Complications associated with the occurrence and treatment of impacted maxillary canines

Anand K. Sajnani

Department of Paediatric and Preventive Dentistry, Kerala Institute of Medical Sciences, Qatar Medical Centre, Abdulrahman Bin Jassim Al Thani Street, P.O. Box 82125, Wakra, Qatar

Paediatric Dentistry, School of Dentistry, University of Western Australia, Perth, Australia

Keywords:
Impacted maxillary canine
Complications of impacted canine
Treatment of impacted canine
Root resorption

Abstract

Background: The aim of this study was to evaluate the complications associated with the occurrence and treatment of impacted maxillary canines.

Methods: This retrospective study was conducted on 533 Southern Chinese children and adolescents who attended the Paediatric Dentistry and Orthodontics Clinics and had at least one impacted maxillary canine. The study material included all the documentation files and radiographs of these patients. Complications that had been recorded in the clinical and surgical notes and that could be diagnosed from the available radiographs were noted. The data obtained were descriptively analyzed.

Results: The most frequently reported phenomenon associated with the occurrence of impacted maxillary canine (prior to surgical treatment) was root resorption of an adjacent permanent tooth in 22 (4.1%) patients. The most frequently reported sequelae observed after any surgical procedure was swelling of the soft tissues around the operation site which often persisted for 48 h as seen in 76 (18.8%) patients. Complications reported most commonly after any form of surgery included post-operative bleeding: 7(1.7%), hematoma: 7(1.7%), post-operative pain: 6(1.5%) and purulent discharge: 6(1.5%), post-operative complications in relation to surgical exposure and bonding of an attachment which included breakage of ligature wire: 5.7%; de-bonding of the attachment: 4.3% and inability to bond the attachment during surgery: 1.4% occurred rarely.

Conclusions: The frequency of root resorption of teeth adjacent to an impacted maxillary canine was low. Swelling of the soft tissue 48 h post-operatively was the most commonly occurring complication after surgical intervention.

Introduction

The prevalence of impacted maxillary canines is reportedly between 1% and 3% [1,3] and the preferred management of an ectopic permanent canine is early diagnosis and interceptive treatment which involves extraction of the associated primary canine [1–3]. The success of this form of treatment is related to the timing of the treatment and availability of space in the dental arch [1,3–5].
However, frequently, the diagnosis of an impacted canine is delayed and the patient often requires surgical intervention as a part of the comprehensive treatment. While most surgical procedures proceed without untoward events, some produce secondary effects and complications depending on the degree of tissue damage [6]. These complications include ecchymosis of the soft tissues, infection, paresthesia and damage to adjacent structures [7,8]. Further, the presence of an impacted canine may cause resorption of the adjacent tooth; most likely a lateral incisor or the canine itself may undergo cystic changes [2,9]. The capability to understand potential complications and to avoid them facilitates efficient therapy. Although there have been numerous reports on the complications associated with surgery on impacted third molars, very few studies have been carried out to determine the post-operative complications associated with the treatment of impacted maxillary canines [5,10-12]. Therefore, the aim of this retrospective study was to evaluate the complications associated with the occurrence and treatment of impacted maxillary permanent canines.

Subjects and methods

This retrospective investigation was conducted on 533 (206 males and 327 females) Southern Chinese children and adolescents who attended the Paediatric Dentistry and Orthodontics Clinics at the Prince Philip Dental Hospital, Hong Kong SAR between February 1982 and February 2009 and had at least one impacted maxillary permanent canine. Efforts were taken to trace every patient from the clinical and patient records and patients with any form of oro-facial cleft; medical complications including metabolic and endocrine disorders were excluded. The study material included all the documentation files and radiographs of these patients. The diagnosis of an impacted maxillary permanent canine was confirmed and the location of the tooth determined on the basis of radiographs according to established standardized techniques [13]. Complications that were recorded in the clinical and surgical notes and their diagnosis based on the available radiographs were noted. Clinical photographs, where available, were also used to determine the complications associated with the occurrence and treatment of the impacted maxillary canines. The data thus obtained were descriptively analyzed.

Results

Of the 533 patients who had an impacted canine, surgical intervention was required in 404 (75.8%) patients. Whilst most of these patients required surgical removal of the impacted canine as a part of their comprehensive treatment plan, 70 (13.1%) of them required surgical exposure and bonding of an attachment as a part of their treatment.

Amongst the 404 patients who needed surgical intervention, 142 (35.1%) were males, 262 (64.9%) were females while 69 (17.1%) had bilateral impactions. The chronologic age of these patients at the time of surgery ranged from 10.2 to 25.8 years with a mean of 16.7 years. The most frequently reported phenomenon associated with the occurrence of impacted maxillary canines, prior to surgery, was root resorption of an adjacent permanent tooth. A total of 22 patients (male=7, female=15) with a total of 28 teeth were diagnosed with resorption of adjacent teeth. Half of these patients (n=11, 50%) had buccally impacted canines whilst 7 (31.8%) had palatally impacted canines; the remaining 4 (18.2%) patients had the impacted canine within the line of the arch. The maxillary lateral incisors were the most commonly affected teeth (n=16), followed by the maxillary central incisors (n=11) and in one case a first premolar.

Likewise, the most frequently reported complication associated with the occurrence of impacted maxillary canines, prior to surgery, was pain (n=8, 1.5%) in the impacted tooth (Table 1). Six (1.1%) patients reported with cystic changes whilst two (0.4%) complained of swelling in relation to the tooth.

The most frequently reported post-operative sequelae observed was swelling of the soft tissues around the surgery site in 76 (18.8%) patients which was persistent even after 48 h. The most frequently reported complication observed after any form of surgery was post-operative bleeding from the surgical site: 7 (1.7%) and hematoma: 7 (1.7%) of the adjacent tissues (Table 2). Also, other complications reported were post-operative pain: 6 (1.5%), purulent discharge: 6 (1.5%), transient paresthesia: 5 (1.2%), unsatisfactory healing: 5 (1.2%), iatrogenic damage to adjacent soft tissue: 4 (1.0%), maxillary sinus perforation: 2 (0.5%), sub-conjuctival hemorrhage: 2 (0.5%) and discoloration of adjacent teeth: 1 (0.3%) (Table 2).

Post-operative complications were reported by 10 (14.3%) of the 70 patients who underwent surgery to expose and bond an attachment to facilitate orthodontic traction. The complications specifically in relation to this procedure are listed in Table 3 and included breakage of the ligature wire: 4 (5.7%); de-bonding of the attachment: 3 (4.3%), no movement of the tooth after traction: 2 (2.9%) and failure to bond the attachment during surgery: 1 (1.4%).

Discussion

Incisor root resorption is a well recognized phenomenon caused by impacted canine. This most commonly affects

<table>
<thead>
<tr>
<th>Table 1 – The pre-operative complication experienced by 16 of the 533 patients with impacted maxillary canines.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-operative complications</td>
</tr>
<tr>
<td>Pain in the impacted tooth</td>
</tr>
<tr>
<td>Cystic changes</td>
</tr>
<tr>
<td>Swelling in relation to the impacted tooth</td>
</tr>
</tbody>
</table>

*M = male and F = female.
maxillary lateral incisors and while central incisors may also be involved, rarely first premolars are affected. In the current study too, maxillary lateral incisors were the most commonly affected teeth followed by the maxillary central incisor thereby confirming previous studies [14,15]. Most studies had focused on the resorption caused by palatally impacted canines, although buccally impacted canines can also cause resorption of incisors [15,16]. Knight in his study found that 33% of the canines associated with root resorption were buccally placed [16]. While the present study supports his finding; the occurrence was much higher with 50% of the patients with buccally impacted canines exhibiting root resorption. Also, a further 31.8% of the patients with root resorption had their canines palatally impacted. Many studies have found resorption of an incisor to be more common in females. These studies have quoted the female:male ratio variously as 2:1, 4:1 and 10:1 [14,15,17]. Our study is in agreement with the lower ratio of 2:1.

The reported frequency of resorption varies widely from 1% to 12% and may in part depend upon the imaging technique used [7,15,18]. Superimposition of the incisor roots and the crown of an impacted canine on intra-oral radiographs are said to obscure the root morphology in 45% of cases [19]. Computed tomography (CT) overcomes this problem as it provides detailed images of the location of an impacted canine and root resorption [20]. The use of CT by Ericson and Kurol indicated that 48% of patients with impacted canines exhibited root resorption of adjacent teeth [21]. While in the present study, the frequency of root resorption was found to be much lower (4.1%); it was in agreement with the findings of Olow-Nordenram and Anneroth [22]. All available radiographs were used to determine the status of the roots of adjacent teeth to achieve as accurate a figure as possible. As the study was in part dependent upon the availability of suitable radiographs, which had been taken solely for clinical purposes and so CT images were available for only a few cases. Thus, the reported frequency of root resorption in this study should be considered to be an under estimation.

The most frequently reported complication associated with the occurrence of impacted maxillary canines, prior to surgery, was pain associated with the impacted tooth. Due to the retrospective nature of the study, it was difficult to determine the exact cause of the pain. However, it was noted that six of the patients who complained of pain had cystic changes associated with the impacted tooth. Further, the remaining two patients had a retained carious primary canine and it can only be hypothesized that the carious primary canine may be the cause of pain. Cystic changes with impacted maxillary canines have been reported previously [9]. In a four-year-period retrospective study of 12,129 Turkish patients aged 14–80 years, 970 had impacted maxillary canines. Fifty-five (5.7%) of the patients with impacted maxillary canines demonstrated cystic changes associated with the impacted tooth. Further, the remaining two patients had a retained carious primary canine and it can only be hypothesized that the carious primary canine may be the cause of pain. Cystic changes with impacted maxillary canines have been reported previously [9]. In a four-year-period retrospective study of 12,129 Turkish patients aged 14–80 years, 970 had impacted maxillary canines. Fifty-five (5.7%) of the patients with impacted maxillary canines demonstrated cystic changes associated with the impacted tooth [9]. In the present study, six patients reported with cystic changes associated with their impacted canines. Radiographically, the cysts in all the cases showed a well-defined radiolucency surrounding the crown of the unerupted canine making this finding consistent with the diagnosis of a dentigerous cyst [9,23]. Two patients reportedly complained of swelling in relation to the unerupted canine. However, from the clinical records it was derived that both

| Table 2 – Post-operative complications experienced by 404 of the 533 patients who underwent any form of surgery for treatment of an impacted maxillary canine. |
|--------------------------------------------------|--|---|
| Post-operative complication | Number of patients | Percentage |
| Bleeding from the site of the surgery | 7 (2M, 5F) | 1.7 |
| Hematoma | 7 (3M, 4F) | 1.7 |
| Post-operative pain | 6 (3M, 3F) | 1.5 |
| Purulent discharge | 6 (4M, 2F) | 1.5 |
| Transient paresthesia | 5 (1M, 4F) | 1.2 |
| Unsatisfactory healing | 5 (3M, 2F) | 1.2 |
| Root resorption due to adjacent soft tissue | 4 (1M, 3F) | 1.0 |
| Maxillary sinus perforation | 2 (2F) | 0.5 |
| Sub-conjunctival hemorrhage | 2 (1M, 1F) | 0.5 |
| Discoloration of adjacent teeth (non-vital) | 1 (1M) | 0.3 |

*M = male and F = female.

| Table 3 – The complications experienced by the 10 patients out of the group of 70 who underwent surgery to bond attachment for orthodontic traction of an impacted maxillary canine. |
|--------------------------------------------------|--|---|
| Complication | Number of patients | Percentage |
| Breakage of the ligature wire | 4 (2M, 2F) | 5.7 |
| De-bonding of the attachment | 3 (3F) | 4.3 |
| No movement of the tooth after traction | 2 (1M, 1F) | 2.9 |
| Attachment could not be bonded during surgery | 1 (1F) | 1.4 |

*M = male and F = female.
the patients had mistaken the bony canine eminence for the swelling in relation to the tooth. The location of the canine requires extra-anchorage which is furnished by the length and shape of their roots and by the bony projection or canine eminence.

The most commonly occurring post-operative sequela was found to be swelling of the soft tissue which was persistent even after 48 h (18.8%). In post-surgical wound healing, swelling is one of the key factors alerting patients to seek professional care out of concern for diminished healing [24,25]. Post-operative swelling results from accumulation of protein rich exudates within the surrounding tissue. This reaction may be a consequence of the formation of prostaglandins and other mediators of inflammation derived from membrane phospholipids which are released during surgery [25,26]. Whilst post-operative swelling associated with surgical removal of an impacted tooth is dependent on a number of factors including age, operation time and type of impaction; most swellings subside considerably within 48 h [27,28].

One prospective study, reported that approximately 3% of the patients who were treated using the closed eruption technique reported severe pain on the third day after surgery and none in the subsequent days, whilst severe pain was reported in patients who had been treated using the open-eruption technique up to the seventh day after surgery [29]. The closed eruption technique is most often employed when the tooth is in a position that does not permit the repositioning of the flap after crown exposure. This technique is frequently used for palatal impactions that are not close to the ridge of the alveolar process. In addition, when a canine is impacted high on the buccal aspect of the maxilla, this technique provides exposure without compromising the periodontal status [30]. However, if the permanent canine has the correct inclination, the open surgical exposure is the treatment of choice. In this technique the tooth is identified, uncovered and left exposed to the oral cavity to allow the canine to erupt naturally [31]. Excision of the gingival over the canine with bone removal is sufficient to allow eruption of the canine. The orthodontic attachment may or may not be placed at the time of the surgery.

All surgical procedures produce secondary effects and complications; the intensity of which depends upon a number of factors including the degree of tissue damage [6]. As with any surgical procedure, patients often experience some degree of pain; moreover it has been suggested that there is slightly more post-operative pain from surgery on impacted maxillary canines than for the surgery related to other impacted teeth [8]. However, a significantly lower incidence of pain (1.5%) was reported by the patients in this study 48 h after the surgery. The overall lower recovery time could have been influenced by the surgical techniques employed and the almost routine use of antibiotics and suitable analgesics. Future investigations to evaluate the efficacy of pre-operative medication, surgical techniques employed, post-operative analgesics and antibiotics and other variables need to be conducted to determine the exact role of surgical trauma in causing post-operative complications.

Uneventful healing of a post-extraction alveolus occurs in most cases following the surgical removal of an impacted tooth [25]. However, occasionally healing is unsatisfactory and not only limited to localized symptoms of pain and swelling but also complications of healing such as alveolar osteitis, acutely inflamed alveolus and acutely infected alveolus [25]. The clinical evaluation of the post-extraction alveolus healing was based on the following criteria: severe pain accompanied by a partially or totally disintegrated blood clot, painful alveolus with profoundly inflamed tissue or a painful alveolus with suppuration, erythema and edema with or without systemic fever [25]. Further, unsatisfactory healing is often the result of interruption of the blood supply to the soft tissue flaps during surgery or post-operative infection [8]. When a flap is thin it is easy to compromise the blood supply and hence careful designing and handling of the flap is important to avoid post-operative unsatisfactory healing. In the present study, only 1.2% of the patients presented with unsatisfactory healing after the surgical procedure. This figure is very low when compared to results from other studies involving impacted teeth [24,25]. A possible explanation for this discrepancy could be the absence of absolute and objective clinical criteria to assess unsatisfactory healing and the varying methodology used in the different studies.

The position of an impacted canine in the arch influences the potential sequelae and complications that may arise with the occurrence and surgical management of the impacted tooth. The location of the impacted canine in close proximity to the roots of the neighboring teeth may cause damage to them [7]. Displacement of a root into the maxillary sinus, or nasal cavity can occur during surgical removal [8]. Also, an oro-antral or naso-antral fistula can follow surgical removal of an ectopic maxillary canine [7]. However, these post-operative complications are uncommon. Likewise, when an impacted maxillary canine is located near to the neurovascular bundle, paresthesia may be sequelae of surgery [8]. If the maxillary canine is impacted palatally, the nasopalatine nerve may be affected, although it rarely presents a problem for the patient. Our study is concomitant with these findings as the complications associated with the occurrence and surgical management of impacted maxillary canines were observed in very low numbers.

Brackets and lingual buttons were commonly used in patients who required surgical exposure and bonding of an attachment as a part of the comprehensive treatment plan. After the tooth was surgically exposed the enamel was etched for 30 s and then irrigated. Success is often directly related to the degree of hemostasis. Once hemostasis was achieved, the primer was placed on the tooth. The bonding agent was then placed on the bracket and pressed firmly against the enamel surface of the tooth followed by curing for 20–40 s. The ligature wire was then attached to the arch wire if present or a tooth if not present. The vector of force used to move the canine could be changed to move the canine away from the incisor roots and then move it vertically. It is advisable for the surgeon to provide photographic or pictorial documentation to familiarize the orthodontist with the relative position of the canine.

Undesirable complications during the course of orthodontic traction to manage impacted canines include failure to erupt, bond failure and anklylosis [2]. Also, it has been suggested that the disadvantage of applying an attachment at the time of surgical exposure is that it is technique sensitive and that the use of a ligature wire to facilitate traction is unreliable [32]. However, in our study the bracket could not be bonded, at the time of surgery, in only one (1.4%) case suggesting that the complications associated with orthodontic traction to manage impacted canines are minimal. Also, breakage of the ligature
wire subsequently occurred in only 4 (5.7%) of the 70 cases treated by surgery. There was no movement of the impacted canine in just two cases (2.9%) after traction was applied post-operatively. Subsequently, in one of the cases, repeat surgery led to successful traction of the impacted canine. While, it could not be definitely concluded that the failed traction occurred due to ankylosis of the tooth, it is unlikely as the tooth was not apparently ankylosed when investigated during the pre-surgical procedures.

The results of this study suggest that exposure of impacted canines followed by bonding of an attachment in the closed flap technique, followed by orthodontic eruption produces a predictable successful outcome with minimal complications.

Conclusions

The frequency of root resorption of teeth adjacent to an impacted maxillary canine was found to be low. Females were found to exhibit root resorption of adjacent teeth twice more often than males. Complications after surgical intervention which occurred rarely were post-operative bleeding from the surgical site, hematoma, post-operative pain, purulent discharge, transient paresthesia, unsatisfactory healing, iatrogenic damage to adjacent soft tissue, maxillary sinus perforation, sub-conjunctival hemorrhage and discoloration of adjacent teeth. Nevertheless, surgical exposure of an impacted maxillary canine and bonding of an attachment to allow orthodontic traction is a reliable treatment option with minimal complications.

References