

Original Article



Prevalence, Morphology, and Complications of Mesiodens: “A Retrospective Panoramic Radiographic Study among Children with Mixed Dentition in Lorestan, Iran”

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Abstract

Introduction: Supernumerary teeth are common developmental dental anomalies, with mesiodens being the most frequent type, typically located in the anterior maxilla. These teeth may appear singly or in multiples and can cause various complications, including delayed eruption, diastema, malocclusion, and, in rare cases, nasal eruption.

This study aimed to determine the prevalence, morphology, and associated complications of mesiodens in children with mixed dentition using panoramic radiographs.

Methods: This descriptive retrospective cross-sectional study was conducted on panoramic radiographs collected between 2017 and 2021 at the Department of Pediatric Dentistry, Lorestan University of Medical Sciences, Iran. A total of 1,361 panoramic radiographs of children in the mixed dentition stage were evaluated to assess the presence, morphology, and associated complications of mesiodens. Statistical comparisons were performed using Chi-square and Fisher's exact tests.

Results: Mesiodens was identified in 18 children, yielding a prevalence of 1.3%. No significant differences were observed in prevalence according to institution, gender, or year of referral ($P > 0.05$). The conical form was the most common morphological type (55.6%), and the majority of cases (61.1%) were asymptomatic. Among symptomatic cases, midline diastema (22.2%) and delayed eruption of adjacent teeth (16.7%) were the most frequent complications. A statistically significant association was found between gender and the presence of complications, with females showing a higher frequency of clinical problems ($P = 0.026$).

Conclusion: Mesiodens is an uncommon finding in children with mixed dentition in Lorestan Province, with a stable prevalence over time. Although most cases are asymptomatic, clinically significant complications—particularly in female patients may occur. These findings emphasize the importance of routine panoramic radiographic evaluation during the mixed dentition period for early detection and appropriate management of mesiodens.

Keywords: Prevalence, Mesiodens, Children, Mixed dentition

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Introduction

Dental developmental abnormalities are important concerns in pediatric dentistry and orthodontics because they may influence tooth eruption, occlusion, esthetics, and overall function of the stomatognathic system. Among these abnormalities, supernumerary teeth are of particular clinical importance and are defined as teeth that exceed the normal

number present in the primary or permanent dentition.¹ Mesiodens, which typically occurs in the midline between the maxillary central incisors, represents the most common type of supernumerary tooth and is frequently identified in the permanent dentition.^{1,2} Although supernumerary teeth may develop in different areas of the dental arch, they are most commonly found in the premaxillary region, with a



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considerably higher occurrence in the maxilla than in the mandible.³

The prevalence and clinical characteristics of supernumerary teeth have been reported to vary among different populations. A retrospective radiographic study reported a prevalence of approximately 2%, with mesiodens being the most frequently observed type and commonly located in the anterior maxillary region.⁴ Similarly, another study involving non-syndromic pediatric patients reported a prevalence of 0.58%, with a greater frequency among males, conical morphology as the predominant form, and complications such as diastema, displacement of adjacent teeth, and root resorption.⁵

Several theories have been proposed to explain the etiology of supernumerary teeth, including the phylogenetic reversion theory (atavism), the dental bud dichotomy theory, and, most notably, the hyperactivity of the dental lamina theory, which is currently the most widely accepted.⁶ Genetic predisposition is also considered significant, particularly in cases involving twins or familial aggregation across multiple generations.⁷

However, this does not follow a simple Mendelian inheritance pattern and may also be influenced by environmental factors.⁸ Clinically, many supernumerary teeth are asymptomatic and are often discovered incidentally during routine radiographic examinations.⁹ Nevertheless, mesiodens can lead to various complications, such as delayed or failed eruption of adjacent permanent teeth, midline diastema, rotation or displacement of central incisors, crowding, cyst formation, root resorption of adjacent teeth, and even ectopic eruption into the nasal cavity.¹⁰

Despite numerous studies on supernumerary teeth in Iran, data on the prevalence, morphology, and associated complications of mesiodens in Lorestan Province are limited. This represents a clear research gap, as region-specific epidemiological information is essential for effective early diagnosis and clinical management. Therefore, this study aimed to determine the prevalence, morphological types, clinical complications, and gender distribution of mesiodens in children with mixed dentition in Lorestan Province, using panoramic radiographs from 2017 to 2021.

Methods

This study was designed as a descriptive retrospective investigation conducted among children in the mixed dentition stage who had undergone panoramic radiographic examinations between 2017 and 2021. Panoramic radiographs were collected from two dental education centers in Lorestan Province, Iran: the School of Dentistry at Lorestan University of Medical Sciences in Khorramabad and the Islamic Azad University, Borujerd Branch. In total, 1,361 panoramic radiographs were reviewed, including 862 cases from Khorramabad and 499 cases from Borujerd. A census sampling approach was employed, whereby all available panoramic radiographs of children referred to the aforementioned centers were evaluated, and those meeting

the inclusion criteria were included in the study.

Entry and Exit Criteria

Inclusion Criteria

- Children aged 6–12 years in the mixed dentition stage
- Panoramic radiographs with acceptable diagnostic quality
- Radiographs obtained between 2017 and 2021
- Children in the mixed dentition stage, operationally defined as the simultaneous presence of primary and permanent teeth, with or after the initial eruption of the permanent maxillary central incisors

Exclusion Criteria

- Radiographs of poor diagnostic quality
- Incomplete or illegible patient data

Data Collection

A structured data collection form was used to record variables such as gender, number of mesiodens, morphological type (conical, supplemental, or tuberculate), and associated clinical complications (e.g., midline diastema, delayed eruption).

Examiner calibration

To ensure the reliability of the radiographic assessment, two examiners trained in oral and maxillofacial radiology, independently and blindly evaluated the panoramic radiographs for the presence of mesiodens, its morphological type, and associated complications. Before the main assessment, both examiners participated in calibration sessions conducted by an oral and maxillofacial radiologist to standardize the diagnostic criteria. Inter-examiner agreement was assessed using Cohen's kappa statistic based on the independent evaluation of 50 randomly selected panoramic radiographs. The kappa coefficient was 0.87 for the identification of mesiodens and 0.82 for the classification of mesiodens morphology, indicating almost perfect agreement. Any disagreements were resolved by consensus with the senior oral and maxillofacial radiologist.

Statistical analysis

After data collection, the information was entered into SPSS software version 21 for statistical analysis. Descriptive statistics, including frequency and percentage, were used to summarize the data. To evaluate the association between variables, the Chi-square test or Fisher's exact test was applied where appropriate. A *P*-value of less than 0.05 was considered statistically significant. In addition, inter-rater reliability was determined in the radiological examination, and the degree of agreement between raters was calculated and evaluated using the kappa statistic.

Results

In this study, the frequency of mesiodens, its morphological characteristics, and associated clinical complications were evaluated in children with mixed dentition. Demographic

variables (institution, gender) and temporal factors (year of referral) were analyzed to provide a comprehensive overview. The findings are summarized using descriptive statistics in Tables, supported by figures illustrating temporal trends and radiographic examples.

Prevalence of Mesiodens

The present study evaluated the prevalence of mesiodens in 1,361 panoramic radiographs of children with mixed dentition in Lorestan Province between 2017 and 2021. Among 1,361 panoramic radiographs reviewed, 18 cases of mesiodens were identified (prevalence 1.3%, CI 95%: 0.84-2.08), while 1,343 children (98.7%, CI 95%: 97.9-99.2) did not have mesiodens, indicating that mesiodens is relatively rare in this population. No significant difference was observed between the two institutions; 1.2% (CI 95%: 0.63-2.12) of children in Khorramabad and 1.6% (CI 95%: 0.82-3.11) of children in Borujerd had mesiodens ($P=0.409$).

Regarding gender distribution, mesiodens was slightly more common in girls (1.7%, CI 95%: 0.95-3.01) than boys (1.0%, CI 95%: 0.48-2.02), but this difference was not statistically significant ($P=0.251$). This finding suggests that gender may not be the main determinant of mesiodens prevalence in children with mixed dentition. Annual prevalence analysis showed that the prevalence

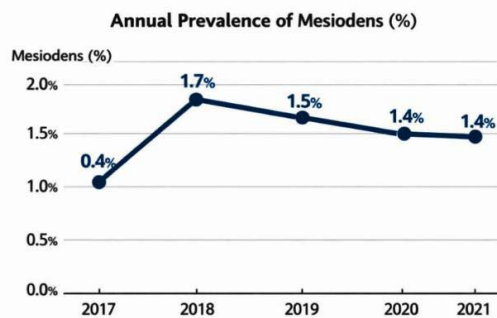


Figure 1. Annual prevalence trend of mesiodens in children with mixed dentition (%) over five years

trend was relatively stable over the five-year study period. The prevalence ranged from 0.4% in 2017 to 1.7% in 2018, with slight fluctuations between 1.4% and 1.5% observed in subsequent years (Figure 1). No statistically significant changes were found between years ($P=0.706$), indicating a stable occurrence of Mesiodens in this population over time.

Overall, these findings suggest that mesiodens affects a small proportion of children in Lorestan, with no significant variation by institution, gender, or year. The stable prevalence trend highlights the need for routine radiographic assessment to detect these anomalies, especially because early identification may prevent potential complications in dental development. Prevalence details by institution, gender, and year are shown in Table 1.

Prevalence of Mesiodens Morphologies & Associated complications

In this study, the frequency of mesiodens, different forms of mesiodens, and associated clinical problems in children with mixed dentition were investigated. In order to avoid data dispersion and repetition of multiple tables, the results related to the form of mesiodens and its associated complications based on demographic and temporal structures are presented in an integrated manner in Table 2. This table can show the morphological pattern of mesiodens and clinical messages in different subgroups.

The conical form was the most common morphological type of mesiodens, followed by the supplemental type. No tuberculate mesiodens was identified in the study population (Figure 2). Among the conical mesiodens cases, 6 teeth (60%) exhibited an inverted orientation, indicating a relatively high frequency of abnormal positioning (Figure 3a).

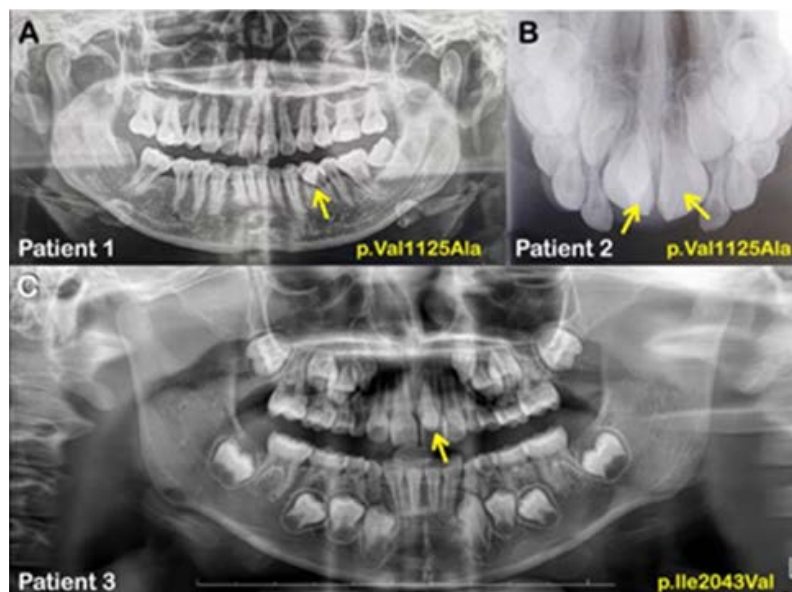
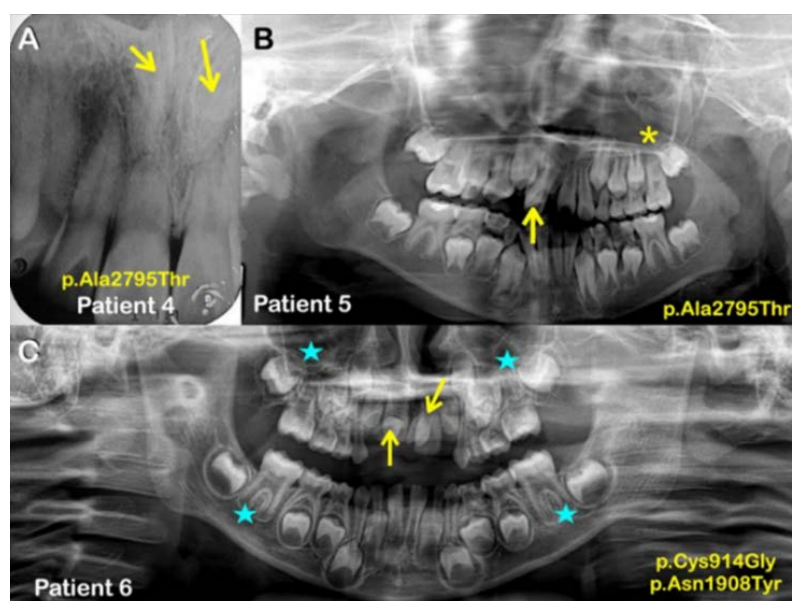
Comparison of mesiodens morphology between the two institutions showed no statistically significant difference. In Khorramabad, conical and supplemental forms were equally distributed, whereas in Borujerd, conical mesiodens

Table 1. Prevalence of mesiodens in children with mixed dentition by institution, gender, and year

Category	Subgroup	No Mesiodens n (%) CI 95%	Mesiodens n (%) CI 95%	Total	P-value
Institution	Khorramabad	852 (98.8) (98.1-99.6)	10 (1.2) (0.63-2.12)	862	0.409
	Borujerd	491 (98.4%) (96.9-99.2)	8 (1.6%) (0.82-3.11)	499	
Gender	Male	705 (99.0%) (98.0-99.5)	7 (1.0%) (0.48-2.02)	712	0.251
	Female	638 (98.3%) (96.5-99.6)	11 (1.7%) (0.95-3.01)	649	
Year	2017 (1396)	251 (99.6%) (97.8-100)	1 (0.4%) (0.02-2.22)	252	0.706
	2018 (1397)	408 (98.3%) (96.6-99.2)	7 (1.7%) (0.83-3.40)	415	
	2019 (1398)	333 (98.5%) (99.4-96.5)	5 (1.5%) (0.6-3.38)	338	
	2020 (1399)	146 (98.6%) (95.2-99.6)	2 (1.4%) (0.38-4.79)	148	
	2021 (1400)	205 (98.6%) (95.6-99.5)	3 (1.4%) (0.48-4.02)	208	
Total	-	1343 (98.7%) (97.9-99.2)	18 (1.3%) (0.84-2.08)	1361	-

Table 2. Distribution of mesiodens morphology and associated complications in children with mixed dentition

Category	Subgroup	Conical n (%)	Supplemental n (%)	Tuberculate n (%)	No Complication n (%)	Diastema n (%)	Failure of Eruption n (%)	Total	P-value
Institution	Khorramabad	5 (50.0%)	5 (50.0%)	0 (0%)	6 (60.0%)	3 (30.0%)	1 (10.0%)	10	0.664 (morphology) / 0.544 (complications)
	Borujerd	5 (62.5%)	3 (37.5%)	0 (0%)	5 (62.5%)	1 (12.5%)	2 (25.0%)	8	
Gender	Male	4 (57.1%)	3 (42.9%)	0 (0%)	7 (100%)	0 (0%)	0 (0%)	7	0.251 (morphology) / 0.026 (complications)
	Female	6 (54.5%)	5 (45.5%)	0 (0%)	4 (36.4%)	4 (36.4%)	3 (27.3%)	11	
Year	2017 (1396)	0 (0%)	1 (100%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	1	0.383 (morphology) / 0.737 (complications)
	2018 (1397)	4 (57.1%)	3 (42.9%)	0 (0%)	3 (42.9%)	2 (28.6%)	2 (28.6%)	7	
	2019 (1398)	2 (40.0%)	3 (60.0%)	0 (0%)	4 (80.0%)	1 (20.0%)	0 (0%)	5	
	2020 (1399)	1 (50.0%)	1 (50.0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2	
	2021 (1400)	3 (100%)	0 (0%)	0 (0%)	1 (33.3%)	1 (33.3%)	1 (33.3%)	3	
Total	-	10 (55.6%)	8 (44.4%)	0 (0%)	11 (61.1%)	4 (22.2%)	3 (16.7%)	18	-

**Figure 2.** (a) Patient 1: Panoramic radiograph showing a supernumerary premolar in the left mandibular region (arrow). (b) Patient 2: Occlusal radiograph revealing two mesiodens in the anterior maxillary region (arrows). (c) Patient 3: Panoramic radiograph showing a single mesiodens located between the maxillary central incisors (arrow)**Figure 3.** (a) Patient 4: Periapical radiograph showing two inverted mesiodens in the maxillary anterior region (arrows). (b) Patient 5: Panoramic radiograph showing a single mesiodens (arrow) and taurodontism in the molars (asterisk). (c) Patient 6: Panoramic radiograph displaying two mesiodens (arrows) and taurodontism (asterisks) in the posterior teeth

were slightly more prevalent than supplemental types. However, this variation was not statistically significant ($P=0.664$), suggesting that institutional location did not influence mesiodens morphology. Similarly, no significant association was found between mesiodens morphology and gender. Conical mesiodens accounted for 57.1% of cases in boys and 54.5% in girls, while supplemental mesiodens comprised 42.9% and 45.5% of cases, respectively ($P=0.251$). Annual analysis also demonstrated no significant variation in mesiodens morphology across the five-year study period ($P=0.383$), indicating a stable distribution pattern over time.

Regarding associated complications, the majority of children with mesiodens (11 cases, 61.1%) did not exhibit any clinical complications. Among the remaining cases, diastema was observed in 4 children (22.2%), and failure of eruption of adjacent teeth was identified in 3 cases (16.7%). Some cases also showed associated anomalies such as taurodontism (Figure 3b, 3c).

The distribution of complications did not differ significantly between Khorramabad and Borujerd institutions ($P=0.544$), nor across different study years ($P=0.737$). In contrast, a statistically significant association was found between gender and the presence of complications ($P=0.026$). All male patients with mesiodens were free of complications, whereas only 36.4% of female patients showed no associated problems. In girls, diastema and failure of eruption were observed in 36.4% and 27.3% of cases, respectively, indicating a higher burden of complications compared to boys.

Overall, these findings suggest that conical mesiodens is the predominant morphological type in children with mixed dentition in Lorestan Province, with most cases being asymptomatic. While morphology was not significantly associated with institution, gender, or year, the presence of complications showed a significant gender-related difference, emphasizing the importance of careful clinical and radiographic monitoring, particularly in female patients.

Discussion

The present study assessed the prevalence, morphological characteristics, and clinical implications of mesiodens in children with mixed dentition in Lorestan Province. The prevalence of mesiodens observed in this study (1.3%) falls within the range reported in previous studies, which have reported a prevalence of mesiodens between 0.1% and 1.9%.¹¹ Considering the prevalence rate in our study, it seems that our findings are quite similar to those of the another studies. The prevalence of mesiodens has been estimated to be 0.45% in Caucasians, 0.4% in Finnish, 1.43% in Norwegian, and 2.2% in Spanish populations.³ In contrast, a study by Goksel et al. using CBCT (higher resolution 3D imaging) reported a significantly higher prevalence of mesiodens (e.g., ~5.04%) than panoramic studies. This difference is due to the better detection power of CBCT.¹² In contrast, a recent study by Bharti et al, which investigated the prevalence and characteristics

of mesiodense based on panoramic images, reported a prevalence of 0.52% mesiodense, indicating a lower prevalence in panoramic studies than in some CBCT studies.¹³

Differences in the age distribution and genetic/ethnic composition of the populations studied may explain variations in reported prevalence rates of mesiodens. For example, studies of supernumerary teeth in different ethnic groups have shown considerable variability in overall prevalence, with rates ranging from around 1.0% to over 2.0% in diverse pediatric and adolescent populations, emphasizing the influence of both demographic and geographic factors on tooth anomalies prevalence.¹⁴ Moreover, patterns of supernumerary tooth occurrence have been shown to differ among European white populations, with some analyzes reporting a higher frequency of supernumerary traits in certain groups compared to others, suggesting that ethnic and population-based differences could contribute to variable findings in mesiodens studies.³ In addition to genetic diversity, variations in diagnostic methods particularly the use of 3D imaging modalities such as CBCT rather than conventional panoramic radiography can lead to differences in detection rates and reported prevalence.¹⁵ Recent CBCT-based epidemiological studies have also demonstrated higher detection rates of impacted and inverted mesiodens compared with conventional panoramic radiography, emphasizing the diagnostic superiority of three-dimensional imaging in identifying supernumerary teeth and their spatial relationships with adjacent structures.^{16,17} These results indicate that although the prevalence of mesiodens in this population may be relatively low, careful radiographic examination of morphological features and associated clinical complications remains clinically important.

In the present study, conical mesiodens was the most frequent morphological type, followed by supplemental forms, while no tuberculate mesiodens was identified. This finding is consistent with previous studies. For instance, Öztürk et al. A recent panoramic survey reported that the majority of misiodens were conical in shape and the overall prevalence in the studied population was about 0.52%, indicating similarity of morphological patterns in different populations.¹⁸ Similarly, Bharti et al. observed that among 117 mesiodens, 70.94% were conical, 19.65% supplemental, and 9.40% tuberculate, supporting the predominance of the conical morphology in children.¹⁹ In contrast to our findings, a study on non-syndromic Turkish pediatric patients reported that, among 83 mesiodens, 48.2% were conical, 31.3% were tuberculate, and 20.5% were incisor-like, indicating a higher proportion of tuberculate morphology than seen in many previous reports.²⁰ The relatively high proportion of inverted conical mesiodens in studies highlights the clinical importance of careful radiographic assessment, as inverted positioning has been associated with delayed eruption or other dental complications.²¹ The lack of a significant association between mesiodens morphology and institution, gender, or year is consistent with previous studies suggesting that

morphology is largely a demographic factor.

The relatively high prevalence of inverted conical mesiodens observed in this study is clinically important, as inverted orientation is associated with increased vegetative risks and impact on diagnosis and may influence clinical severity and outcomes. In the present study, in terms of clinical complications associated with mesiodens, 61.1% of cases were clinically asymptomatic, 22.2% had a midline diastema, and 16.7% had delayed growth. Notably, none of the male patients developed complications, while only 36.4% of the affected females were asymptomatic. These differences were statistically significant and suggest a possible gender-based difference in clinical effects. These findings emphasize the importance of careful and regular examination of the mesiodens, especially in girls, who may be more prone to complications such as midline diastema and delayed eruption. Interestingly, in a recent retrospective study by Zhao et al. in China, the distribution of mesiodontia and supernumerary teeth was related to gender, but its prevalence was reported to be higher in males and the most common type of mesiodontia was inverted and conical, indicating the importance of careful clinical and radiographic evaluation.²²

A statistically significant association was observed between gender and the presence of mesiodens-related complications ($P=0.026$), with female patients demonstrating a higher frequency of clinical problems. While all male patients with mesiodens were asymptomatic, complications such as diastema and failure of eruption were observed exclusively among girls. This difference may be partly explained by sex-related variations in dental development and eruption timing, as female children generally exhibit earlier eruption of permanent incisors, which could increase the likelihood of interference by a mesiodens during critical stages of occlusal development.¹⁶ Additionally, esthetic concerns such as midline diastema may be detected and documented more readily in female patients, potentially contributing to higher reported complication rates.²³ It is also possible that differences in craniofacial growth patterns or tooth–arch size relationships between genders play a role.²⁴ Nevertheless, given the relatively small number of mesiodens cases, this finding should be interpreted with caution and confirmed through larger, multicenter studies. Management of mesiodens remains a subject of debate in the literature.

Early removal during the mixed dentition period has been widely advocated to prevent eruption disturbances, malocclusion, and the need for complex orthodontic treatment.² The optimal timing for extraction is generally considered to be around 8–9 years of age, coinciding with the eruption of the maxillary central incisors. However, in cases where the mesiodens is asymptomatic or located in close proximity to developing permanent teeth, a conservative approach with careful radiographic monitoring may be justified.²⁵ The findings of the present study underscore the importance of early detection and individualized management strategies, as even asymptomatic mesiodens may interfere with normal dental development and lead

to esthetic or functional complications during the mixed dentition stage. Despite these considerations regarding etiology and management, the interpretation of the present findings must take into account several methodological limitations that may influence their generalizability and clinical implications. Another issue in this study is the use of retrospective panoramic radiographs without CBCT, which, although more accurate for determining mesiodens morphology and orientation, was not practical for routine use in this sample due to its unavailability for all patients and radiation considerations. Panoramic radiographs remain a suitable tool for epidemiological studies with large samples, and future research could incorporate CBCT to provide more precise assessments. Finally, the limited number of mesiodens cases ($n=18$) reduces statistical power and limits the ability to detect subtle relationships or minor differences between groups; nevertheless, this sample still provides preliminary information and allows comparisons with similar studies, while larger future studies could yield more reliable results. The study samples were limited to two university educational centers in Lorestan province and may not be representative of the entire pediatric population in the region; however, these centers had a broad referral base from both urban and rural populations, and using their data allowed for a preliminary investigation of the prevalence and characteristics of mesiodens in children with mixed dentition, while future multicenter studies could increase the generalizability of the results.

Conclusion

The present study demonstrated that mesiodens is an infrequent finding among children with mixed dentition in Lorestan Province, with a prevalence of 1.3% based on panoramic radiographic evaluation. The occurrence of mesiodens showed no significant variation according to institution, gender, or year of referral, indicating a relatively stable prevalence pattern over time. Conical mesiodens was the predominant morphological type, and the majority of cases were asymptomatic. However, clinically relevant complications such as diastema and failure of eruption were observed in a subset of patients, with a significantly higher frequency in females. These findings highlight the importance of routine radiographic assessment during the mixed dentition period to facilitate early detection of mesiodens and prevent potential disturbances in dental development. Given the observed gender-related difference in complications, careful clinical monitoring may be particularly warranted in female patients. Future studies with larger, multicenter samples and the use of cone-beam computed tomography (CBCT) are recommended to validate the prevalence estimates, clarify gender-related differences, and better elucidate the three-dimensional position and clinical implications of mesiodens in Iranian children.

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Competing Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

Ethical Approval

This study was approved by the Ethics Committee of Lorestan University of Medical Sciences under the code IR.LUMS.REC.1401.129.

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