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***Original Research Article***

# Comparison of Open and Closed Surgical Exposure Techniques for Impacted Maxillary Canines

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**Abstract:** *Impacted maxillary canines are commonly managed through surgical exposure followed by orthodontic traction. Open and closed exposure techniques are widely used, but their comparative benefits regarding operative efficiency and postoperative morbidity remain clinically relevant.* ***Objective:*** *To compare open and closed surgical exposure techniques for impacted maxillary canines.* ***Methods:*** *This study was conducted on 44 patients, aged 18 years or above, both male and females with impacted maxillary canines, patients were enrolled using non probability consecutive sampling. Patients with diabetes, bleeding disorders and immune deficiencies were excluded. Patients were divided in two groups equally at Kohat institute of Dental sciences, Kohat. Group A underwent open surgical exposure technique while group B patients underwent closed surgical exposure technique, Postoperative pain was measured at 24 hours using a ten point visual analogue scale. Operative time, analgesic need, intraoperative and postoperative bleeding, bonding failure, hanging chain discomfort and impaction laterality were also recorded. Data were analyzed using SPSS 28.* ***Results:*** *The mean operative time was significantly shorter in the open group (27.14±5.15 minutes) than closed group (34.77±6.11 minutes; p<0.001). Postoperative pain at 24 hours was lower in the closed group (3.23±0.81) than open group (4.09±1.66, p = 0.034). Postoperative bleeding occurred in 5 (22.7%) patients in open group and none in the closed group (p=0.018).* ***Conclusion:*** *Open surgical exposure technique had significantly shorter operative time as compared to close technique, however closed exposure technique was associated with significantly lower postoperative pain and less postoperative bleeding.*

**Keywords:** Impacted maxillary canine, open surgical exposure, closed surgical exposure, orthodontic traction, postoperative pain, operative time.

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## Introduction

Impaction of maxillary canine is frequency developmental disturbance, which represents the challenging conditions encountered in orthodontic practice. Following the third molars, maxillary canines are second most commonly impacted teeth as their strategic position within dental arch leads to facial aesthetics, arch stability and functional efficiency during the mastication. (1) Failure of eruption leads to malocclusion, cyst formation, periodontal complications as well as aesthetic concerns thereby requiring the timely diagnosis and management. Etiology of impacted maxillary canines is multifactorial by including the genetic influences, arch length discrepancies, abnormal eruption pathways and local pathological conditions.(1,2) Advances within the diagnostic imaging have enhanced localisation of impacted canines and improved the treatment planning by providing the detailed assessment of tooth position along with the surrounding anatomical structures. Precise diagnosis is vital as the extent and direction of impaction may impact the complexity and duration of orthodontic treatment.(3,4)

Management of impacted maxillary canines requires a multidisciplinary approach thus involving the oral surgery. Principal aim is to reposition impacted tooth into normal location in dental arch though maintaining the periodontal health and achieving the satisfactory aesthetics.(5) Surgical exposure after the orthodontic traction remains the extensively accepted treatment modality for the impacted canines that possess a good prognosis for the alignment. Within the available surgical approaches; open and closed exposure techniques are most frequently employed.(6) Open surgical technique involves exposing impacted canine and leaving crown uncovered within oral cavity allowing spontaneous eruption. Such approach offers the direct visual access to impacted tooth and encourages monitoring throughout the treatment. Concerns have been raised about the postoperative discomfort, delayed healing and possibility of gingival scarring linked to protracted exposure of surgical site. Closed surgical exposure practice involves bonding an orthodontic attachment to impacted canine nearly after exposure followed by the repositioning of mucoperiosteal flap over tooth. Orthodontic traction is then applied beneath soft tissues thus simulating the natural eruption pathway. (6-9)

This present study aims to compare the open and closed surgical exposure techniques for impacted maxillary canines undergoing orthodontic traction and to evaluate their outcomes. Findings of this study may help clinicians to optimise the treatment planning, improve patient outcomes and contribute to development of standardised management protocols for impacted maxillary canines.

## Methodology

This comparative study was conducted from July 2022 to July 2023. Patients in the study were selected via non-probability sampling technique. A total of 44 patients were enrolled in this study.

Patients were 18 years or older, of either gender presenting with impacted maxillary canines were enrolled in this study. Impacted maxillary canine was clinically identified by delayed canine eruption, retention of the baby canine, missing lip-side bulge, palatal prominence and tilting or shifting of the neighbouring lateral incisor. Patients with medical conditions that could affect the movement of the tooth such as diabetes, bleeding disorders and immune deficiencies were excluded.

All the patients gave their written consent to participate in the study. All the patients underwent radiographic and clinical assessment. Patients were allocated to two groups, group A patients underwent open surgical exposure technique in which the crown was exposed and left open to the oral cavity to allow spontaneous eruption or delayed orthodontic

attachment. Group B patients underwent closed surgical exposure technique in which an orthodontic attachment with a gold chain was bonded to the crown and the flap was repositioned and sutured for immediate orthodontic traction. All the patients were assessed for postoperative pain at 24 hours post procedure, using visual analogue scale, which is a ten point scale, lower numbers show lower intensity of pain. Operative time, need for analgesics, intraoperative bleeding, bonding failure, postoperative bleeding, hanging chain discomfort and laterality of impaction were also recorded. All the procedures were performed by an experienced Orthodontist.

Data was analyzed using SPSS 28. Age, postoperative pain and operative time were presented using mean and standard deviation. Gender, need for analgesics, intraoperative bleeding, bonding failure, postoperative bleeding, hanging chain discomfort and laterality of impaction were presented using frequency and percentages. Chi square test and Independent samples test were used for comparing various parameters. P value ≤ 0.05 was considered significant.

**Results**

A total of 44 patients were included in this study, divided in two equal groups. In the open technique group (Group A) the mean age was 26.23±6.06 years while the closed technique group (Group B) had a mean age of 25.23±4.66 years. Regarding gender distribution, group A had 10 (45.5%) males and 12 (54.5%) females. Group B had 9 males (40.9%) and 13 females (59.1%). Unilateral impaction was seen in 18 patients (81.8%) in group A and 17 patients (77.3%) group B. Bilateral impaction was observed in 4 patients (18.2%) in group A and 5 patients (22.7%) in group B.(Table 1)

Intraoperative bleeding occurred in 3 patients (13.6%) in group A, while no such event was observed group B (p=0.073). Analgesic intake on the first postoperative day was reported by 18 patients (81.8%) in group A and 13 patients (59.1%) group B (p=0.099). The mean surgical time was significantly shorter in group A at 27.14±5.15 minutes, compared to 34.77±6.11 minutes in the closed group (p<0.001). Postoperative pain measured on the visual analogue scale was higher group A with a mean score of 4.09±1.65, and 3.23±0.81 in group B. This difference was statistically significant (p=0.034) (Table 2).

Postoperative bleeding was significantly higher in Group A (Open technique) compared to Group B (Closed technique) (22.7% vs. 0.0%, p=0.018). Bonding failure and hanging chain discomfort were more frequent in Group B, but the differences were not statistically significant. (Table 3)

**Table 1: Baseline characteristics**

| | | Groups<br>Group A (Open) | | Group B (Close) | |
|---|---|---|---|---|---|
| | | n | % | n | % |
| Gender | Male | 10 | 45.5% | 9 | 40.9% |
| | Female | 12 | 54.5% | 13 | 59.1% |
| Laterality of impaction | Unilateral | 18 | 81.8% | 17 | 77.3% |
| | Bilateral | 4 | 18.2% | 5 | 22.7% |

**Table 2: Comparison of intraoperative bleeding, analgesic intake, operative time and postoperative pains score between both groups**

| | | Groups<br>Group A (Open) | | Group B (Close) | | p value |
|---|---|---|---|---|---|---|
| | | n | % | n | % | |
| Intraoperative bleeding | Yes | 3 | 13.6% | 0 | 0.0% | 0.073 |
| | No | 19 | 86.4% | 22 | 100.0% | |
| Analgesic intake | Yes | 18 | 81.8% | 13 | 59.1% | 0.099 |
| | No | 4 | 18.2% | 9 | 40.9% | |
| Mean | | | SD | Mean | SD | p value |
| Mean surgical time (Mins) | | 27.14 | 5.157 | 34.77 | 6.110 | < 0.001 |
| Pain VAS post-surgery | | 4.09 | 1.659 | 3.23 | .813 | 0.034 |

**Table 3: Comparison of postoperative complications between both groups**

| | | Groups<br>Group A (Open) | | Group B (Close) | | p value |
|---|---|---|---|---|---|---|
| | | n | % | n | % | |
| Postoperative bleeding | Yes | 5 | 22.7% | 0 | 0.0% | 0.018 |
| | No | 17 | 77.3% | 22 | 100.0% | |
| Bonding failure | Yes | 0 | 0.0% | 1 | 4.5% | 0.312 |
| | No | 22 | 100.0% | 21 | 95.5% | |
| Hanging chain discomfort | Yes | 0 | 0.0% | 3 | 13.6% | 0.073 |
| | No | 22 | 100.0% | 19 | 86.4% | |

**Discussion**

The present study compared open and closed surgical exposure techniques for impacted maxillary canines in 44 patients, divided in two groups. The open technique required significantly less operative time than the closed method. However the closed technique was associated with lower pain scores on the first postoperative day. Postoperative bleeding was more common in the open group. Hanging chain discomfort occurred only in the closed group. Analgesic consumption and intraoperative bleeding showed trends favouring the closed technique but did not reach statistical significance.

The findings of the present study aligns with the randomised controlled trial by Faerovig et al. as they reported that the open approach produced higher VAS scores for pain and discomfort from the operation onwards.(10) Faerovig et al. also reported that complications were more common in the open group with bleeding being the most frequent event. The present study observed postoperative bleeding in 22.7% of open patients compared to 17.8% Faerovig et al.(10)

Regarding surgical time Faerovig et al. reported shorter duration for the open technique particularly when no flap surgery was performed. The present study found mean times of 27.14 minutes for open technique and 34.77 minutes for close techqniue.(10) These values are slightly higher than those reported by Faerovig et al. (28.42 and 24.83 minutes for unilateral cases). The difference may be due to surgeon experience, case complexity or setting specific factors.

Bari et al. conducted a prospective cohort study, they reported surgical times of 23.17 minutes for open and 31.17 minutes for closed exposure. The present study found slightly longer times (27.14 and 34.77 minutes). This small discrepancy may reflect differences in impaction severity or surgical technique.(11) Bari et al. reported no significant difference in pain scores between groups while the present study found a statistically significant difference favouring the closed technique. Regarding recovery time Bari et al. reported 74.8 hours for open and 49.04 hours for closed technique.(11) The present study did not measure recovery time in hours but observed that analgesic consumption was higher in the open group on day one suggesting a similar pattern.

Sampaziotis et al. conducted a systematic review comparing open and closed exposure for palatally impacted maxillary canines. The authors concluded that there is no difference between open and closed techniques in terms of periodontal outcomes and aesthetic appearance. They also reported that the surgical procedure was shorter in the open exposure group.(12) These conclusions are broadly consistent with the present findings. The present study adds to the literature by providing data from a Pakistani population a setting previously underrepresented in this area.

Hu et al. examined gingival health after surgical exposure of labially impacted maxillary canines. The authors emphasised the role of dental follicle preservation in promoting soft tissue healing. They reported that maintaining the follicle improved periodontal outcomes and aesthetic results. should investigate whether follicle preservation reduces complications in palatal exposures not just labial ones.(4)

Khan et al. documented pathologies associated with impacted maxillary canines. The most common pathology in their study was adenomatoid odontogenic tumour (30%), followed by dentigerous cyst (26.67%) and odontoma (18.33%).(13) Impacted canines are not always benign. Clinicians should obtain preoperative radiographs to rule out associated pathology before proceeding with exposure.

The choice between open and closed exposure carries practical implications. For surgeons the open technique offers efficiency. Shorter operative time reduces operating room costs and allows more patients to be treated per session. This is relevant in public hospitals in Pakistan where resources are limited and waiting lists are long. For patients the closed technique provides a more comfortable early recovery. The trade off is a slightly longer operation.

## Conclusion

The presents demonstrated that open surgical exposure technique had significantly shorter operative time as compared to close technique, however closed exposure technique was associated with significantly lower postoperative pain and less postoperative bleeding, which may favor comfort and early recovery.

## Declarations

**Data Availability statement**
All data generated or analysed during the study are included in the manuscript.

**Ethics approval and consent to participate**
Approved by the department concerned.

**Consent for publication**
Approved

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Not applicable

**Conflict of interest**

The authors declared the absence of a conflict of interest.

**Author Contribution**

**GEL (Internship)**
*Manuscript drafting, Study Design, Data analysis, and drafting articles*
**MA (Dental Student)**
*Review of Literature and assists in interpretation of data*
**MZ (Resident Medical Officer, General Medicine)**
*Literature search and proof reading,*

*All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.*

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