

Open v/s Closed Surgical Exposure Technique for Impacted Maxillary Canine-Surgical and Orthodontic Perspective

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Received: 22 Apr 2024 / Revised: 01 Dec 2024 / Accepted: 31 Dec 2024 / Published online: 22 Jan 2025

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ABSTRACT

Objectives: To compare open and closed surgical exposure techniques for impacted maxillary canines in terms of postoperative pain, dislodgement of bonding bracket, food impaction, and overall patient satisfaction

Materials and Methods: A quasi-experimental study was conducted at Dental College HITEC (IMS) Taxilla Cantt for 18 months, from 1st Aug 2020 to 31st Jan 2022. The sample size for the study was 32, which was calculated using the Open EPI Sample Size Calculator, with a confidence level of 95% and prevalence of impacted canine as 1.2%. A nonprobability (purposive) sampling technique was used and the patients were screened from the OPD of the Oral & Maxillofacial Surgery Department, who were candidates for surgical exposure of impacted canine followed by orthodontic traction. They were divided into two groups, group A was surgically exposed with an open surgical technique, and group B patients were exposed via closed surgical technique. The outcome of both techniques was compared in terms of postoperative pain, complaint of food impaction at the surgical site and dislodgment of the bonding device.

Results: A total of 32 patients, and 58 impacted maxillary canines were treated with open and closed surgical exposure technique, postoperative outcome of both techniques were compared. Pain on postoperative day 2, according to Visual Analogue Scale, was moderate in 10 patients and severe in 6 for group A. Group B patients had mild pain in 10 patients while 6 had moderate pain. The orthodontic bonding device was dislodged in 6 patients of Group A and in 1 patient of Group B. 12 patients from Group A and 3 from Group B complained of food impaction at the site of surgical exposure.

Conclusion: The closed surgical exposure technique was found to be more beneficial and superior when compared with the open surgical technique in terms of postoperative pain, food impaction at the exposure site, and dislodgment of the traction device.

Keywords: Ankylosis, Impacted Canine, Orthodontic Traction, Post-Operative Pain, Tooth Eruption

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DOI:10.33897/fujd.v5i1.414

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How to cite this Article:

Siddiq M, Khattak F, Moin S, Behroz E. Open v/s Closed Surgical Exposure Technique for Impacted Maxillary Canine-Surgical and Orthodontic Perspective. Found Univ J Dent. 2025;5(1):25-31

INTRODUCTION

A tooth that is not fully erupted in the oral cavity much past the anticipated age is known as an impacted tooth. After the mandibular third molar, the maxillary canine is the tooth that is impacted the most frequently.¹ Permanent canines are vital for both static and functional occlusal relationships in addition to aesthetics.²

Impaction of the upper canine can be caused by a variety of circumstances, however, the precise origin is unknown³ but the most common local etiological factors are loss of arch space, missing adjacent lateral incisors, ankylosis, root dilacerations, supernumerary teeth, retained deciduous teeth, trauma, reconstructive surgery for cleft lip/palate repair, and ankylosis and idiopathic causes.^{4,5}

Incidence of impacted canines among various populations is as high as between 0.3% to 2.4% and prevalence in females is twice in comparison to males.^{1,6}

Furthermore, compared to bilateral impaction, unilateral impaction is more frequent. In comparison with labial impaction, palatal impaction of the permanent canine has been reported to occur more frequently.⁷

Impacted maxillary canines can be guided to a suitable location in the dental arch and permitted to erupt with prompt diagnosis, prompt interception, and well-managed surgical and orthodontic treatment planning. Remarkably, impacted maxillary canines can be successfully treated only because of the collaborative treatment provided by general dentists, maxillofacial surgeons, orthodontists and periodontists.⁵

Treatment of an impacted maxillary canine requires patient counselling for multiple visits and a longer duration of orthodontic treatment which continues even after complete tooth eruption for tooth alignment in the arch. Treatment planning requires a thorough evaluation of the position, angulation, and orientation of the impacted maxillary canine.⁸

Most of the time, a combined intervention of surgical exposure followed by orthodontic traction is required as part of the treatment plan.⁹ The surgical technique should fulfill the aim of surgical exposure, and bonding of orthodontic traction device, along with the least discomfort to the patient and minimum loss of keratinized gingival

tissue. The two most common surgical techniques for the exposure of impacted canines are open surgical exposure which involves bonding an orthodontic traction device at the cusp tip and removing the soft tissue and bone covering the crown. The crown is then left exposed in the oral cavity for the remainder of the orthodontic treatment. The second surgical approach is the closed technique, which involves raising a flap, exposing the tooth's crown, bonding the device, moving the flap back to its original location, and suturing.^{6,9,10,11}

The pros and cons of both methods have been outlined by researchers, which makes the decision challenging.^{12,13} Although open surgical exposure may offer a shorter operating time and equivalent postoperative discomfort levels on the first day, some research indicates that both approaches produce comparable results in periodontal health and aesthetics.^{14,15}

While the open and closed surgical exposure techniques for impacted canines have been extensively studied in terms of basic outcomes such as duration of complete tooth eruption and immediate post-surgical complications, there is a significant gap in the literature regarding the dislodgment of bonding device, which is not an uncommon complication of surgical exposures. Moreover, there are no available studies on our local population that address the patient perception of pain and discomfort after surgical exposure of impacted canines.^{16,17}

This study aims to perceive an optimum surgical technique that is conducive to the best therapeutic outcome with minimum patient discomfort, postoperative pain, complication of orthodontic device detachment, and food impaction at the surgical site in a Pakistani cohort.

MATERIALS AND METHODS

The study was conducted at Dental College –HITEC (IMS) Taxilla Cantt, for a duration of 18 months, from 1st Aug 2020 to 31st Jan 2022. After seeking approval from the Ethical Review Board, an ERB letter with the number: F.2/2020/ERB/DC/HITEC-IMS was issued.

Informed consent (written and verbal) was taken from all the subjects. The sample size for the study was 32, which was calculated using the Open EPI Sample Size Calculator, with a confidence level of 95% and prevalence

of impacted canine as 1.2%.

Non-probability (purposive) sampling technique was used and patients were screened from the OPD of Oral & Maxillofacial Surgery Department of Dental College –HITEC (IMS), who were candidates for surgical exposure followed by orthodontic traction via bonding device. The sampling technique used in this research is purposive because the choice of surgical exposure technique is influenced by several factors such as the anatomical location of the canine, severity of impaction (depth and height), amount of overlying bone, and availability of attached gingiva. Keeping in view the recommended guidelines for the choice of surgical exposure techniques^{18,19}, it was not possible to select the patients on a probability basis. All these patients were referred from the Orthodontics Department of the same institute. Inclusion criteria for the study were males and females with varying age ranges of 15 to 25 years, who were being treated in the orthodontics department of the same hospital, all the patients were referred from the orthodontics department. Patients with cleft lip and palate, those with syndromic disease conditions, and who were referred from outside hospital settings were not included in the study as per exclusion criteria. This was done in order to overcome any possibility of bias and risk of loss of patient for the follow-up.

Diagnosis of impacted canine was based on clinical evaluation (palpable/non-palpable), and radiographic evaluation via periapical with or without SLOB technique was done. An OPG (orthopantomogram) of all patients was acquired. An occlusal view and a Cone Beam CT Scan were also procured where necessary.

The sample size for the study was 32, which was calculated using the Open EPI Sample Size Calculator, with a confidence level of 95% and prevalence of impacted canine as 1.2%.

Patients were allocated into two equal groups, group A: open surgical technique and group B: closed surgical technique. Anatomical location of the impacted tooth (palatal/labial), presence/absence of a retained deciduous tooth, dislodgment of bonding device, Visual Analogue Scale (VAS) postoperative pain score on days 2, 5, and 7 and complaints of food impaction were listed and documented for every patient on a proforma. A score of 0

on VAS indicated that the patient had no pain at all after surgery, while a score of 10 indicated the most severe pain the patient had encountered.

Group A patients underwent open surgical exposure involving bonding an orthodontic traction device at the cusp tip and removing the soft tissue and bone covering the crown. The crown is then left exposed in the oral cavity for the remainder of the orthodontic treatment. The closed technique was performed on Group B patients, which involves raising a flap, exposing the tooth’s crown, bonding the device, moving the flap back to its original location, and suturing.

SPSS version 26 was used to analyze data. Descriptive analysis was done for demographic data like age, gender distribution and anatomical location of canines. Chi-square test to compare the severity of pain among groups A and B at the 2nd, 5th and 7th postoperative days respectively, and to determine the relation of dislodgment of the device with surgical technique along with food impaction complaint at the surgical site. A p value of < 0.05 was considered to be significant.

RESULTS

Table 1 shows a total of 32 patients who were surgically exposed to 58 impacted canines, out of which 09 were males and 23 were females, the anatomical location of the impacted teeth, 36 canines were located in the palate, 18 were located labially and 4 canines were vertically located. And also, the mean age of patients is 17.3 years with a minimum age of 15 years and a maximum age of 23 years.

Table 1: Demographics Of Age, Gender and Anatomical Location Of Impacted Canine

Gender Distribution	Males=9 (28.1%)	Total Number Of Patients=32
	Females=23(71.9%)	
Age	Minimum Age=15 Years	Mean Age=17.3 Years
	Maximum Age=23 Years	
Anatomical Location Of Impacted Canines	Palatal=36 (62%)	Total No Exposed Canines=58
	Labial/Buccal=18 (31.1%)	
	Vertical=4 (6.9%)	

Table 2 shows the pain perception by the patients of

Groups A and B on 2nd, 5th, and 07th post-operative days. Group A patients underwent open surgical exposure and Group B patients were treated with closed exposure technique. Day 02 postoperative pain perception of Group B patients was significantly lesser than the Group A patients. Similarly day 05 pain perception by Group B patients was also significantly lesser than the Group A patients. Postoperative day 07 most of the patients from both groups had no pain but a few patients reported to have mild pain. No significant difference in pain was found on day 07 after surgical exposure among both groups of patients.

Table 2: Pain Score On Visual Analog Scale

Patient group	Post-Operative Pain Day 2 on VAS				
	No Pain	Mild	Moderate	Severe	
Group A Open Technique	0	0	10	6	P= 0.00
Group B Close Technique	0	10	6	0	
Post-Operative Pain Day 5 on VAS					
Group A Open Technique	2	6	8	0	P=0.03
Group B Close Technique	8	8	0	0	
Post-Operative Pain Day 7 on VAS					
Group A Open Technique	11	5	0	0	P=0.2
Group B Close Technique	14	2	0	0	

The number of surgical exposures that resulted in the complication of orthodontic traction device dislodgement is shown in Table 3. Overall 12% of surgical exposures had this complication. Group A patients had a statistically significant number of these complications in comparison to Group B, in which only 01 impacted canine had a dislodged device but re-exposure was required in that case. On the other hand, 06 patients of Group A with a dislodged device did not require any surgical intervention because of the already exposed crown.

Table 3: Orthodontic Bonding Device Dislodgment

Patient Group	Orthodontic Bonding Device Dislodgment		P=0.03
	Yes	No	
Open Technique	6	23	P=0.03
Close Technique	1	28	
Total =58	7=12.0 %	51=87.9%	

Table 04 presents patient perception regarding complaints of food impaction postoperatively.

Group A patients had this complaint statistically significant as compared to Group B patients.

Table 4. Food Impaction At The Site Of Exposure

Patient Group	Food impaction at the site of exposure		P=0.001
	Yes	No	
Open Technique	12	4	P=0.001
Close Technique	3	13	
Total = 32	15=47%	17=53%	

DISCUSSION

Results of this study revealed that females have more propensity for impacted canines in comparison to males. Palatal position in impacted canines is more prevalent than any other anatomical position. The findings of this study closely resemble those of studies conducted by Lövgren ML et al, Zabielskaite G et al, de Araujoa et al, Manne R et al, Hamada Y and Mahardawi B^{1,2,3,4,5,6}

Sampaziotis D et al. in their systematic review and Parkin NA et al. who conducted a multicenter study in Sheffield, UK, discovered that there was no discernible difference between the two surgical approaches in terms of how long the process took, how patients felt about their pain, discomfort, and food impaction, as well as other treatment outcomes.^{14,15} The results of this study are in contrast to Sampaziotis D et al¹⁴ and Parkin NA et al.¹⁵ which revealed a higher postoperative pain perception and delayed recovery from pain among patients with open surgical exposures, moreover, discomfort and food impaction were also higher among these patients.

In a study by Samar et al.¹⁶ they reported no significant post-operative pain after surgical exposures while in their meta-analysis, Cassina C et al.²⁰ found that the open surgical method is better than the closed method in terms

of time required for tooth eruption and alignment which is shorter as compared to closed technique but patient perceptions of pain and discomfort are same for both the techniques. These findings are in contrast to our study in which the open exposure group experience more pain as compared to close exposure technique.

However, the present study didn't evaluate the aesthetic and periodontal health outcomes of erupted canines due to the constraints of long-term follow-up, because these parameters can be observed only after the complete eruption of the impacted tooth which can take several months after surgical exposure. But Parkin NA et al.²¹ concluded in their study that there is no difference in aesthetics among erupted canines that were surgically exposed by either technique. Incerti P S et al.²² in 2016 in their systematic review concluded close surgical approach is better in terms of periodontal outcomes.

In their study on postoperative pain perception, Gharaibeh M T et al.¹² found that while patients in the closed-eruption group perceived pain regression more quickly, the open surgical method resulted in a considerably shorter procedure length. In addition, Björksved M et al.²³ found that the open surgical exposure group experienced noticeably greater post-surgery discomfort than the closed surgical exposure group, they also stated that patient pain perception and discomfort were higher in bilateral exposure cases. A study by M'arton et al.²⁴ found that postoperative discomfort increased till the 3rd to 4th postoperative day in the open exposure group but then settled by the end of the 7th post-operative day.

Compared to 76% of patients who were treated with the closed exposure technique, Chaushu et al.²⁵ observed that 80% of patients experiencing open exposure needed analgesics within the first 24 hours. The current study's findings are consistent with those of Gharaibeh M T et al.¹², Björksved M et al.²³, and Chaushu et al.²⁵

One of the relative risk factors of close exposure technique is the re-exposure procedure²⁶, this should be discussed with the patient at the time of consent. In the present study, 1 of the closed surgical exposure canine had dislodgement of the device on day 02 of surgery and the re-exposure was performed on day 07 of 1st surgical exposure. Lwin et al.²⁶ reported 10 patients required re-

exposure in a closed surgery group in their study. This might be due to the fact their study has a large sample size as compared to our study.

Although the dislodgement of the device was statistically significant in the open exposure technique but due to the reason of existing exposed crown, no surgical re-exposure was required.

Besides the surgical technique used, other factors like the extent of surgical exposure done, amount of bone removal, and patient threshold to perceive pain also contribute to the post-operative pain and discomfort reported by the patients.²⁴

The effects of additional factors including aesthetics, duration of tooth eruption and problems such as ankylosis, infection, and postoperative edema need to be further studied. The results of this study highlight how essential it is to select the best surgical method for impacted maxillary canines in order to improve patient comfort and lower complications. Targeted screening programs for early diagnosis in adolescent females may be helpful, given the increased susceptibility for impaction in females. Clinicians should also give priority to effective pain management techniques since patient perceptions of pain and discomfort Affect treatment adherence.

The study is single-centered, which is a limitation of this study. Future research featuring multiple centers in various areas of Pakistan would assist in extrapolating the results and account for regional differences in patient outcomes and clinical practice.

Moreover, other associated outcome variables like periodontal health, tooth eruption time, postoperative complications like ankylosis, and infections should be assessed in future studies. These factors would provide a more extensive insight into the positive aspects and drawbacks of both surgical approaches.

CONCLUSION

The closed surgical exposure technique was found to be more beneficial and superior when compared with the open surgical technique in terms of postoperative pain, food impaction at the exposure site, and dislodgment of the traction device.

DISCLAIMER

None to declare.

CONFLICT OF INTEREST

There is no conflict of interest among the authors.

ETHICAL STATEMENT

Ethical approval was provided by the Ethical Review Committee at HITEC-IMS Dental College, Taxila Cantt. (ERC No.F.2/2020/ERB/DC/HITEC-IMS)

FUNDING DISCLOSURE

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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Conception and design of the study: M. Siddiq

Acquisition of data: M. Siddiq

Analysis and interpretation of data: M. Siddiq

Drafting of the manuscript: F. Khattak, S. Moin, E. Behroz

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