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Research Article

Skeletal and Dental Characteristics in Patients with Retained Canines

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Abstract

Background: A retained canine is a tooth that fails to erupt due to obstruction by either bone or adjacent teeth. This study aims to describe the most common skeletal and dental characteristics associated with retained canines, with the goal of enabling early and accurate diagnosis to prevent long-term complications.

Methods: The study sample were 43 patients with retained canines. Variables assessed included gender, age, skeletal classification, root resorption of adjacent teeth, canine angulation on panoramic radiographs, lateral incisor morphology and canine position.

Results: Most patients were young female. A vestibular location of the retained canine was observed in most of the cases, with skeletal Class I being the most common skeletal classification, most canines had bad eruption prognosis, 41% of retained canines associate to a root resorption of at least one incisor, most lateral incisors had normal anatomy.

Conclusion: This study provides a comprehensive description of the skeletal and dental features commonly observed in patients with retained canines, offering valuable insights for early diagnosis and intervention.

Keywords: Retained Canine; Skeletal Characteristics; Dental Anomalies; Canine Angulation; Lateral Incisor Morphology

Introduction

The objective of this study was to describe the most common skeletal and dental characteristics associated with retained canines. Currently, there are no clear statistics to fully explain the clinical situations related to this condition. Due to its multifactorial origin, there is a lack of studies that associate patient`s skeletal and dental characteristics with retained canines. The goal of this research is to identify and classify these features more clearly, in order to provide a reliable and accurate diagnosis.

Maxillary canines are among the teeth most commonly retained in the dental arch after the third molars [1]. Therefore, it is crucial to define their anatomical characteristics, position, angulation, and relationship with adjacent teeth and structures during the diagnostic phase. Around 9 years old, clinical examination may reveal the presence of canines through an increase in volume on the vestibular side of the maxilla. If no findings are detected during palpation, it is essential to suspect potential eruption disturbances. At this point, clinical evaluation should be complemented with radiographic analysis, such as panoramic radiographs. This type of imag-

ing allows for the assessment of eruption prognosis through Power-Short's analysis [2], which uses the angle formed between the longitudinal axis of the canine and a reference perpendicular line passing through the anterior nasal spine on the radiograph (Figure 1). If the angle is between 0° and 15°, the prognosis is favorable; between 15° and 30°, the prognosis is moderate; and if the angle exceeds 31°, the likelihood of the canine following its normal eruption path significantly decreases, resulting in a poor prognosis [3].

Understanding these characteristics is important because canines are the longest and most resistant teeth in the mouth. Consequently, it is crucial to guide them into the dental arch as early as possible, as they play a fundamental role in functional occlusion.

The etiology of retained canines is multifactorial, involving both general and local factors. This study focuses on local factors, particularly the relationship between skeletal class and retained canines. Some studies have shown a higher prevalence of retained canines in patients with skeletal Class II (69%), followed by 27% in Class I patients, and only 4% in Class III patients [4]. There is a high probability that the presence of retained canines may alter the roots of adjacent teeth, leading to root resorption. Furthermore, it is important to examine the prevalence of retained canines by gender and their position within the arch, as studies suggest that the position of retained canines is often lingual or palatal in females and buccal in males. Maxillary canines are more frequently impacted palatal than buccally, with a ratio of 6:1 [5].

Materials and Methods

Study design

This observational study was conducted according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. The study protocol was approved by the Scientific and Bioethics Committee of the Faculty of Dentistry at Universidad Andrés Bello, Santiago, Chile (Protocol number: PROPRGFO_002022_72).

Selection criteria

This study included patients who met the following criteria: (1) diagnosed with retained canines, (2) aged between 9 and 50 years, (3) had panoramic radiographs and previous scans available before treatment, (4) had records available in the clinical files, (5) mixed dentition, phase two or permanent dentition, (6) were enrolled in the orthodontic postgraduate program at Universidad Andrés Bello between 2017 and 2022, and (7) had signed informed consent prior to treatment.

Evidence selection process

A total of 43 patients were selected for this study. Patient selection was carried out through a survey distributed to postgraduate orthodontic students at Universidad Andrés Bello, where patients with a diagnosis of retained canines were identified.

Once information was gathered, a data collection process was undertaken, ensuring all participants met the inclusion criteria. Data were compiled into an Excel spreadsheet, which included the following information obtained from clinical files: gender, age and skeletal class). Additionally, the anatomy of the lateral incisor was noted, recording whether it was of normal size or exhibited microdontia.

Panoramic radiographs were then analyzed to determine the eruption prognosis of the retained canines. This was achieved by Power-Short analysis (2), which calculates the angle between the longitudinal axis of the canine and a reference line perpendicular to the radiograph's edge passing through the anterior nasal spine. If the angle was between 0° and 15°, the prognosis was considered favorable; between 15° and 30° was considered moderate; and greater than 31° indicated a poor prognosis (3). The presence or absence of root resorption in the lateral incisors was also recorded, as well as the position of the canine in the maxillary bone, which was classified as either vestibular or palatal (Figure 1).

Cone Beam Computed Tomography (CBCT) scans were analyzed to determine the location of retained canines: vestibular or palatal (Figure 2).

Panoramic radiographs were analyzed to determine the anatomy of the lateral incisors and the presence of resorption in the central or lateral incisors (Figure 3).

Data collection process

The collected data was organized into a frequency table in Excel. These clinical files were reviewed anonymously. Each patient was anonymized in the dataset (e.g., Patient n1-Clinical file 1, Patient n2-Clinical file 2, and so on). The information was independently gathered by two examiners to reduce bias.

To ensure reliable data collection from the panoramic radiographs, the examiners underwent a training process under the guidance of an expert. This training was conducted on two separate occasions within the Faculty of Dentistry to ensure consistency and reliability of the results.

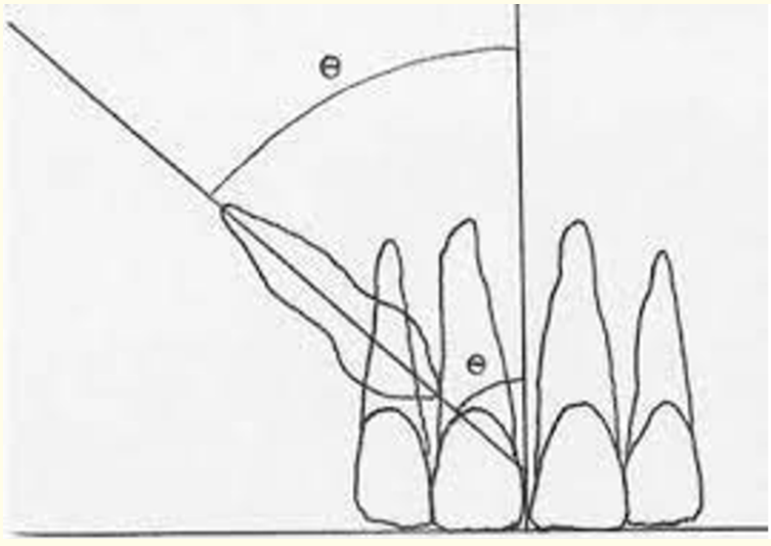

Figure 1: Power-Short analysis.

Figure 2: CBCT.

Figure 3: Panoramic Radiograph.

Statistical analysis

Data analysis was performed using SPSS software, applying the Chi-square test to examine frequency distributions and the relationships between variables. A p-value under 0.05 was considered statistically significant.

Results

A total of 43 patients with retained canines were included in this study. After data collection, the results were tabulated in an Excel spreadsheet. Of the sample, 65.1% (n=28) were female. The observed age range of the patients was between 9 and 32 years. A higher proportion of retained canines was found in female patients, particularly those between the ages of 9 and 10 years. 58,14% of the sample had radicular resorption in at least one incisor. Power-Short analysis lead that 16,28% of the canines had good eruption prognosis, 39,53% regular and 44,19% a bad prognosis. 48,84% of the sample were Class I, 30,32% Class II and 20,93% Class III (Table 1).

Results (%)									
Gender		**Radicular resorption**		**Lateral Incisor Anathomy**		**Location**		**Skeletal Class**	
Man	34,88	Presence	41,86	Normal	81,40	Vestibular	67,40	I	48,84
Female	65,12	Absence	58,14	Microdontic	18,60	Palatal	32,50	II	30,23
								III	20,93

Table 1: Results in percentage.

After obtaining the results, the following variables were subjected to Chi-square analysis:

- Prevalence of root resorption in lateral incisors in relation to the location of retained canines (vestibular or palatal).
- Abnormal anatomy of lateral incisors (microdontia or agenesis) in relation to retained canines.
- Prevalence of canine retention in patients with skeletal Class III malocclusion.

The Chi-square analysis yielded a p-value > 0.05, indicating no significant association between these variables.

Discussion

After collecting the information, it was observed that out of a total of 43 patients, 28 were female. This result is similar to the results obtained in a study conducted by the Universidad Antenor Orrego in 2019, which studied the prevalence of retained canines, finding that the female gender predominated over the male gender [6].

Regarding root resorption, the results of this study show that 41,86% present root resorption. In comparison, a study conducted by the Universidad Nacional de Cuyo on 159 retained canines found that only 39 presented root resorption, corresponding to 25.65% [7].

In relation to skeletal classes and canine impaction, this study shows a total of 48% (21 patients) with Class I, 30% (13 patients) with Class II, and 20% (9 patients) with Class III. Therefore, no direct relationship can be established to explain greater retention of canines in the upper anterior sector with Class III skeletal pattern. This information coincides with a study published by the *Revista Latinoamericana de Ortodoncia y Odontopediatría*, which examined retained upper teeth and skeletal relationships, finding that 69% of patients with retained upper anterior teeth had a Class II skeletal pattern, 27% had a Class I skeletal pattern, and only 4% had a Class III skeletal pattern, thus no relationship was found between these variables either [8].

Regarding the location of the retained canine, according to the results obtained in this study, 67% of patients had vestibular impaction and the rest had palatal impaction. These results do not align with the 2018 article published in the *Revista de Ciencias Médicas de Pinar del Río*, which indicated that in 60% of cases, the retained canines were located in the palate, 30% were vestibular, and 10% were in an intermediate position [9].

It is important to emphasize that all the sources analyzed had a much larger sample size than this study, so their results were more representative. Therefore, it is suggested that future research on this topic include a larger sample to obtain more reliable results.

Conclusion

This study successfully described the skeletal and dental characteristics associated with retained canines. It also found a higher prevalence of this anomaly in female patients. Most patients were adolescents, with the minimum age being 9 years and the maximum age reaching 32 years in young adults.

When grouping patients by skeletal class, it was observed that nearly 50% of the sample had skeletal Class I, which contradicted the initial hypothesis that a higher prevalence of retained canines would be found in Class III patients due to a less developed maxilla.

In conclusion, the limited sample size of 43 patients means that the data analyzed in this study is insufficient to draw reliable conclusions. Therefore, it is recommended that future research in this area be carried out with a larger sample size to determine whether the study variables examined in this research, or new ones, are relevant to the eruption of retained canines. However, the description of skeletal and dental characteristics in patients with retained canines can be useful for clinical decisions in orthodontics.

Author Contributions

All the authors have read and agreed to the published version of the manuscript.

Conflict of Interest

The authors do not declare any conflict of interest.

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