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RESEARCH ARTICLE
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ORTHODONTIC AND SURGICAL MANAGEMENT OF IMPACTED MAXILLARY CANINE: A CLINICAL CASE SERIES

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ABSTRACT

Objective: To describe and discuss various orthodontic and surgical management options and their outcomes for impacted maxillary canine in patients presenting to a tertiary care centre.

Methodology: This case series was conducted from July 2022 to June 2024 at Oral & Maxillofacial Surgery Department and Orthodontic Department of Nishtar Institute of Dentistry, Multan. A total of 114 patients with 130 impacted maxillary canines matching inclusion and exclusion criteria were included in the study. Patient demographic data, clinical and radiographic findings were recorded and were treated by different orthodontic and surgical ways. All the data were collected on a specially designed proforma. Data were analysed using SPSS version 23 and frequencies, percentages, ratios, means ± SD were calculated.

Results: Overall frequency of canine impaction in all patients presenting was 3.5%. Male to female ratio was 1:2.5. Unilateral impacted maxillary canines were more than bilateral with a ratio of 6:1 and more palatal than buccal canine impaction with a ratio of 3:1. Most common treatment option was surgical exposure with or without orthodontic intervention followed by surgical removal, leave in situ

and auto-transplantation. Overall success rate of all treatment modalities was significantly high.
Conclusion: Overall frequency of maxillary 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. The most common type of canine impaction was palatal followed by buccal one. The most commonly used treatment option for impacted maxillary canine was surgical exposure with or without orthodontic intervention.

Keywords: Canine impaction, maxilla, mal-position, eruption, retention, surgical exposure, auto-transplantation.

Introduction

Impacted teeth are those which fail to erupt in dental arch within expected time due to some primary or mechanical eruption failure.[1] Overall incidence of impacted canine in general population is 1-2% and is second most commonly impacted tooth after third molars.[2,3] Male to female ratio is 30%:70% (1:2.5), maxilla to mandible ratio is 5:3 with a more palatal (85%) predilection than buccal one (15%) and unilateral to bilateral ratio is 6:1.[4,5] Impacted maxillary canines may cause different complications such as external root resorption, loss of vitality in adjacent teeth, shortening of existing arch length, odontogenic cyst or tumour formation, development of ankylosis, infection or pain.[6,7,8]
Different treatment options for impacted maxillary canines include: Leave in situ, surgical exposure of tooth with or without orthodontic intervention, transplantation and removal of impacted tooth.[9] Each of these options has its own indications and pre-requisites. The current study is aimed to describe and discuss various treatment options of impacted maxillary canine in local population especially with reference to orthodontic and surgical management and their clinical outcomes. This study will not only contribute about basic knowledge of various treatment modalities especially orthodontic and surgical treatment options but also be helpful for selection of indicated treatment option and its pros and cons which in turn will guide towards accurate treatment planning and treatment execution.

Material and Methods

This clinical case series was carried out at the Department of Oral and Maxillofacial Surgery and the Department of Orthodontics of Nishtar Institute of Dentistry, Multan from July 2022 to June 2024. Patients of both genders with age range from 14–30 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, paranasal radiograph (PNS) and/or computerized tomography (CT Scan).
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 ethical committee of institution and written informed consent was taken from all patients to be included in the current study. Impacted maxillary canines were classified according to Archer's classification, Sector analysis and relation of impacted canine to adjacent lateral incisor.[5,10-12]
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 and various orthodontic and surgical treatment options. All the records of the patients were entered in SPSS version 23 to analyze and find out distribution of different variables in terms of proportions and percentages. Various indications for these different orthodontic and surgical treatment options used in the current study to manage impacted maxillary permanent canine are listed below in Table 1.

Table 1: Indications of Orthodontic and Surgical Treatment Options

Sr. No.	Treatment Options	Indications
1	Surgical exposure with orthodontic intervention	1. To assist eruption of permanent maxillary canine in patients demanding orthodontic alignment of their maxillary dentition. 2. When there is adequate space in the arch to accommodate tooth.
2	Surgical Exposure without orthodontic intervention	1. When potential path of eruption of tooth is unobstructed and it is only covered by soft tissue. 2. The rest of the maxillary dentition is well aligned and no orthodontic intervention is required.
3	Surgical removal	1. Deciduous canine is in good condition, can be covered with crown & retained for longer period. 2. Impacted tooth is in unfavouable position to be aligned in the arch e.g. canine transposition. 3. To permit orthodontic alignment of other anterior teeth. 4. Before construction of full or partial denture 5. Causing resorption of adjacent tooth. 6. Associated with any pathology.
4	Leave in situ	1. Asymptomatic impacted permanent maxillary canine. 2. When extraction of impacted maxillary canine can cause damage to adjacent teeth or vital structures.
5	Auto-transplantation	1. When deciduous canine is missing 2. When other restorative options like implants or bridges are not feasible. 3. Deciduous canine is carious & has to be extracted. 4. Permanent canine can be removed in toto and is without any pathology.

Fig. 1: Pre-operative clinical assessment of palatally impacted left maxillary canine.

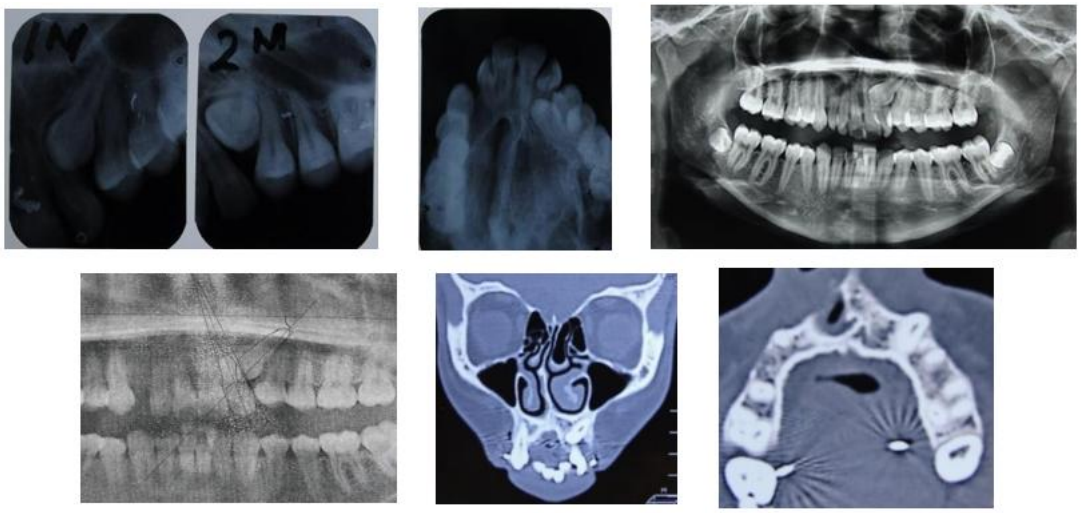

Fig. 2: Pre-operative radiographic assessment of palatally impacted left maxillary canine.

Mean and standard deviation (mean±SD) were calculated for age of patients with impacted maxillary canines. The frequency and percentages were calculated for gender, causative factors and treatment modalities. Chi-square test was applied to compare aetiological factors and treatment modalities in different age groups as well as in male and female patients. P value <
0.05 was considered significant. Different surgical techniques for exposure of permanent impacted maxillary canine and their indications are given in Table 2.

Table 2: Surgical Techniques for Exposure of Impacted Maxillary Canine

Sr. No.	Surgical Technique	Indications
1	**Gingivectomy/ Surgical excision of overlying soft tissue**	1. When there is only soft tissue impaction 2. A collar of attached gingiva is there after excision of soft tissue for at least 2/3rd of crown of impacted tooth.
2	**Apical repositioned flap**	1. When impacted tooth is covered by either soft tissue only or soft tissue and bone. 2. To expose buccally impacted tooth. 3. To increase the amount of attached labial muco-periosteum & preserve gingival health.
3	**Close Eruption Technique** a. **With window** b. **Without window**	1. To expose palatally impacted canine. 2. When canine tooth is deeply impacted within bone either buccally or palatally.

Results

Overall frequency of canine impaction in all patients presenting was 3.5%. A male (n=38) to female (n=88) ratio of (30%:70%) 1:2.5 with female predominance was found. There was more occurrence of unilateral impacted maxillary canine (n=98) than bilateral (n=16) with a ratio of 6:1 and more palatally (98) impacted canines than buccally (32) impacted with a ratio of (75%:25%) 3:1. The most common clinical diagnostic indicator for impacted canine was presence of palatal or buccal buldge. Radiologically, most of the canine impactions fall in Sector III grade and type II in relation to root of adjacent lateral incisor.

Fig. 3: Per-operative treatment progression of palatally impacted left maxillary canine

The relative distribution of different treatment options in patients with impacted maxillary canines and their relative percentage is shown in Table 3.

Table 3. Relative distribution of patients/impacted maxillary canines with respect to treatment options.

Sr. No.	Treatment Options	No./%age of patients		No./%age of impacted maxillary canines	
1	Surgical exposure with orthodontic intervention	52	45.61%	59	45.38%
2	Surgical exposure without orthodontic intervention	16	14.04%	19	14.62%
3	Surgical removal	33	28.94%	39	30%
4	Leave in situ	7	6.14%	7	5.38%
5	Auto-transplantation	6	5.26%	6	4.62%
	Total	114	100 %	130	100%

Fig. 4: Post-operative photographs of palatally impacted left maxillary canine

Discussion

Maxillary canine plays a very fundamental role in facial appearance, dental aesthetics, arch development and functional occlusion.[8,13] Being corner stone of mouth, it should be preserved as much as possible rather to remove it. Like other impacted teeth, impacted maxillary canine may also be associated with various pathologies or vital structures. Moreover, it may be dilacerated, ankylosed or associated with infection resulting in loss of natural and orthodontic tooth movemen.[14]

The current clinical case series comprised of 114 patients with 130 impacted permanent maxillary canines. Most commonly used treatment option was surgical exposure along with orthodontic intervention to bring and align the impacted canine in the dental arch.[8] Second commonly used treatment option for impacted maxillary permanent canine in the current study was surgical removal especially if it was associated with pathological lesion, ankylosed or dilacerated, causing resorption of adjacent teeth, hindrance in orthodontic alignment of other anterior teeth or transmigration. These findings of the current study are in accordance with many of the international studies e.g. Plakwicz and colleages reported the surgical extraction of transmigrated canines in their study.[14,15]

In the current study, most commonly used technique for surgical exposure of impacted canine was close eruption technique (n=41) followed by apical repositioned flap (n=16) and gingivectomy (n=11). In close eruption technique we adopted the one without window (n=33) in most of the cases and with window (n=8) in a few cases.[16] In patients where after surgical exposure, orthodontic intervention (n=52) was required to align the impacted canine in the dental arch, in close eruption techniques cases, we used canine button and in cases where exposure was done by apical repositioned flap or gingivectomy/gingival soft tissue excision, orthodontic bracket was used to bring the tooth in the arch.[17-20] In cases where only surgical exposure was required without orthodontic intervention, gingivectomy was most commonly used technique.[21] Ligature wire made by customization of lace pack wire with or without power chain or elastic thread was used to apply traction to bring the tooth in its final position in the arch.[22] Trans-palatal arch with soldered hook, open or close coil spring, ballista loop, piggy back wire, modifications in arch wire, customized tractional wires with terminal loop or couple force generated by double application of canine button on labial and palatal surface of canine were the common mechanics used for posterior, downwards extrusion or derotation of impacted canine to settle it in the alveolar arch. Therefore, the role of orthodontist can not be overlooked in this regard and we worked in close collaboration with the orthodontic department so that patient can get maximum benefit and impacted maxillary permanent canine of patients could be saved as much as possible.[23-27]

Impacted maxillary canine may cause different complications such as external root resorption, loss of vitality in adjacent teeth, shortening of existing arch length, odontogenic cyst or tumour formation, development of ankylosis, infection or pain.[6,7,9,14,28,29] To prevent or manage these complications, impacted permanent maxillary canine was removed in 33 patients (28.94%). In the current study most commonly removal cases were with odontogenic pathology. In others removal was done to facilitate orthodontic treatment and prevent resorption of adjacent teeth.

Moreover, impacted canine in more horizontal position in the dental arch and with transposition were also removed after discussion with orthodontist due to infeasible nature of such teeth to align in the dental arch.[30-32] In few cases, permanent maxillary canine was in aberrant position and was removed. In a very few cases deciduous canine was in good condition and was crowned and retained to mimic permanent canine.

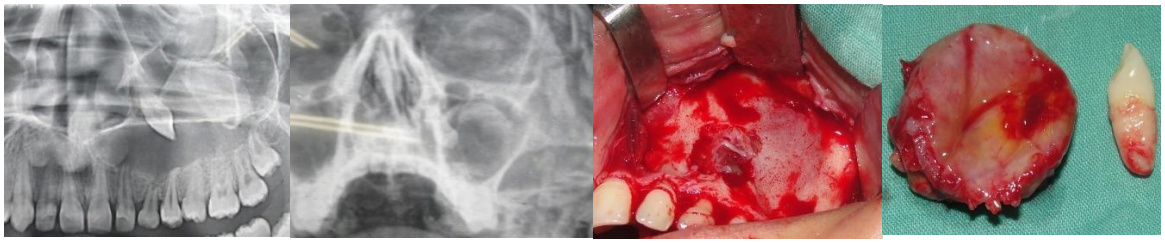

Fig. 5: Surgical Removal of Impacted Left Maxillary Canine along with Pathological Lesion.

In seven (6.14%) patients, impacted maxillary canine was in aberrant position or near the vital structures. In such situations, it was not feasible to bring it in the arch or its removal may have caused serious complications. So, it was decided to leave it in situ and radiographs at regular intervals were done to monitor any pathological changes, root resorption or cystic degeneration and other possible complications.[33-35]

In six (5.26%) patients, with otherwise well aligned dentition, impacted maxillary canine was so favourable to be removed in toto atraumatically to prevent damage to PDL cells. Socket shaped space was created with slow speed straight surgical hand piece and round bur after removal of deciduous maxillary canine and permanent canine was auto-transplanted immediately into prepared recipient site. It was splinted slightly infraocclusion with respect to adjacent teeth with half round wire and its root canal treatment was performed after 2 weeks by experienced endodontist to prevent infection related root resorption.[36-39]

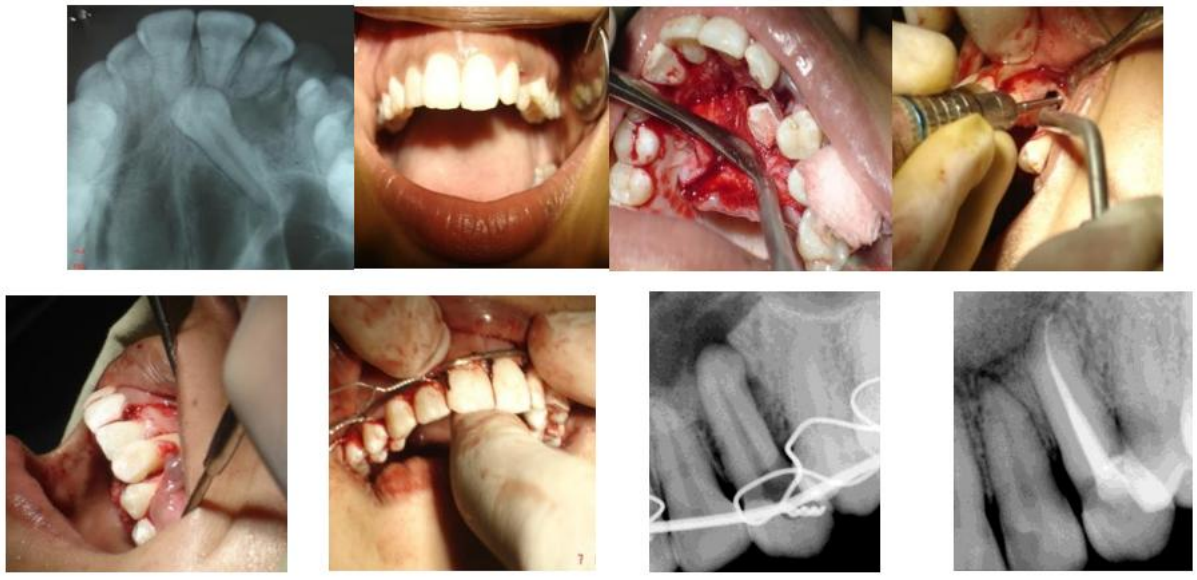

Fig. 6: Auto-transplantation of Impacted Left Maxillary Canine

Conclusion

The treatment of choice for management of impacted maxillary canine was surgical exposure with orthodontic intervention to bring it in the dental arch. The most commonly used surgical technique to expose impacted canine was close eruption technique. Canine button along with fixed orthodontic appliance was strategy of choice for extrusion and alignment of impacted canine. Timely diagnosis and selection of indicated treatment option was the key for successful outcomes of orthodontic and surgical management of impacted permanent maxillary canine in the current study.

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Dr. Muhammad Raza Zahid: Data collection, Literature search, Data analysis.
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