Prevalence rate of Buccally Displaced Canine and Its Dentoskeletal 3-Dimensional relation in Indian Population

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ABSTRACT

Objective: The aim of the study was to analyse the prevalence and distribution of buccally displaced canines (BDCs) in subjects scheduled for orthodontic treatment and to investigate the association between BDC and sagittal, vertical, and transverse dentoskeletal relationships. Material and methods: A study sample of 748 subjects was examined, and it was divided randomly into two groups. A first group of 189 subjects served as control group: the ‘reference’ prevalence rates for the examined parameters were calculated in this group. The remaining 748 subjects comprised the sample from which the experimental BDC group was derived. Presence of unilateral or bilateral maxillary BDC, ANB, and SN-GoGn angles for sagittal and vertical skeletal relationships, intercanine and intermolar distances at the maxillary arch was recorded for each subject. The statistical significance of differences between the BDC and the control groups in transverse relations at the upper arch was tested by means of independent sample t-tests. Chi-square tests were performed to compare the prevalence rates of BDC and also sagittal and vertical skeletal features in the two groups. Results: The prevalence rate of BDC was 3.06 per cent with a male-to-female ratio of 1:1. BDC subjects exhibited a significant association with hyperdivergent skeletal relationships (21.8%), reduced maxillary intercanine width, and crowding in the upper arch. Conclusion: The presence of specific dentoskeletal characteristics (i.e. hyperdivergent growth, reduced transverse inter-canine width and crowding) can be considered as a risk indicator for developing a buccal displacement of upper permanent canines.

KEYWORDS: Buccally displaced canines, Prevalence rate, 3- dimensional skeletal relation, Crowding and Indian population.

INTRODUCTION

Most canine eruption anomalies diverge from the normal eruptive site in either of two directions: palatal or buccal [1]. The occurrence of palatal impaction exceeds that of buccal impaction with a ratio that ranges from 3:1 to 6.6:1[1,2]. Both genetic and local factors have been shown to be intimately associated with eruption disturbances of the maxillary permanent canine [3,4].

Two major theories explaining the occurrence of the ectopic eruption of the maxillary permanent canine have been presented, i.e. the ‘guidance theory’ [5,6] and the ‘genetic theory’ [1,7]. Spatial conditions in the upper jaw are possible etiological factors associated with eruption disturbances (ectopic eruption and impaction) of the maxillary permanent canines. Lack of space in the upper dental arch and in the area of the maxillary apical base is often suggested as an etiological factor in the buccally displaced canines (BDCs)[8,9]. The palatal position of the ectopic canine is associated with excess space in the maxillary apical base, or a more frequent occurrence of Angle Class II, Division 2 malocclusions [10,11].

Despite extensive analyses of displaced or impacted canines, studies that relate displaced canines to craniofacial characteristics are scarce. Basdra et al. [12] did not find any relationship between canine impaction and craniofacial skeletal characteristics on the sagittal plane (maxillomandibular antero-posterior discrepancy; skeletal Class I, II, or III). Sacerdoti and Baccetti [13] showed a significant association between vertical craniofacial features and PDCs with a prevalence rate for hypodivergent cases in the PDC subjects three times greater than in control subjects. With regard to the correlations between BDC and sagittal and vertical craniofacial relationships, the literature does not provide information. Only one study [14] analysed the transverse, sagittal, and vertical dimensions of the
maxillary complex in cases with ectopic maxillary canines with the aid of both cephalometrics and dental casts. The authors concluded that in subjects with displaced canines, the size of the maxillary complex was excessive transversally, while it was deficient sagittally and vertically. However, no distinction between PDCs and buccally displaced canines was performed in that investigation.

The aim of the present study was to analyse the prevalence and distribution of buccally displaced maxillary canines (BDCs) in an Indian population of subjects scheduled for orthodontic treatment and to investigate the association between BDC and its skeletal relationship in all the 3 dimensional planes i.e. sagittal, vertical, transverse when compared with a control group.

MATERIALS AND METHODS

The parent sample for this study collected of 748 subjects from the Department of Orthodontics in Rural Dental College, Pravara University of medical sciences, India; over the period of one year. All subjects were observed prior to orthodontic treatment. For each subject, dental casts and radiographic material (panoramic radiographs and lateral cephalograms) were examined.

Exclusion Criteria: Subjects with craniofacial anomalies, cleft lip and/or palate, sequelae of traumatic injuries on the permanent teeth, odontomas, or cysts were excluded from the study.

The remaining 680 subjects (314 females and 366 males) included the sample from which the final experimental group was derived, and it was investigated for the presence of BDC. This sample size is further divided into two groups. First groups contain 189 subjects, which was used as control group. Remaining subjects of total sample size was investigated for the presence of BDC. A total of 38 subjects with buccally displaced maxillary canines were found in the experimental group and they were identified as the ‘BDC group’ through the application of the following criteria:

Presence of buccal displacement of maxillary canine/s (BDC/s): the intraosseous buccal position of the upper permanent canine, unilaterally or bilaterally, was evaluated on the basis of the panoramic radiograph, lateral cephalogram, and periapical radiographs (according to the technique of double determination by Clark) and clinical examination (Figure 1). On the panoramic radiograph, the presence of displaced canines was identified when they overlapped the adjacent lateral incisors; the double determination radiographs by Clark allow specifying the intraosseous location (palatal versus buccal) of the canine; Dental age older than 9 years and younger than 13 years according to the method by Becker and Chaushu [15].

Figure 1: Bilaterally buccally placed canines in both the arches (frontal view, maxillary occlusal view)

Figure 2: Measurements of transverse dimensions on dental cast (intercanine width, inter molar width) using digital caliper
The following parameters were recorded for each subject:

**Sagittal skeletal relationships:** It is derived from the analysis of the lateral cephalogram by means of the angular measure ANB. Sagittal skeletal relationships were defined as skeletal Class I when ANB values ranged between 0° and 4°, skeletal Class II when they were greater than 4°, and skeletal Class III when they were smaller than 0° (Steiner’s analysis) [16].

**Vertical skeletal relationships:** It is derived from the analysis of the lateral cephalogram by means of the angular measure SN/GoGn. Vertical skeletal relationships were defined as normodivergent when SN/GoGn values ranged between 27° and 37°, hypodivergent when they were smaller than 27°, and hyperdivergent when they were greater than 37° (Steiner) [16].

**Transverse maxillary relationships:** It is calculated on dental casts by recording the intercanine and intermolar distances. Maxillary intercanine width was measured as the distance between the most mesial points on the palatal surface of the deciduous canines at the upper arch. Maxillary intermolar width was measured as the distance between the central fossae of right and the left first permanent maxillary molars [17,18]. (Figure 2). The measurements were made with a digital caliper (0.01 mm error).

**Statistical analysis:**
Chi-square tests were performed to compare the prevalence rates of BDC, sagittal, and vertical skeletal features in the two groups. The statistical significance of differences in transverse relations within the upper arch between the BDC and the control groups was tested by means of independent sample t-test. Method error for dental cast measurements was smaller than 0.5 mm. The error for angular cephalometric measurements was 0.6 degrees for ANB angle and 0.5 degrees for SN/GoGn angle.

**RESULTS**
The prevalence rate of maxillary BDC was 3.06 per cent of the experimental sample (38 subjects). Unilateral-to-bilateral ratio of BDC was 17:8 subjects. The M/F ratio in BDC subjects was 20:18, which approximates an M/F ratio of 1:1.

**Sagittal relationship:** As reported in Table 1, the prevalence rates for sagittal skeletal relationships in BDC subjects were 4 Class III subjects (10.2%), 10 Class II (28%), and 24 Class I subjects (61.2%). These data were very similar to the standard prevalence rates in the control group. (Table 1)

**Vertical relationship:** The prevalence rates of vertical skeletal relationship in BDC subjects were 15 hyperdivergent subjects (39.4%), 3 hypodivergent subjects (7.9%), and 20 normodivergent (52.6%). The prevalence rate for hyperdivergent subjects in the control group was significantly smaller (21.8%), while the prevalence rate for normodivergent subjects was significantly greater (69.9%; Table 1).

**Transverse Relationship:** The BDC group showed significantly smaller average maxillary intercanine width (25.70 mm) when compared with the control group (29.52 mm; P < 0.001). No significant differences were assessed for the comparisons of maxillary intermolar width in the BDC group (average value of 44.79 mm) when compared with the control group (average value of 44.65 mm; Table 2).

**Crowding:** A significant greater prevalence of crowding in the upper arch (81.5%) in BDC group when compared with the control group 22.7%, (Table 1).

### Table 1: Prevalence rate and distribution study of sagittal and vertical craniofacial characteristics

<table>
<thead>
<tr>
<th>Sagittal and vertical characteristics</th>
<th>Experimental groups N=38</th>
<th>Control group N=189</th>
<th>X2</th>
<th>P value</th>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>Prevalence (%)</td>
<td>N</td>
<td>Prevalence (%)</td>
</tr>
<tr>
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<td>24</td>
<td>61.2</td>
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<tr>
<td>Skeletal class II</td>
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<td>Skeletal class III</td>
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<td>7.9</td>
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<tr>
<td>Normodivergent</td>
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<td>52.6</td>
<td>132</td>
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<tr>
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<td>39.4</td>
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<td>Crowding</td>
<td>31</td>
<td>81.5</td>
<td>43</td>
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</table>
DISCUSSION

The prevalence rate of maxillary BDC in the examined sample was 3.06 per cent. This prevalence rate reflects the occurrence of the dental anomaly in an orthodontic population and therefore does not indicate the absolute prevalence rate of BDC in the general population. The prevalence rate of buccally displaced canines has been reported rarely, whereas many authors reported the prevalence rate of PDCs that ranged from 1 to 3 per cent in population samples [13,14]. The M: F ratio was 1:1, whereas the occurrence of PDC is significantly more frequent in females [1,13]. BDC did not demonstrate significant associations with any specific craniofacial pattern in the sagittal plane (skeletal Class I, II, or III) when compared with the control group. The distribution of categories of sagittal skeletal relationships in subjects with intraosseous buccal malposition of the maxillary canines is very similar to reference normative orthodontic populations. Our results are in agreement with data of the literature with regard to the lack of association between PDC and craniofacial skeletal characteristics in the sagittal plane [12,13].

A significant association between BDC and vertical craniofacial features was revealed in the present study. The prevalence rate for hyperdivergent cases in BDC subjects was almost two times greater than in control subjects, which was mirrored by the prevalence rate for normodivergent cases in BDC subjects being significantly reduced when compared with controls. In a recent study, Larsen et al.[14] analysed the morphology of the craniofacial maxillary complex in cases with ectopic canines and they reported a reduced vertical dimension of the maxillary complex measured by N–ANS length; no other vertical craniofacial features, however, were described in association with displaced canines. Our findings differ significantly from the results reported by Sacerdoti and Baccetti [13] with regard to the relationship between PDC and vertical skeletal characteristics. These authors described a significant association between hypodivergency and PDC, with a prevalence rate for hypodivergent cases in PDC subjects three times greater than in control subjects.

With regard to the occlusal characteristics in the transverse plane, subjects with BDC showed a significant reduction of the maxillary intercanine width when compared with the control group. However, no significant difference between the two groups for maxillary intermolar width was found. Larsen et al. [14] reported that the maxillary complex is significantly enlarged transversally in patients with ectopic canines, but in that study, maxillary width had been evaluated using intermolar distance only. It must be underlined that the results reported by Larsen et al. [14] for sagittal, vertical, and transversal dimensions of the maxillary complex did not present any distinction between buccal and palatal displacement of the canines.

The present investigation also noticed a significant greater prevalence of crowding in the upper arch when compared with the control group. This result confirms previous evidence that buccal canine eruption often occurs when the canine area is characterized by a reduced space.

To summarize, BDC is significantly associated with crowding at the upper arch, reduced maxillary intercanine width, and facial hyperdivergency. Further, no differences in prevalence rate of BDC between genders were found (contrary to PDC); the ratio of unilateral expression of BDC is greater than the bilateral one (differently from PDC)[8,13].

CONCLUSION

The prevalence rate of BDC in subjects scheduled for orthodontic treatment was 3.06 per cent. Unilateral buccal displacement of canine was more prevalent than the bilateral distributed equally in female and male subjects. The intraosseous buccal displacement of the canine was significantly associated with Hyperdivergent vertical skeletal relationships, Contraction of the anterior region of the maxilla, Crowding of the teeth. These characteristics can be considered as risk indicators for developing a buccal displacement of the maxillary canine, thus reflecting local environmental causes in the aetiology of the dental anomaly.

REFERENCES


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