

Prevalence of Impacted Maxillary Canines in Puerto Rican Adolescents

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Abstract

Objectives: This cross-sectional study is designed to estimate the prevalence of both impacted maxillary canines and partially erupted maxillary canines in a group of Puerto Rican adolescents. **Methods:** A convenience sample of 155 adolescents, 13 to 18 year-of-age was recruited from 5 local high schools. University of Puerto Rico's IRB approved the study, and the consent and assent were completed for each participant. A calibrated dentist performed an oral evaluation of the study participants at each school. Descriptive statistics were derived and Fisher's exact tests were performed using SAS statistical software. **Results:** The mean age of participants is 16+ 1.2; and 60% are females. A prevalence of 3.2% of impacted canines and 2.6% of partially erupted canines is observed. Females present a lower prevalence of impacted maxillary canines compared to males (2.2% vs. 4.8%, respectively); however, these differences are not statistically significant ($p=0.3$). **Conclusion:** The results of this study are consistent with findings from previous studies on impaction and partial eruption; 5.8% of the study population is in need of treatment for impacted and delayed maxillary canines according to the Index of Treatment Needed (IOTN).

Canine Eruption

Eruption is defined as the developmental process responsible for moving a tooth from its crypt position through the alveolar process into the oral cavity to its final position of occlusion with its antagonist. It is a dynamic process that encompasses completion of root development, establishment of the periodontium and maintenance of a functional occlusion (0). The term "emergence" is used for a tooth that has just pierced the gingiva, but is no more than 3mm above the gingival level, estimated from the tip of the cusp or from the incisal margin (2). Gingival emergence of the maxillary canine after 12.3 years-of-age in girls and 13.1 years-of-age for boys is considered late (3); while emergence after 13.9 years-of-age for girls and 14.6 years-of-age for boys is considered very late, as by this time 95 % of the canines should have erupted.(4) Established norms for mean eruption ages are usually calculated from population studies, and when the tooth emergence is more than 2 standard deviations from the mean of established norms for eruption times, it should be considered delayed (5). The maxillary canine follows a more difficult and tortuous path of eruption than any other tooth. At the age three, it is high in the maxilla, with its crown directed mesially and somewhat lingually. It moves towards the occlusal plane, gradually uprighting itself until it seems to strike the distal aspect of the root of the lateral incisor. It then seems to be deflected to a more vertical position; however, it often erupts into the oral cavity with a marked mesial inclination (**Error! Reference source not found.**). When viewed early from transverse aspect, much of its eruption has a palatal inclination until 10 to 12 years-of-age, when it assumes a buccal direction (7). Impacted teeth are those prevented from erupting by some physical barrier in their path, lack of space due to crowding of the dental arch, premature or late loss of deciduous teeth and/or rotation or positional deviation of tooth buds (0).

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Clinical signs that indicate ectopic or impacted canines include: lack of a canine bulge in the buccal sulcus by the age of 10, over-retained primary canines, delayed eruption of their permanent successor and asymmetry in the exfoliation and eruption of the right and left canines. Primary canines that are retained beyond the age of 13 and have no significant mobility strongly indicate displacement and impaction of permanent canines (0). Early detection of impacted maxillary canines may reduce treatment time, complexity, complications and cost. Ideally, patients should be examined by 8 or 9 years-of-age to determine whether the canines are displaced from a normal position in the alveolus and to assess any potential for impaction (0,0). The sequence of dental eruption (**Error! Reference source not found.**), the contra-lateral eruption pattern on the arch (0), the dental age (0) and the root development of the canine (0) are many tools the clinician can use to determine the canine eruption and avoid a future impaction.

Prevalence

The incidence of maxillary canine impaction is reported to be 1.7% in the Swedish population and is twice more common in females (1.17%) than in males (0.51%) (0); a reported 2.2% in the Turkish population (0); and a reported 3% in Saudi and Indian populations (16, 17). In addition, the incidence of canine impaction is a reported 8.4% in the Greek population (18), but the highest reported prevalences are 12.33% in the Pakistan population (0), and 14.45% in the Australian population (0). Impacted and partially-erupted maxillary canines are conditions that might require orthodontic treatment. The Index of Orthodontic Treatment Need (IOTN) ranks malocclusion in terms of the significance of various occlusal traits for a person's dental health and perceived esthetic impairment, with the intention of identifying those most likely to benefit from orthodontic treatment; impaction and partial eruption are traits that require orthodontic treatment (0)]. Recent studies show that physical proximity (<1 mm) between the impacted canine and an adjacent root is the most important predictor for root resorption, and this characteristic is largely similar for Chinese and Caucasian populations (0). The specific aim of the present study is to determine the prevalence of impacted and partially erupted maxillary canines in adolescents from selected high schools in the municipality of San Juan, Puerto Rico (2012-2013). The results will yield epidemiological information that may be compared with previous studies on other populations. This data will provide better information regarding IOTN with respect to maxillary canine impaction and partial eruption.

Materials and Methods

This cross-sectional study was submitted to the Institutional Review Board of the University of Puerto Rico, Medical Sciences Campus for evaluation and approval. Prior to the initiation of patient examinations, intra and inter-examiner calibration exercises were performed utilizing 30 sets of diagnostic casts randomly selected from the Orthodontic Graduate Clinic, Medical Science Campus at the University of Puerto Rico. Percent of agreement was calculated for the intra and inter-examiners versus the reference examiner to determine reliability of the intra and inter-examiners. Relative to the reference examiner, intra-examiner agreement was 90% for examiner #1, and 95% for examiner #2, while the inter-examiner agreement was 98% for both examiner # 1 and # 2. This calibration emphasized the accuracy of this study's evaluation of presence or absence of canines in the arch, and eruption of the canines, (by agreement of examiners, eruption was categorized as related to the visual aspect of the clinical crown of the maxillary canine by thirds), presence or absence of a bulge, buccal or lingual location, and available space in the arch. A study group totaling 184 school children between 13 and 18 years-of-age were selected by convenience and agreed to serve as participants from five high schools in the municipality of San Juan, Puerto Rico between September, 2012 to September, 2013. A consent from the parents of each participating student and an interview was conducted with them to collect information including: demographics, review of medical history, age, weight, height, and if participant has had any previous orthodontic treatment. After the examination, all participants with the following characteristics were included in this study:

- (1) Participants older than 13 and younger than 18 years-of-age
- (2) Participants with no previous or current history of orthodontic treatment
- (3) Participants with no previous extraction of the permanent maxillary canines
- (4) Participants with no history of craniofacial anomaly/syndrome

A comprehensive dental exam was performed, with specific attention to the partial eruption and impaction of the maxillary canines. All the information was collected in a customized data collection form prepared by the principal investigator.

A customized data collection form was used to record the presence or absence of the permanent maxillary canines during the clinical exam, and it includes the following four sections:

- 1) The degree of eruption of the canine (Figure 1):
 - 0 If the maxillary canine was absent from the arch
 - 1 If erupted from the visible tip of the canine up to 1/3 of the crown
 - 2 If erupted from the visible tip of the canine up to 2/3 of the crown
 - 3 If erupted from the visible tip of the canine up to 3/3 of the crown
- 2) The presence or absence of bulge to the palpation and localization: lingual or buccal.
- 3) The available space for eruption, measured with a periodontal #15 UNC color coded probe (Hu Friedy Mfg. Co.LLc, Chicago, IL) from the most convex point of the distal surface of the lateral incisor and the most convex point of the mesial surface of the first bicuspid.
- 4) Radiographic examination, to determine presence and location of the canine. Two periapical x-rays are taken, then, Clark's rule (22) is utilized to localize the buccolingual position of the canine. If the canine moves on the x-ray to the same position relative to the tube it is -considered palatal, and if it moves to the opposite position relative to the tube it is considered buccal.

Descriptive statistics are derived and Fisher's exact tests are performed using SAS statistical software.

Results

Of the total of 1,899 students enrolled in five selected high schools from the municipality of San Juan, Puerto Rico, 184 agreed to serve as study participants. Twenty five of these participants were excluded because of previous orthodontic treatment, and four were excluded due to age. The final sample included 155 participants; 62 males (40%) and 93 females (60%) with a mean of 16 ± 1.2 years-of-age. A total of 7 canines were impacted, 5 in male participants and 2 in female participants. The prevalence of maxillary canine impaction is 4.84 % in males and 2.15% in females (Figure 3). Bilateral canine impaction is more common than unilateral cases (Table 2). The prevalence of impacted maxillary canines among all the participants is 3.23%. Partially- erupted canines are found in 2.58% of participants. Partial eruption of 2/3 is found to have a higher prevalence (1.93%) as compared to partial eruption of 1/3 (0.65%) (Figure 4).

Discussion

The prevalence of impacted maxillary canines is 3.23% in adolescents from selected high schools in the municipality of San Juan, Puerto Rico. This prevalence is higher than previously reported in United States (0). It is important to note that many of these previous studies reported prevalence in patients from a hospital or clinic, while results from the present study are obtained in a community setting. The present study has several limitations including a low rate of student participation due to lack of parent disinterest and restricted cooperation of the Department of Education. In addition, while the radiographic location of impaction was recorded in many participants, for some study participants the x-ray machine was not available on the day they were evaluated. Finally, the space available in the arch was measured and recorded for most study participants, but for some, the presence of the primary canine interfered with this measurement. In the present study, 2.58 % of study participants presented partially erupted maxillary canines, which when added to maxillary impactions yields a total of 5.81% study participants that would benefit from orthodontic treatment following IOTN, (Shaw et al, 1995). This index considers five categories, including the partial-erupted and impacted teeth as clinical traits that require orthodontic treatment. Unfortunately, the process of canine eruption process is sometimes unattended by the clinicians who underestimate potential impaction, thereby postponing any possible intervention. Even when impaction is suspected, the conservative approach is to wait for some additional and reasonable time for the eruption process to occur. There is significant evidence that demonstrates that such a conservative approach is not necessary, and may even be considered negligent (0). Ideally, patients should be examined by 8 or 9 years-of-age to determine if their canines are displaced from a normal position in the alveolus, and to assess the potential for impaction (0, 0). Early detection of impacted maxillary canines may reduce treatment time, complexity, complications and cost.

The present study helps dental professionals learn more about the prevalence of impacted canines and emphasizes the importance of early diagnosis and referral (0), thereby improving the prognosis of treatment and reducing the prevalence of impacted maxillary canines in the future.

Conclusions

1. The prevalence of impacted maxillary canines is found to be 3.23% among study participants.
2. The prevalence of impacted maxillary canines is higher in males than females, contrary to previous reported studies.
3. The prevalence of partial canine eruption is found to be 2.58 % among study participants, and when this is combined with the prevalence of canine impactions, a total of 5.81 % of study participants would benefit from orthodontic treatment for functional and esthetic purposes.

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