D.R., G.K.; Methodology – M.S.D.R., G.K.; Data Collection – Z.Ü.G.; Formal Analysis – Z.Ü.G., M.S.D.R.; Statistical Analysis – Z.Ü.G., G.K., Ş.Ç.; Writing – Original Draft – M.S.D.R., G.K.; Writing – Review and Editing – Z.Ü.G., G.K.; Supervision – Z.Ü.G.

Author Statement Regarding the Use of Artificial Intelligence-Enhanced Tools: No artificial intelligence tools were used for data generation, statistical analysis, or creation of any scientific content within this manuscript. AI-based tools (ChatGPT and QuillBot) were employed solely for language editing purposes, including proofreading, grammar correction, and sentence-level refinement to improve clarity and readability. All intellectual content, interpretations, and conclusions are entirely the authors' own.

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