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Mesiodens-type supernumerary teeth evaluated through digital panoramic radiographs in a private radiology center in Manizales, Colombia

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ABSTRACT

Objective: To evaluate mesiodens supernumerary teeth in digital panoramic radiographs taken between 2019 and 2020 at a private radiological center in Manizales, Colombia. **Materials and Methods:** A retrospective, descriptive, cross-sectional, observational study was conducted. The study population consisted of 1,000 panoramic radiographs from the radiological center in Manizales, Colombia, from 2019-2020. A virtual database was accessed for this purpose. The evaluated variables included age, sex, presence or absence of mesiodens, number of teeth with anomalies, tooth shape, position, location, and evolution. Statistical analysis was performed using frequencies and percentages. **Results:** The frequency of mesiodens supernumerary teeth was 3.8% (n = 40), with a higher occurrence in males. Most cases involved a single mesiodens (n = 38), with the highest number of cases in the age groups of 6 to 11 years (n = 13) and 12 to 17 years (n = 21), characterized by a rudimentary type and intraosseous evolution. **Conclusion:** Mesiodens type DS is a condition not very frequently found in the population studied; however, this study allowed us to carry out a characterization for Colombia, where there is not much scientific evidence in this regard, in order to have the possibility of contrasting it with other studies carried out nationally and internationally.

Keywords: dental anomaly; panoramic radiography; mesiodens; supernumerary tooth; abnormalities.

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INTRODUCTION

Radiology is a medical-odontological specialty that focuses on obtaining images of the inside of the human body through the use of physical agents (mainly X-rays, ultrasound, magnetic fields, among others) which, through the interpretation of images, is oriented to the diagnosis of different patient-related acquired conditions. The importance of radiology in this field has been essential over time and will continue to be so in the diagnosis of conditions that may affect health (1). Dental anomalies are developmental disturbances in tooth formation that arise from genetic factors, environmental influences, or acquired conditions occurring during odontogenesis. These conditions can be classified mainly, according to the affection of the dental pieces, in alterations of shape, number, size, structure and eruption (2-4).

Extraoral radiography, mainly panoramic radiography or orthopantomography, plays an essential role in the diagnosis of this type of lesions, which are often found incidentally during routine exams. These projections allow to analyze in a panoramic view the oral cavity, the maxilla, the mandible and the related anatomical structures which, when interpreted by the professional, may provide a diagnosis of dental anomalies. During the clinical exam, they complement the information to provide a diagnosis, considering that these alterations must have information from both clinical and radiographic sources (5). In relation to anomalies in the number of teeth, the existence of a greater number of teeth in addition to the normal dental formula is known as supernumerary teeth (ST), which are independent of the shape of dental pieces or the location in the maxilla or mandible. This condition occurs mainly in the permanent dentition, with a higher prevalence in males than in females, and it is classified according to the region where the dental piece is located (mesiodens, paramolar, or distomolar), or the similarity connected to the dental tissues (supplementary or rudimentary) (5, 6). STs are teeth or structures anatomically similar to dental tissues that generally remain unerupted, but may erupt, in addition to the 20 primary and 32 permanent teeth (6). These teeth can be located in the midline, referred to as mesiodens, at a 48.6%, being the most common among the STs. The etiology of STs remains unclear. Prior studies have shown that several genes are associated to ST, particularly the mesiodens (7, 8).

In different studies conducted in Ecuador, Colombia, China, Peru, and other countries, it has been found that the most common dental anomalies are alterations related to the number of dental pieces with 1.6 to 9.6%, with agenesis being the most common in permanent dentition (9-11). The main objective of this research was to evaluate the mesiodens-type ST in digital panoramic radiographs taken between 2019 and 2020 in a private radiology center in Manizales, Colombia.

MATERIALS AND METHODS

The study design was retrospective, descriptive, cross-sectional and observational. The population consisted of 1000 radiographs. A convenience sampling was performed and it consisted of all panoramic radiographs taken during January and December of 2019 and 2020 at a private radiology center in Manizales, Caldas, Colombia. The selection criteria included digital panoramic radiographs obtained in 2019 and 2020 from patients aged 3 to 20 years, showing all six anterior teeth and the presence of the mesiodens dental anomaly. Additionally, the radiographs had to meet quality standards, including proper patient positioning and adequate contrast, sharpness, and image density. The variables considered were age, sex (male/female), presence of mesiodens, number of teeth with mesiodens (one/two), shape of the mesiodens tooth (supplementary/rudimentary, depending on whether it had the anatomical appearance of a normal tooth), position/inclination (vertical, horizontal, inverted, inclined evaluating the longitudinal axis of the tooth), location (maxilla: midline, left or right hemiarch), and evolution of mesiodens (intraosseous/extraosseus, determined by the formation of the dental piece).

The project was carried out once the Institutional Ethics Committee of Universidad Peruana Cayetano Heredia (CIE-UPCH) had given its approval on October 1, 2021 and with SIDISI code No. 206267-Certificate 357-35-21. A calibration process was implemented prior to the analysis with radiological images and alterations of interest, where the evaluator was trained for an adequate review. This calibration was carried out with the help of a specialist and master in Oral and Maxillofacial Radiology, who reviewed different images for the recognition of dental anomaly. These images were taken from the dental teaching center of Universidad Peruana Cayetano Heredia. The same exercise was performed by the evaluator and, after that, the data were coded in an Excel sheet with the same variables that were used in the study, considering age, sex (male/female), presence or absence of mesiodens, number of teeth with mesiodens anomaly (one/two), shape of the mesiodens tooth (supplementary/

rudimentary, depending on whether it had the anatomical appearance of a normal tooth), position/inclination (vertical, horizontal, inverted, inclined evaluating the longitudinal axis of the tooth), location (maxilla: midline, left or right quadrant), and evolution of mesiodens (intraosseous/extraosseus, determined by the formation of the dental piece).

After the exercise was completed by both, the calibrator and the evaluator met and verified the information and found a 96% agreement in the recorded data. Subsequently, the necessary corrections or adjustments were made so the evaluator could finish the calibration. For the process of radiographic analysis and data storage, an *ad hoc* form was used ("Dental Anomaly Identification Form – Mesiodens-type Supernumerary Tooth"), to evaluate and analyze each radiograph. This form registered the elements to identify the patient, using general data such as age and date of the radiograph acquisition, correlative code assigned to the radiographic image, characterization of the mesiodens dental anomaly and its distribution. The data were coded and consolidated into a database created using Microsoft Excel version 12 software. The information was organized during the radiographic analysis for this research, based on the presence or absence of the mesiodens dental anomaly and the characterization available according to the variables analyzed. As it is a database, patient anonymity was ensured for the research project by coding each evaluated radiograph. Additionally, since this study involved radiographs, no harm was done to the integrity of the patients. The statistical analysis was carried out through the chi-squared test and Fisher's exact test, as appropriate. The study had a confidence level of 95% and a $p < 0.05$ value. The SPSS 24.0 statistical program was used.

RESULTS

At the Oral and Maxillofacial Radiology Service center, located in the city of Manizales, Colombia, a total of 1000 digital panoramic radiographs acquired in the period 2019-2020 were analyzed. From them, 38 presented mesiodens-type ST, with a frequency of 3.8%, where a total of 40 STs were found. It is worth mentioning that a patient can present single or multiple, unilateral or bilateral STs, in each arch. In this study, a total of two male radiographs were found with 2 mesiodens present (5.3%) (table 1).

Table 1. Frequency of mesiodens in panoramic radiographs in a private radiology center in Manizales, Colombia.

Variable	n	%
Sex		
Male	454	45.4
Female	546	54.6
Age		
From 0 to 5 years old	11	1.1
From 6 to 11 years old	234	23.4
From 12 to 17 years old	453	45.3
From 18 to 20 years old	302	30.2
Presence of mesiodens		
Yes	38	3.8
No	962	96.2
Number of mesiodens		
One	36	94.7
Two	2	5.3
Mesiodens shape		
Supplementary	2	5.0
Rudimentary	38	95.0
Position/inclination		
Vertical	8	20.0
Horizontal	5	12.5
Inverted	13	32.5
Inclined/oblique	9	22.5
Cross-sectional	5	12.5
Location		
Mx Midline	10	25.0
Mx right hemiarch	15	37.5
Mx left hemiarch	15	37.5
Evolution of mesiodens		
Extraosseous evolution	8	20.0
Intraosseous evolution	32	80.0

Mx: maxilla.

Analysis of ST prevalence by sex revealed that, among the 38 radiographs exhibiting the dental anomaly (3.8%), 70.0% (n = 26) were from male patients and

30.0% (n = 12) from female patients. The relation man:woman found in this study was 2.1:1 (table 2). Fisher's statistic test showed a p-value higher than 0.05, which does not establish statistically significant differences between the prevalence of STs and the sex. The analysis also revealed that the majority of radiographs with the dental anomaly—94.7% (n = 36)—showed a single mesiodens, while only 5.3% (n = 2) presented with two mesiodens. There was no statistically significant association.

Table 2. Presence and number of mesiodens according to sex in panoramic radiographs in a private radiology center in Manizales, Colombia.

Variable	Sex				Total		p
	Male		Female				
	n	%	n	%	n	%	
Presence of mesiodens							
Yes	26	2.6	12	1.2	38	3.8	
No	428	42.8	534	53.4	962	96.2	
Total	454	45.4	546	54.6	1000	100.0	
Number of mesiodens							
1 (one)	24	63.2	12	31.6	36	94.7	
2 (two)	2	5.3	0	0.0	2	5.3	0.685*
Total	26	68.4	12	31.6	38	100.0	

*Fisher's exact test.

When evaluating mesiodens according to age groups, it was observed that most cases occurred in the age group between 12 and 16 years old, representing 52.5% (n = 21), followed by a group between 6 and 11 years old, representing 32.5% (n = 13). It is worth noting that there were no cases within the age range of 0 to 5 years old, inferring from here that the preference of this condition is evidenced in permanent teeth in most cases (table 3).

Table 3. Number of mesiodens according to age in panoramic radiographs at a private radiology center in Manizales, Colombia.

Age group	Number of mesiodens				Total		p
	One		Two				
	n	%	n	%	n	%	
From 0 to 5 years old	0	0.0	0	0.0	0	0.0	
From 6 to 11 years old	13	32.5	0	0.0	13	32.5	
From 12 to 17 years old	19	47.5	2	5.0	21	52.5	0.485*
From 18 to 20 years old	4	10.0	2	5.0	6	15.0	
Total	36	90.0	4	10.0	40	100.0	

* Fisher's exact test.

According to the shape of mesiodens and sex, it is evident that most cases are in the rudimentary type for the male sex, accounting for 65.0% (n = 26) of the cases. There were no statistically significant differences (p = 0.48). Furthermore, with respect to the analysis of the distribution by sex according to location, it was found that in the male sex the greatest number of cases in males is positioned in the left hemiarch of the maxilla, showing 27.5% (n = 11), followed by the right hemiarch of the maxilla, which shows 25.0% (n = 10). On the other hand, in the female sex, the majority of cases remained in the right hemiarch, representing 12.5% (n = 5). Finally, according to the position/inclination of the mesiodens by sex, 17.5% (n = 7) of the males presented vertical position and inclined/oblique; while 20.0% (n = 8) of the females presented an inverted position (table 4).

Table 4. Shape (morphology), location and position/inclination of the mesiodens according to sex in panoramic radiographs in a private radiology center in Manizales, Colombia.

Variable	Sex				Total		p
	Male		Female				
	n	%	n	%	n	%	
Shape of mesiodens							
Supplementary	2	5.0	0	0.0	2	5.0	
Rudimentary/complementary	26	65.0	12	30.0	38	95.0	0.485*
Total	28	70.0	12	30.0	40	100.0	
Location							
Mx midline	7	17.5	3	7.5	10	25.0	
Mx right hemiarch	10	25.0	5	12.5	15	37.5	
Mx left hemiarch	11	27.5	4	10.0	15	37.5	0.924*
Total	28	70.0	12	30.0	40	100.0	
Position/inclination							
Vertical	7	17.5	1	2.5	8	20.0	
Horizontal	5	12.5	0	0.0	5	12.5	
Inverted	5	12.5	8	20.0	13	32.5	
Inclined/oblique	7	17.5	2	5.0	9	22.5	0.054*
Cross-sectional	4	10.0	1	2.5	5	12.5	
Total	28	70.0	12	30.0	40	100.0	

*Fisher's exact test; Mx: maxilla.

In the analysis of the distribution of ST characterization according to position/inclination, the inverted position was predominant in the first place, representing 32.5% (n = 13), in 8 women and 5 men. In second place, the inclined position was found, representing 22.5% (n = 9), in 7 men and 2 women. In third place, the vertical position shows 20.0% (n = 8), in 7 men and 1 woman. On the other hand, according to the analysis of position by age groups, it was found that 85.0% (n = 34) of the cases, regardless of the position, evidenced a higher proportion in the groups between 6 and 11 years old, and 12 and 17 years old. No statistically significant differences were found between the prevalence of STs and position, resulting in p > 0.05 (table 5).

Table 5. Position/inclination of mesiodens according to age in panoramic radiographs in a private radiology center in Manizales, Colombia.

Age group	Position/inclination										Total		p
	Vertical		Horizontal		Inverted		Inclined/oblique		Cross-sectional				
	n	%	n	%	n	%	n	%	n	%	n	%	
From 0 to 5 years old	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
From 6 to 11 years old	4	10.0	1	2.5	2	5.0	5	12.5	1	2.5	13	32.5	
From 12 to 17 years old	4	10.0	4	10.0	8	20.0	4	10.0	1	2.5	21	52.5	0.071*
From 18 to 20 years old	0	0.0	0	0.0	3	7.5	0	0.0	3	7.5	6	15.0	
Total	8	20.0	5	12.5	13	32.5	9	22.5	5	12.5	40	100.0	

*Fisher's exact test.

DISCUSSION

According to the results of this study, the majority of the radiographs (n = 36), that is 94.7%, presented a single ST, while 2 presented two ST-type pieces. This finding supports the observation made by Contreras et al. (12), who noted that cases involving more than two mesiodens may occur, depending on the morphodifferentiation process of the teeth. Furthermore, in Venezuela, Villavicencio et al. (6) mentioned a possible relationship between genes and the condition of mesiodens ST; in addition, a higher rate of hyperdontia was found. Even some genes can change the risk of occurrence of dental anomalies, each one expressed in a different way (12).

On the other hand, the condition of supernumerary teeth was observed in 38 of the 1000 digital panoramic radiographs analyzed (3.8%), which indicates that the presence of this anomaly is actually low in the population analyzed. It would be important to know the incidence of this condition not only in other private hospitals of the city, but also in other areas and cities to have a general panorama in Colombia. It is worth mentioning that the value found in this study is in agreement with that reported by Doroteo et al. (13) and Villavicencio et al. (6), who reported frequencies between 0.5 and 3.8% of ST in the permanent dentition. These data are consistent with our research (3.8%), which confirms that, according to the population studied, there could be a connection with the already existing studies based on available scientific evidence (13, 14).

From these results, it was determined that the presence of STs is more frequent in men than in women, as evidenced by the ratio of men:women cases (2.1:1) obtained from the data. This is in agreement with the results reported by various studies and those of Fernández et al. (15). This information could determine that there is a relationship with this condition, the expression of the genes present and the formation of ST-type dental pieces.

Similarly, Yu et al. (8) mentioned that mesiodens STs occur mostly on a genetic basis. This information may mark an interesting path towards the origin of STs, considering the relevance that genetic and molecular studies have gained in Odontology. When analyzing the results by age, it was found that the highest percentage of cases (52.6%) occurred in the 12 to 17-year-old age group, which corresponds to the adolescent stage. Thus, substantial changes in hormonal levels, growth and development factors, or the need for some type of orthodontic treatment could be related and provide evidence of risk factors in the appearance of this condition. It would be advisable to gather more scientific evidence and conduct further studies to determine the role of certain hormones in the development of this anomaly, particularly in the Colombian population.

Among the limitations presented in this study, reliability tests were not applied in the calibration process of the evaluator, there were delays in the access to information by the radiological center and little scientific evidence was found in the Colombian

territory, which restricted the direct orientation of the discussion towards the population within the same country. It is recommended to encourage this type of studies in Colombia to obtain relevant findings and studies related to the improvement of scientific data currently available.

CONCLUSION

From the study conducted, it can be concluded that mesiodens-type STs are a relatively uncommon condition in the studied population. However, it has allowed for the characterization of this condition in Colombia, a country where there is limited scientific evidence on the subject and it offers a basis for comparison with other national and international studies.

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