

Frequency, Causes and Pattern of Presentation of Impacted Maxillary Canine, A Clinical and Radiographic Study

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ABSTRACT

Aim: To assess frequency, causes and pattern of presentation of maxillary canine impaction.

Method: This cross-sectional study was conducted from August 2022 to July 2023 at Oral & Maxillofacial Surgery Department and Orthodontic Department of Nishtar Institute of Dentistry, Multan. A total of 84 patients with 96 impacted maxillary canines matching inclusion and exclusion criteria were included in the study. Patient demographic data, clinical and radiographic findings were recorded and all the data were collected on a specially designed proforma. Data were analyzed using SPSS version 22 and frequencies, percentages, ratios, means \pm SD were calculated.

Results: Overall frequency of canine impaction in all patients presenting was 3.5%. A male to female ratio of (30%:70%) 1:2.5 with female predominance was found. There was more occurrence of unilateral impacted maxillary canine than bilateral with a ratio of 6:1 and more palatally impacted canines than buccal once (75%:25%).

Conclusion: Overall frequency of canine impaction in local population was low. The most common cause of maxillary canine impaction was a mismatch in jaw size and tooth size followed by wrong line and long path of eruption. Frequency of odontogenic pathology associated with maxillary impacted canine was low. The most common type of canine impaction was palatal followed by buccal one. The most common clinical diagnostic indicator for impacted canine was presence of palatal or buccal bulge. Radiologically, most of the canine impactions fall in Sector III grade and type II in relation to root of adjacent lateral incisor.

Keywords: Canine impaction, maxilla, mandible, mal-position, eruption, retention.

INTRODUCTION

Impacted teeth are those which fail to erupt in dental arch within expected time due to some primary or mechanical eruption failure.^{1,2,3} The various causative factors for impacted canine include: local factors, systemic factors, genetic factors and idiopathic factors.^{4,5}

Maxillary canine is the most commonly impacted tooth after third molar.⁶ Among different local factors are: rotation of tooth bud, lack of space due to under-developed jaw, dense overlying bone and soft tissue, wrong line of eruption, failure of primary canine root to resorb, ankylosis of permanent canine, pathological lesions e.g. odontogenic cyst or neoplasm.^{7,8} Systemic factors include endocrine deficiencies, febrile diseases, irradiation. Genetic aetiological factors are heredity, malposed tooth germ, presence of an alveolar cleft.⁹

Various clinical findings of impacted canine include presence of bulge either on buccal or palatal side, tilting of root resorption of lateral incisor, presence of space distal to lateral incisor, absent permanent maxillary canine in the arch, ipsilateral maxillary dental midline shift, presence or mobility of retained deciduous tooth.¹⁰

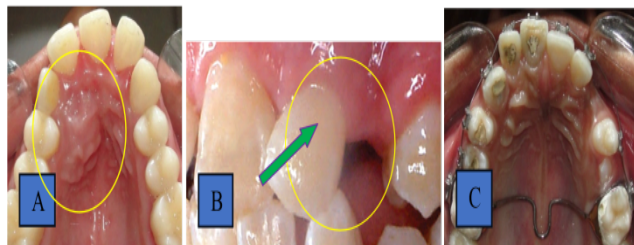


Fig. 1: Clinical Presentation of Impacted Maxillary Canine. A) Palatal bulge of palatally impacted canine. B) Tilting of lateral incisor due to impacted canine. C) Space distal to lateral incisor.

Radiographic findings of impacted maxillary canine include malpositioning of impacted tooth, altered root pattern, abnormal relation with lateral incisor or 1st premolar, involvement by any pathology, in close relation to vital structures e.g. maxillary sinus or nasal cavity.¹¹ Various radiographs useful for this purpose include: periapical view, upper occlusal view, panoramic view, lateral cephalogram, PNS view, CT scan and CBCT.¹²

The rationale of current study was to find out frequency and causes of impacted maxillary canine and its pattern of presentation in terms of clinical and radiographic features in local population. This study will not only contribute towards the basic knowledge of clinical and radiographic features of impacted maxillary canine but also helpful for its proper diagnosis which in turn will guide towards accurate treatment planning and treatment execution.

MATERIAL AND METHODS

This cross-sectional study was carried out at the Department of Oral and Maxillofacial Surgery and the Department of Orthodontics of Nishtar Institute of Dentistry, Multan from a period between August 2022 to July 2023. Patients of both genders with age range from 14–25 years who attended both of these departments were evaluated for presence of maxillary canine impaction. The status of impacted maxillary canine was assessed by detailed history, clinical evaluation and by relevant radiographs i.e. periapical, maxillary occlusal view, panoramic view and paranasal radiograph (PNS). Patients with unilateral, bilateral, isolated canine impaction or along with other impacted teeth, syndromic or non-syndromic all were included in the current study. Ethical approval was taken from the ethical committee of the institution and written informed consent was taken from all patients to be included in the current study. Impacted canine were classified according to Archer's classification, Sector analysis and relation of impacted canine to adjacent lateral incisor.^{13,14,15}

Table 1: Archer's Classification of Impacted Maxillary Canine

CLASS 1	Palatally Impacted Canine 1- Horizontal 2- Vertical 3- Oblique	CLASS-4	Tooth is present vertically in the alveolus in b/w lateral incisor & first premolar.
CLASS 2	Labially Impacted Canine 1- Horizontal 2- Vertical 3- Oblique	CLASS-5	Impacted canine present in edentulous patient
CLASS-3	Intermediate position Tooth is present in such a way that crown is present on palatal side & root is on buccal side.	CLASS-6	Aberrant position.

Sector analysis, Grade I-IV

Sector I - Distal to the outline of the root of the lateral incisor
 Sector II - Mesial to sector I, but distal to the midline of the root of the lateral incisor.
 Sector III - Mesial to sector II, but distal to the mesial outline of the root of the lateral incisor.
 Sector IV - Mesial to sector III.

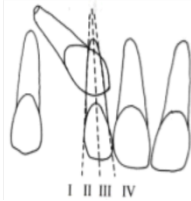


Fig. 2: Sector analysis assessment of impacted maxillary canine

Table 2: Relation of Impacted Maxillary Canine to Lateral Incisor

Type I	Tip of impacted canine is at cervical line of lateral incisor
Type II	Tip of impacted canine is coronal to apex & apical to cervical line of lateral incisor
Type III	Tip of impacted canine is apical to the apex of lateral incisor

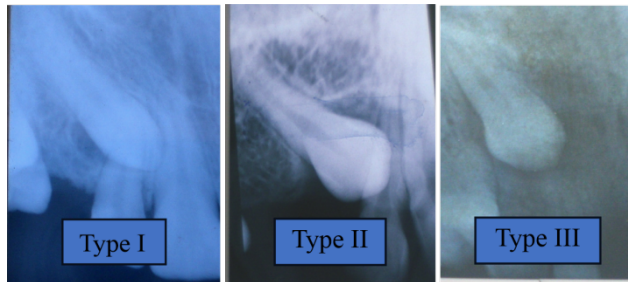


Fig. 3: Diagrammatic representation of relation of impacted maxillary canine to lateral incisor.

A structured questionnaire was designed and used to record all the data e.g. patient's demographics like patient's name, age and gender, causative factors, educational and medical status, clinical and radiographic characteristics of impacted maxillary canine. All the records of the patients were entered in SPSS version 22 to analyze and find out distribution of different variables in terms of proportions and percentages. Mean and standard deviation (mean±SD) were calculated for age of patients with impacted maxillary canines. The frequency and percentages were calculated for gender, monthly family income, educational status and causative factors. Chi-square test was applied to compare aetiological factors in different age groups as well as in male and female patients. P value < 0.05 was considered significant.

RESULTS

Overall frequency of maxillary canine impaction was found to be 3.5% in local population of all patients presenting to OPD of the departments. A male to female ratio of (30%:70%) 1:2.5 was found with 24 male and 60 female patients. Unilateral maxillary canine impaction was more common than bilateral with 72 patients of unilateral and 12 of bilateral impaction (6:1). So, there were 84 patients (n=84) with 96 impacted maxillary canines. Among the unilateral ones, there was more involvement of left side than right side and more palatally impacted canines than buccal once 75%:25%. Relative frequency and percentages of different types of impacted maxillary canine are shown in Table 3.

Table 3: Relative frequency and percentage of maxillary canine impaction.

Type of Impaction	No. of Canine Impaction(n=96)	Percentage
Type I	63	60.48 %
Type II	23	22.08%
Type III	3	2.88%
Type IV	4	3.84%
Type V	0	0 %
Type VI	3	2.88%

Prompt diagnosis of palatal versus buccal canine impaction was made by presence of bulge either on palatal or buccal side. There were cases without prominent bulge and this finding was

common in type III, IV or VI. Presence of space distal to lateral incisor was found in 89 % cases due to early loss of primary canine and clinical absence of permanent canine. Ipsilateral maxillary dental midline shift was in 48 % cases. Deciduous canine was present in 11 % cases of impacted permanent maxillary canine and it was mobile in 7 % cases.

Table 4: Relative frequency and percentage of radiographic findings of impacted maxillary canine.

Radiographic Features	No. of Canine Impaction(n=96)	Percentage (%)
Malpositioning of impacted tooth	30	31
Altered root pattern	24	25
Root resorption of lateral incisor	39	41.5
Tilting of lateral incisor	33	34
Sector assessment	Sector I	36
	Sector II	25
	Sector III	22
	Sector IV	13
Involvement by pathological lesion	13	13.5
In close relation to maxillary sinus	8	8.3
In close relation nasal cavity	5	5.2

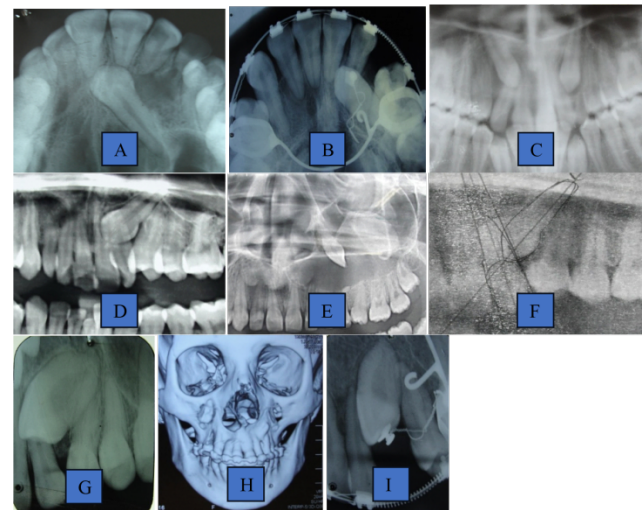


Fig. 4: Radiographic findings of impacted maxillary canine. A) Malposed tooth. B) Palatally impacted canine. C) Bilateral impacted maxillary canines. D) Impacted canine causing tilting of lateral incisor. E) Impacted canine in pathological lesion. F) Impacted canine with sector II level. G) Impacted canine causing root resorption of lateral incisor. H) Palatally impacted canine with root tip buccally. I) Type IV impacted canine.

DISCUSSION

Symptoms associated with impacted teeth are the common complaints of patients presenting to oral surgeons for treatment.^{2,16} The present study was conducted on patients of 14-35 years, because within this age limit, maxillary impacted canine poses different kind of problems e.g. insufficient space or improper position, incomplete root formation and involvement by pathological lesion.¹⁷

Overall frequency of maxillary canine impaction was found to be 3.5% in the current study but the literature holds a relatively lower frequency i.e. 1.38 %, 2.1 % and 1-3 % in Indian, Chinese and American population respectively.¹⁸⁻²⁰

A male to female ratio of 1:2.5 was found in the current study which is consistent with the results of studies conducted by El Beshlawy DM and Dinu S et.al.^{21,22}. In certain other studies, there is higher male ratio than female in contrary to the current study.²³

Unilateral maxillary canine impaction was more common than bilateral. Among the unilateral ones, there was more involvement of left side than right side and more palatally impacted canines than buccal once. Absence of eruption guidance from lateral incisor permits a new path for canine to take to palatal side.

These findings of the current study are in consistent with many of the national and international studies.²⁴⁻²⁶

The presence of bulge either on palatal or buccal side due to underlying impacted canine in Type I and Type II respectively is a very significant clinical diagnostic indicator which makes surgical approach and future management much easier. In Type III and Type IV exact localization of impacted maxillary canine may become much frustrating and multiple radiographs e.g. single periapical or two periapical projections with SLOB rule, OPG or upper occlusal may be required. In case of aberrant position or association with pathological lesion additionally PNS view may also be valuable. But with the advent of CT Scan or CBCT, diagnosis of impacted canine and its exact localization have become accurately possible.²⁷⁻²⁹ Tilting of adjacent lateral incisor or its root resorption is encountered due to pressure effect posed by impacted maxillary canine. Presence of space distal to lateral incisor, presence or mobility of retained deciduous tooth were the common clinical and radiographic finding of impacted maxillary canine in the current study. Prompt diagnosis of palatal versus buccal canine impaction was made by presence of bulge either on palatal or buccal side in case of many of the patients as is also in many of the national and international studies.^{24,30}

Presence of space distal to lateral incisor was found in 89% cases due to early loss of primary canine and/or clinical absence of permanent canine in alveolar ridge and this space is mostly less than the actual space required for eruption of permanent canine. This decrease in space might be due to ipsilateral maxillary dental midline shift, tilting/drift of adjacent first premolar or lateral incisor. Ipsilateral maxillary dental midline shift was noticed in 48% cases due to decreased number of teeth ipsilaterally in the arch and pushing effect of dentition from contralateral side. Deciduous canine was present in 11 % cases of impacted permanent maxillary canine and it was mobile in 7% cases. Ectopic positioning of impacted canine, altered root pattern, abnormal relation with lateral incisor or 1st premolar, involvement by pathological lesion, in close relation to vital structures e.g. maxillary sinus or nasal cavity were also significant but less common radiographic findings of impacted permanent maxillary canine in the current study.^{31,32} Ericson and Kurol investigated predisposing factors of root resorption of adjacent permanent lateral incisor caused by impacted maxillary canines. According to their results, when cusp of impacted canine was positioned mesially to lateral incisor, risk of complications increased three times. Furthermore, risk of resorption increased by 50% when mesial angle eruption inclination exceeded 25° as compared with controls. Lateral incisor root resorption was 3 times more common in girls than boys and the sex factor account for about 16% of variance of score.^{31,33}

The latest understanding of biological, mechanical and hormonal factors responsible for maxillary canine impaction may be the areas of future research in terms of prevention of canine impaction. The current study may be a road map for future directions for understanding causative factors, pattern of presentation of maxillary canine impaction in terms of clinical and radiographic features. Majority of the findings of current study are in accordance with many of the national and international studies regarding maxillary canine impaction. More studies with large patient samples are required to establish the correct standards of aetiology, clinical and radiographic findings of canine impaction. Previously majority of the radiographic findings of canine impaction were based on plain and digital radiography as well as CT Scan but the advent of CBCT has greatly revolutionized the radiographic localization, exact position and associated anomalies and pathologies and hence accurate diagnosis of maxillary canine impaction.

CONCLUSION

Impaction of maxillary canine was commonly seen in patients in their late 2nd and 3rd decade of life. The most common pattern of impaction was palatally impacted canine with a vertical position followed by labially positioned impaction. Overall frequency of

maxillary canine impaction is relatively low in the current study conducted on our local population. Patients having unfavorable angulations, patterns and positions could be considered the candidates for prophylactic removal of impacted maxillary canines. Moreover, basic concepts and knowledge about clinical and radiographic features of permanent maxillary impacted canine and consequently early diagnosis of associated pathologies and proper management of impacted maxillary canine is necessary to prevent further consequences.

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