RESEARCH ARTICLE

ASSESSING THE FACTORS INFLUENCING ROOT RESORPTION IN IMPACTED MAXILLARY CANINE: A CLINIC-RADIOGRAPHIC STUDY

*,1Dr. Hemant Kumar Halwai and 2Dr. Vanita Gautam

1Department of Orthodontics and Dentofacial Orthopedics, UCMS College of Dental Surgery, Bhairahawa, Nepal
2Department of Conservative dentistry and Endodontics, UCMS College of Dental Surgery, Bhairahawa, Nepal

ARTICLE INFO	ABSTRACT
	Aim: to correlate the position of impacted maxillary canines on panoramic radiography with cone beam CT (CBCT). **Materials & Methods:** In this study fifty patients with sixty impacted maxillary canine were retrospectively radiographed. The labiopalatal position of the impacted canines and root resorption of permanent incisors were evaluated with CBCT. The findings of panoramic radiography and CBCT were analysed and compared through statistics. Results Results revealed a statistically significant association between the panoramic sectors of the impacted canines and the labiopalatal position of the canines ($p < 0.001$). **Conclusions** The labiopalatal position of impacted canines and resorption of permanent incisors might be predicted using sector location on panoramic radiography.

INTRODUCTION

An impacted maxillary canine is usually diagnosed during a routine dental examination. Disturbance in the eruption of permanent maxillary canines can cause problems in the dental arch and adjacent teeth, which require special care and attention. Therefore, clinicians should be capable of dealing with this clinical situation in order to deliver optimal treatment. Clinicians have various definitions of "impaction." Canine impaction can be defined as an unerupted tooth after its root development is complete; or a tooth still unerupted when the corresponding tooth on the other side of the arch has been erupted for at least 6 months and has a complete root formation; or a condition in which a tooth is embedded in the alveolus and is locked in by bone, adjacent teeth, or other obstacles and cannot properly erupt into the oral cavity. (Bishara, 1992; Ngan *et al*., 2005; Schindel and Duffy, 2007; Bedoya and Park, 2009) Maxillary canines are among the last teeth to develop and have the longest period of development.

*Corresponding author: Dr. Hemant Kumar Halwai,
Department of Orthodontics and Dentofacial Orthopedics, UCMS College of Dental Surgery, Bhairahawa, Nepal.

They also have the longest and most devious path of eruption from the formation point lateral of the pisiform fossa to the final position in the dental arch. (Bishara, 1992; Ngan *et al*., 2005; Schindel and Duffy, 2007; Bedoya and Park, 2009) Therefore, there is an increased potential for mechanical disturbances resulting in displacement and impaction. The incidence of impacted maxillary canines varies from 1% to 3% (Dachi and Howell, 1961; Thilander and Myrberg, 1973). The incidence of palatally displaced canines in the Caucasian population is approximately 2% (Peck *et al*., 1994) and 1.2% in African–Americans (Kramer and Williams, 1970). Canine impactions are most frequently bucally located in the Asian populations (Malmgren *et al*., 1982).

The incidence of detecting impaction may increase through the utilization of three-dimensional imaging techniques, such as CBCT for dentomaxillofacial applications. Liu *et al*. (2008) found in 210 patients utilizing CBCT that impacted canines were located palatally in 41%, labially in 45%, and midalveolus in 14% of cases. Thus in this study, we tried to correlate the position of impacted maxillary canines on panoramic radiography with CBCT.

MATERIALS AND METHODS

This study was a retrospective radiographic review of 50 patients with 60 impacted maxillary canines. The study sample was selected from 64 patients who had CBCT ordered for localization of impacted maxillary canines after they had panoramic radiographs and clinical examinations at universal college of dental sciences, Bhairahawa, Nepal. This study was approved by the institutional review board. The patients were aged 10–48years and the average age was 20.4 ± 8.6 years. Because the root of the maxillary canine is completely formed by the age of 13–15 years, (Ash and Stanley, 2010) patients were classified into two age groups: ≤ 15 years and > 15 years. Panoramic radiographs were made using Vatech radiography unit. CBCT scans were also acquired. Scanning parameters were 90 kVp, 24 s, 4 mA, voxel size 0.4 mm and field of view 20×19 cm. The data was statistically analysed using the χ^2 test and the Fisher's exact test.

frequent and all cases of Sector 5 showed palatal impaction. Of the total 60 impacted maxillary canines, 34 (56.6%) were impacted labially, 16 (26.6%) in the mid-alveolus and 10 (16.6%) palatally. Labially impacted canines were more frequent in Sectors 1, 2 and 3, mid-alveolus impacted canines were most frequent in Sector 4 and palatally impacted canines were most frequent in Sector 5. There was a statistically significant association between the sectors of the canines and the labiopalatal position of the canines ($p < 0.001$, Table 1). In the ≤ 15 years group, Sectors 3, 4 and 5 showed root resorption of permanent incisors. In the > 15 years group, Sectors 4 and 5 showed root resorption. The ≤ 15 years group showed more frequent root resorption of permanent incisors than the > 15 years group but there was no statistically significant difference between the two groups. Resorption of permanent incisors was present in 18 patients (30%), was observed in Sectors 3, 4 and 5 and showed significant differences according to sector location ($p < 0.001$, Table 2).

Table 1. Relationship between sector location on panoramic radiograph and labiopalatal position on cone beam compute tomography images

Age(years)	Sector Location	Labial	Mid-alveolus	Palatal	Total
≤15	1	12	1	1	14(31.8%)
	2	8	1	0	9(20.4%)
	3	6	2	0	8(18.2%)
	4	3	2	0	5(11.2%)
	5	1	5	2	7(15.9%)
Subtotal		**30(68.2%)**	**11(25%)**	**3(6.8%)**	**44**
>15	1	1	1	0	2(12.5%)
	2	1	2	1	4(25%)
	3	1	0	2	3(18.7%)
	4	1	2	1	4(25%)
	5	0	0	3	3(18.7%)
Subtotal		**4(25%)**	**5(31.2%)**	**7(43.8%)**	**16**
	1	13	2	1	16
	2	9	3	1	13
	3	9	2	2	13
	4	4	4	1	9
	5	1	5	5	11
TOTAL		**34(56.6%)**	**16(26.6%)**	**10(16.6%)**	**60(100%)**

Table 2. Relationship between sector location on panoramic radiograph and labiopalatal position on cone beam compute tomography images

Age(years)	Sector Location	Labial	Mid-alveolus	Palatal	Total
≤15	1	12	1	1	14(31.8%)
	2	8	1	0	9(20.4%)
	3	6	2	0	8(18.2%)
	4	3	2	0	5(11.2%)
	5	1	5	2	7(15.9%)
Subtotal		**30(68.2%)**	**11(25%)**	**3(6.8%)**	**44**
>15	1	1	1	0	2(12.5%)
	2	1	2	1	4(25%)
	3	1	0	2	3(18.7%)
	4	1	2	1	4(25%)
	5	0	0	3	3(18.7%)
Subtotal		**4(25%)**	**5(31.2%)**	**7(43.8%)**	**16**
	1	13	2	1	16
	2	9	3	1	13
	3	9	2	2	13
	4	4	4	1	9
	5	1	5	5	11
TOTAL		**34(56.6%)**	**16(26.6%)**	**10(16.6%)**	**60(100%)**

RESULTS

In the ≤ 15 years old group, labially impacted canines were most frequent and were more frequent in Sectors 1, 2 and 3. In the > 15 years old group, palatally impacted canines were most

DISCUSSION

Results of literature review reveal that mesiodistal position of impacted maxillary canine does affect the duration of treatment. Olive (2005) reported that canines impacted in

Sectors 4 and 5 emerged after 21 months of treatment and canines in Sectors 2 and 3 emerged after 8 months of treatment. Therefore, sector location of impacted canines on panoramic radiography could be helpful in treatment planning for impacted canines. In this study we found that in the ≤ 15 years group, Sectors 1, 2 and 3 showed more frequent labially impacted canines, Sector 4 showed more frequent mid-alveolus and labially impacted canines and Sector 5 showed more frequent mid-alveolus and palatally impacted canines. In the > 15 years group, the sample size in each category of Sectors 1, 2 and 3 was too small to see a pattern. In the > 15 years group, Sector 4 showed more frequent mid-alveolus and palatally impacted canines and Sector 5 showed the most frequent palatally impacted canines. This finding was in accordance with the results of study conducted by Lindauer *et al.* (1992). Diagnosis of root resorption by impacted canines might further reduce complications during treatment and the presence or absence of root resorption will determine the treatment plan. In our study, root resorption was associated with 30% of 60 impacted canines. The percentage of root resorption was lower than the 40.5% reported by Liu *et al.* (1992), 38% reported by Ericson and Kurol (2000) and 66.7% reported by Walker *et al* (2005).

Conclusion

When maxillary canines are impacted or show delayed eruption on panoramic radiographs, CBCT scans would be appropriate to localize the position of impacted canines and assess any root resorption.

REFERENCES

Ash MM, Stanley JN. Wheeler's dental anatomy, physiology, and occlusion. 9th edn St. Louis, MO: Saunders Elsevier; 2010

Bedoya MM, Park JH. A review of the diagnosis and management of impacted maxillary canines. *J Am Dent Assoc*. 2009;140:1485-1493.

Bishara SE. Impacted maxillary canines: a review. *Am J Orthod Dentofacial Orthop*. 1992;101:159-171.

Dachi SF, Howell FV (1961) A survey of 3, 874 routine full mouth radiographs. *Oral Surg Oral Med and Oral Pathol* 14:1165– 1169

Ericson S, Kurol PJ. Resorption of incisors after ectopic eruption of maxillary canines: a CT study. *Angle Orthod* 2000;70:415–423

Kramer RM, Williams AC (1970) The incidence of impacted teeth. A survey at Harlem hospital. *Oral Surg Oral Med Oral Pathol* 29:237–241

Lindauer SJ, Rubenstein LK, Hang WM, Andersen WC, Isaacson RJ. Canine impaction identified early with panoramic radiographs. *J Am Dent Assoc* 1992;123:91–92 ,95–97

Liu DG, Zhang WL, Zang ZY *et al* 2008. Localization of impacted maxillary canines and observation of adjacent incisor resorption with cone-beam computed tomography. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 105:91–98

Malmgren O, Goldson L, Hill C *et al* 1982. Root resorption after orthodontic treatment of traumatized teeth. Am J Orthod 82:487– 491

Ngan P, Hornbrook R, Weaver B. Early timely management of ectopically erupting maxillary canines. *Semin Orthod*. 2005;11:152-163.

Olive RJ. Factors influencing the non-surgical eruption of palatally impacted canines. *Aust Orthod J.*, 2005;21:95–101

Peck S, Peck L, Kataja M 1994. The palatally displaced canine as a dental anomaly of genetic origin. *Angle Orthod* 64:249–256

Schindel RH, Duffy SL. Maxillary transverse discrepancies and potentially impacted maxillary canines in mixed-dentition patients. *Angle Orthod*. 2007;77:430-435.

Thilander B, Myrberg N 1973. The prevalence of malocclusion in Swedish schoolchildren. *Scand J Dent Res.*, 81:12–21

Walker L, Enciso R, Mah J. Three-dimensional localization of maxillary canines with cone-beam computed tomography. *Am J Orthod Dentofacial Orthop.*, 2005; 128:418–423.

****