

“Evaluation of the Esthetic and Periodontal Status Following Surgical and Orthodontic Alignment of Impacted Maxillary Canine”

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Abstract:

Background: One of the key surgical issues in the management of teeth, which are erupting aberrantly angulated, is the exposure of the crown to allow eruption. The specific surgical procedure and the orthodontic mechanics, vary depending upon the tooth and its position.

Aim: The aim of this study was to evaluate the esthetics and periodontal status of impacted canine using two different surgical procedures namely: apically positioned flap and closed-eruption techniques.

Subjects and Methods: The study consisted of 13 patients with unilateral labially impacted maxillary canine. Six of the patients had undergone an apically positioned flap (APF) procedure, and the remaining seven had undergone the closed-eruption (CE) technique.

Results: Clinical evaluation showed no significant differences in plaque and gingival bleeding indexes in both groups. In the apically positioned flap group, the gingival margin was more apically placed on the mesial surface, the clinical crowns were relatively longer, the attachment loss was more on the facial surface, the attached gingiva was relatively wider on the facial surface and the bone loss was relatively more for the test teeth in the APF group when compared to the closed eruption group. There was no significant scarring on the test teeth when compared to their controls in both the groups.

Conclusion: The closed eruption technique proved to have more esthetic and periodontal benefits when compared to the apically positioned flap technique.

Keywords: Closed eruption, Apically positioned flap, Orthodontics, Clinical appearance, periodontal status

I. Introduction

The prevalence of impacted maxillary canines ranges from 1.5 to 4%.¹ One of the key surgical issues in the management of impacted teeth is the exposure of the crown to allow eruption. Surgical exposure should be performed providing sufficient attached gingiva. Attached gingiva is essential to secure the gingival tissues, prevent loss of periodontal structure, promote tooth eruption, reduce gingival recession and marginal bone loss. Non-keratinized mucosa does not provide such function. The specific surgical procedure and the orthodontic mechanics, however, vary depending upon the type of tooth and its position relative to the remaining erupted teeth.

II. Diagnosis Of Tooth Impaction

The orthodontic-surgical management of impacted canines requires accurate diagnosis and precise location of the impacted canine and the surrounding structures. In labial impactions, this can be achieved by visual inspection, manual palpation and the use of radiographs. The panoramic radiograph is the basic radiograph for detecting impacted teeth because it provides an overall view of the maxilla, mandible, alveolar processes, dentition and nasal fossae; and precise location of the impacted canine and the surrounding structures. If the tooth is in the middle of the alveolus or palatally, it would require two intraoral periapical radiographs taken at different angles to determine the location of the tooth. Use of buccal object rule comes to play in these situations. An occlusal radiograph could also aid in locating the tooth position.²

III. Surgical Procedures

The various methods that can be employed for uncovering impacted teeth are Gingivectomy (Window approach), Double pedicle graft, Apically positioned flap, Modified apically positioned flap, Free gingival graft and Closed eruption technique.³ The most common methods of uncovering labial impactions have been the excisional gingivectomy and apically positioned flap techniques; while a few surgeons use the closed-eruption technique. The esthetic and functional outcomes of these procedures, such as effects on gingival height, clinical crown length, width of attached gingiva, gingival scarring, relapse potential, and attachment levels need to be critically assessed in order to identify the optimal method of uncovering labial impactions.

The purpose of this study was to evaluate the esthetic and periodontal differences between the apically positioned flap and closed-eruption techniques for uncovering labially impacted maxillary canines.

IV. Subjects And Methods

The study consisted of 13 patients who were recalled a minimum of three months after orthodontic treatment with unilateral labially impacted maxillary canine. The treatment plan and the surgical protocol was explained to the patient and guardians and consent was obtained. The study consisted of two groups depending on the method of surgical exposure of the impacted canines.

Group A: Included six patients who had undergone an Apically Positioned Flap (APF) procedure

Group B: Included seven patients who had undergone the Closed-Eruption (CE) technique.

The age at the start of treatment, treatment duration, recall period, and age at the time of recall were almost similar for both groups.

V. Surgical Procedures

5.1 Apically Positioned Flap (APF):

Apically Positioned Flap is a full-partial thickness pedicle reflected from the edentulous area saving as much gingiva as possible and positioning it apical to the permanent tooth, which would get converted into attached gingiva.^{4,5,6}

The area was surgically exposed under local anesthesia, by placing two vertical releasing incisions mesial and distal to the unerupted canine extending beyond the mucogingival junction (MGJ). A crestal incision was given in the edentulous region connecting both the releasing incisions. A full thickness flap was then raised beyond the MGJ and then continued as a partial thickness flap so as to leave the periosteum covering the bone. Bone covering the enamel was removed with a curette or a No. 6 surgical round bur. Two-thirds of the crown was exposed, and the connective tissue follicle was curetted from the periphery of the exposed portion of the crown. The flap was sutured to the periosteum, leaving one-half to two-thirds of the crown uncovered using a 3-0 silk suture. The orthodontist placed an orthodontic bracket immediately under proper isolation. The patient was put on NSAID for three days.

The patient was reviewed after a week wherein the surgical site showed satisfactory healing. The orthodontist started the force application at the same appointment using 0.016 Niti archwire into the bracket placed on surgically exposed canine. The patient was scheduled for a review after one month. At one month the canine had erupted halfway into the space between lateral incisor and the premolar and showed about 3-4mm of keratinized mucosa. On the next appointment at three months the canine was completely aligned and showed a healthy keratinized gingiva of around 3 mm with a gingival sulcus of around 2mm. [Figure: 1(a) – 1(e)]

5.2 Closed Eruption Technique:

The closed-eruption technique involved elevating a flap, placing an attachment on the impacted tooth, and returning the flap to its original location.^{4,5,6}

The area was surgically exposed under local anesthesia. A crestal incision was made in the edentulous region, and a buccal flap was reflected. Curettes and surgical round burs were used to find the tip of the impacted tooth, and enough bone was removed from the incisal portion to place a bracket or chain on the impacted tooth. A 0.010-inch ligature wire or gold chain was attached from a pin or mesh pad to the arch wire. The flap was returned to its original location for complete closure. The wire or chain passed under the flap and exited at the midcrestal incision area, and was attached to the archwire. The orthodontist typically activated force within one week, creating a normal direction of tooth eruption mimicking its natural eruptive path. [Figure: 2(a) – 2(e)]

VI. Clinical Evaluation

The test tooth (impacted tooth) and its contralateral control tooth were examined. The oral hygiene and gingival inflammation were evaluated using the Visible Plaque Index (Loe and Silness) and Gingival Bleeding Index (Carter and Barnes) respectively. Probing pocket depth was measured to the nearest 0.1mm using a constant pressure probe (Brock probe TM). The distance from the gingival margin to the cemento-enamel junction (CEJ) was measured to the nearest millimeter using a UNC 15 probe. A negative recording indicated that the gingival margin was located apical to the CEJ. The width of gingiva, which was the distance from the gingival margin to the mucogingival junction, was measured to the nearest 0.1 mm using calipers. The distance from the gingival margin to the bone was measured to the nearest millimeter using a UNC 15 probe. Three variables were calculated as differences between measures. Probing attachment level was calculated by subtracting the value of CEJ to gingival margin from the probing pocket depth value. The width of attached gingiva was calculated by subtracting the probing pocket depth from the width of gingiva. Probing bone level was calculated by subtracting the value of CEJ to gingival margin from the value of gingival margin to bone. Clinical crown length and presence of a gingival scar were finally evaluated. The clinical crown length was measured on the midfacial surface of the tooth from the incisal edge to the gingival margin, parallel to the long axis of the tooth to the nearest 0.1 mm using a caliper. Any gingival scars around the teeth were also recorded.

VII. Results

The apically positioned flap (Group A: N=6) and closed-eruption technique (Group B: N=7) groups were analyzed separately. Each variable was compared between the test tooth and its contralateral control. A paired two-tailed t-test for means was employed for the following variables: probing pocket depth, gingival margin to CEJ, clinical crown length, probing attachment level, width of attached gingiva and probing bone level. Differences between the Plaque Index and Gingival Bleeding Index were tested using the Wilcoxon T test. The presence of scarring, and the photographic variations were analysed using McNemar's test.

Clinical Evaluation:

There were no statistically significant difference in the Visible Plaque Index and Gingival Bleeding Index between the test teeth and their contralateral controls in either group. [TABLE: 1]

In the apically positioned flap group, the gingival margin was more apically placed on the mesial surface when compared to the closed-eruption group ($p < 0.01$). The clinical crowns in the APF group were relatively longer ($p < 0.02$) when compared to the closed eruption group. The attachment loss was more on the facial surface ($p < 0.02$) in the apically positioned group in comparison to the closed eruption group. Bone loss was relatively more on the facial, mesial and distal surfaces for the test teeth ($p < 0.01$) in the APF group when compared to the closed eruption group. The attached gingiva was relatively wider on the facial surface of the APF group ($p < 0.002$) in comparison to the closed eruption group. [TABLE: 2] There was no significant scarring on the test teeth when compared to their controls in both the groups.

VIII. Discussion

In the present case series an Apically positioned flap and closed eruption were successfully used to uncover labially impacted maxillary canine. The apically repositioned flap is a quick, simple and reliable method for exposing teeth that are impacted labially or within the line of the arch. The technique provides an adequate width of attached gingiva. The tooth can easily be inspected at follow-up appointments; debonding of the attachment is readily detected and easily reattached.

The closed eruption entails creation of a flap, uncovering the impacted tooth, installing an attachment and closing the flap. This technique is best used with high labially impacted teeth and teeth that are impacted in the mid-alveolar area. With appropriate orthodontic mechanics, the tooth can be erupted, mimicking its natural eruptive path through the mid-crestal area. The only problem that could be encountered is debonding of the attachment, which needs a surgical re-entry for the rebonding of the bracket.

This clinical study showed that the gingival margin on the mesial surface of the apically positioned flap group were more apically placed relative to their control. The clinical crowns in the APF group were relatively longer when compared to the control group. The higher tendency for apical gingival position and greater clinical crown length produce uneven anterior gingival margins and may be esthetically less favorable. Neither of these problems were observed in the teeth treated with the closed-eruption technique.

The attachment loss was more on the facial surface in the apically positioned group in comparison to the control group. This result is consistent with cases of impacted palatal canine. Bone loss was relatively more on the facial, mesial and distal surfaces for the test teeth in the APF group when compared to the closed eruption group. The increased potential of plaque accumulation around teeth exposed with an apically positioned flap could also explain this difference in outcome between the two techniques.

The attached gingiva was relatively wider on the facial surface of the APF group in comparison to the closed eruption group. There was no significant scarring on the test teeth when compared to their controls in both the groups.

IX. Figures And Tables
Apically Positioned Flap Technique



Fig 1(a): Pre-op



Fig 1(b): Incisions given, flap raised.



Fig 1(c): Flap apically positioned & sutured.

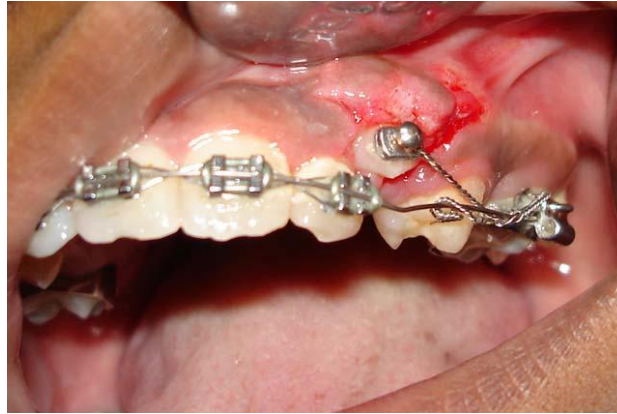


Fig 1(d): Post-op one week.



Fig 1(e): Post-op three months.

Closed Eruption Technique

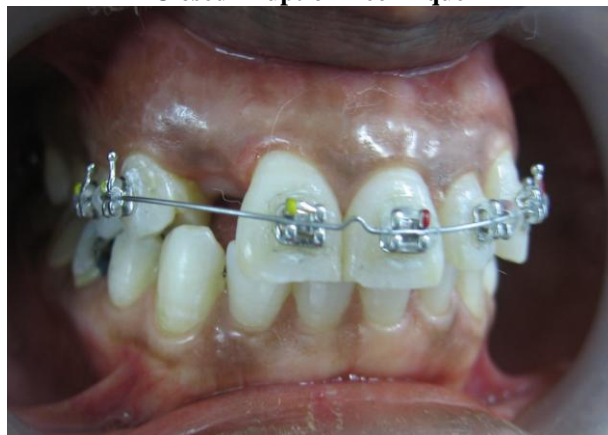


Fig 2(a): Pre-op



Fig 2(b): Flap raised, bone removed



Fig 2(c): Tooth exposed, Orthodontic button placed



Fig 2(d): Flap sutured



Fig 2(e): Post-op three months

Table: 1

Plaque Index And Gingival Bleeding Index (Percentage of tooth surfaces)						
Index	Apically positioned flap (N=6)			Closed eruption technique (N=7)		
	0	1	2	0	1	2
Visible Plaque Index	80%	20%	1%	85%	10%	6%
Gingival Bleeding Index	55%	38%	5%	60%	32%	5%

Table: 2

Parameters	Clinical Evaluation						
	Surface	Apically positioned flap (N=6)			Closed eruption technique (N=7)		
		Test	Control	P-value	Test	Control	P-value
Probing pocket depth	Facial	2.0 (0.55)	2.2 (0.57)	P < 0.2	2.2(0.56)	2.3 (0.57)	p< 0.4
	Mesial	3.0 (0.78)	3.0 (0.48)	P < 0.2	2.8(0.70)	3.0 (0.74)	p< 0.5
	Distal	3.0 (0.68)	3.1 (0.89)	P < 0.5	3.0(0.71)	2.9 (0.50)	p< 0.3
Probing attachment level	Facial	-1.5(1.06)	-0.9(0.60)	P < 0.02*	-1.4(0.89)	- 0.9(0.52)	p< 0.2
	Mesial	-0.7 (0.78)	-0.6(0.66)	P < 0.5	-0.6(0.49)	-0.7(0.70)	p< 0.6
	Distal	-0.8(0.79)	-0.7(0.69)	P < 0.4	-0.8(0.57)	-0.5(0.50)	p< 0.1
Gingival margin	Facial	0.9(1.02)	1.2(0.70)	P < 0.5	0.8(1.01)	1.4(0.69)	p< 0.1
	Mesial	2.2(0.69)	2.6(0.62)	P < 0.01*	2.4(0.72)	2.3(0.59)	p<0.5
	Distal	2.1(7.0)	2.2(0.68)	P < 0.5	2.4(0.64)	2.4(0.63)	p<0.6
Width of attached gingiva	Facial	3.5(2.09)	1.8(0.69)	P < 0.002*	2.3(0.88)	2.1(1.19)	p< 0.4
	Mesial	5.4(2.76)	4.6(1.46)	P < 0.1	4.2(2.15)	4.6(1.50)	P < 0.4
	Distal	3.7(2.00)	3.8(1.70)	P < 0.8	3.6(1.50)	4.3(1.37)	p< 0.02*
Probing bone level	Facial	2.4 (0.88)	1.5 (0.59)	P < 0.002*	2.0(0.78)	1.6 (0.51)	p< 0.02*
	Mesial	2.2 (0.56)	1.8 (0.69)	p< 0.006*	1.6(0.47)	1.7 (0.45)	p< 0.6
	Distal	2.2 (0.60)	1.6 (0.57)	p< 0.006*	1.7(0.48)	1.7 (0.46)	P < 0.2
Crown length	Mid-facial	10.2 (1.0)	9.6 (0.97)	p< 0.02*	10.0(1.19)	9.5 (1.0)	p< 0.1

* Statistically significant, p < 0.05

X. Conclusion

Both the surgical procedures used in this case series produced optimal keratinized tissue on the labial surface. This case series shows that the mucogingival interceptive surgeries, when used judiciously and at appropriate time can be helpful in preventing future mucogingival problems. This requires a coordinated approach on the part of both the periodontist and the orthodontist, which would ultimately benefit the patient in maintaining a trouble free periodontium.

References

- [1]. Stewart JA et al. Factors that relate to treatment duration for patients with palatally impacted maxillary canines. Am J Orthod Dentofacial Orthop. 2001 Mar; 119(3): 216-25.
- [2]. Richards A. The buccal object rule. Dental Radiography and Photography 1980;3:53
- [3]. Watchel HC. Session 11. In: Lang NP, Karring T, eds. Proceedings of the 1st European Workshop on Periodontology Surgical-periodontal therapy pp.159-171. London: Quintessence, 1994.
- [4]. Vermette ME, Kokich VG & Kennedy DB. Uncovering labially impacted teeth: apically positioned flap & closed eruption techniques. Angle Orthod. 1994; 65 (1): 23-34.
- [5]. Prato GP, Baccetti T, Magnani C, Agudio G & Cortellini P. Mucogingival interceptive surgery of buccally-erupted premolars in patients scheduled for orthodontic treatment. I. A 7- year longitudinal study. J periodontol 2000; 71: 172-181.
- [6]. Prato GP, Baccetti T, Giorgetti R, Agudio G & Cortellini P. Mucogingival interceptive surgery of buccally-erupted premolars in patients scheduled for orthodontic treatment. II. Surgically treated versus nonsurgically treated cases. J periodontol 2000; 71: 182-187