

## Titanium Button With Chain by Watted For Orthodontic Traction of Impacted Maxillary Canines

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**Abstract:** Advances in bonding techniques and materials allow for reliable bracket placement on ectopically positioned teeth. This prospective study evaluates the outcome of forced orthodontic eruption of impacted canine teeth in both palatal and labial positions. Eighty-two impacted maxillary canines in 2200 patients were included in the study and were observed for 2006 to 2013, in **Center for Dentistry research and Aesthetics, Jatt/Israel** after exposure. Following exposure by means of a palatal flap or an apically repositioned buccal flap, an orthodontic traction hook, with a **Titanium Button with chain by Watted (Dentaurum)** attached, was bonded to each impacted tooth using a light cured orthodontic resin cement. A periodontal dressing was placed over the surgical site for a period of time. All teeth were successfully erupted. Complications consisted of: failure of initial bond, at the time of surgery, which required rebonding; premature debonding at the time of pack removal and; debonding of brackets during orthodontic eruption. There was no infection, eruption failure, ankylosis, resorption or periodontal defect (pocket greater than 3 mm) associated with any of the exposed teeth. Forced orthodontic eruption of impacted maxillary canines with a well bonded orthodontic traction hook and ligation chain, used in conjunction with a palatal flap or an apically repositioned labial flap, results in predictable orthodontic eruption with few complications.

**Key Words:** cuspid/surgery; orthodontics, corrective; tooth, impacted/therapy

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### I. Introduction:

The orthodontic treatment of impacted maxillary canine remains a challenge to today's clinicians. The treatment of this clinical entity usually involves surgical exposure of the impacted tooth, followed by orthodontic traction to guide and align it into the dental arch. Bone loss, root resorption, and gingival recession around the treated teeth are some of the most common complications.[1,2,3]

Early diagnosis and intervention could save the time, expense, and more complex treatment in the permanent dentition. Tooth impaction can be defined as the infraosseous position of the tooth after the expected time of eruption, whereas the anomalous infraosseous position of the canine before the expected time of eruption can be defined as a displacement. Most of the time, palatal displacement of the maxillary canine results in impaction.[3,4,5,6]

Incidence of maxillary canine impactions vary from 0.92% - 1.7%.<sup>1,2</sup> Impactions are twice as common in females(1.17%) than males(0.51%). Impacted canines are found palatally in 85% of the cases, with labial position in 15% of cases.[1,4,5,6]

Etiology of impacted maxillary canine is obscure and most likely it is multifactorial. In general, the causes for impacted canine may be generalized or localized.[1,7,8,9,10,11]he most common causes for canine impactions are usually localized and might be the result of any of the combinations. (a)Tooth size-arch length discrepancies (b) Prolonged retention or early loss of deciduous canine (c) Abnormal position of the tooth bud (d) The presence of an alveolar cleft (e) Ankylosis (f) Cystic or neoplastic formation (h) idiopathic condition with no apparent cause.[9,10,11,12,13]

Other suggested cause of palatal impaction is trauma to the maxillary anterior region at an early stage of development.[11] Also studies have shown that the presence of lateral incisor root with the right length, formed at the right time is an important variable to guide the mesially erupting canine in a more favourable distal and incisal direction. An increase of 2.4 times in the incidence of palatally impacted canines adjacent to missing lateral incisors as compared with the general population was noted.[12,13,14]

A genetic predisposition was shown in some studies; the relatives of patients with palatal canines are likely to exhibit palatally displaced canines and anomalous lateral incisors.<sup>13</sup> Peck et al concluded that palatally displaced canines appear to be a product of polygenic multifactorial inheritance.[14]Also Prinin et al found that palatally impacted canines are genetic and related to incisor premolar hypodontia and peg shaped lateral incisors.[15]

Internal or external root resorption of teeth adjacent to canine is the most common sequelae. It is estimated that 0.7% of the children in the 10 to 13 year old age group have permanent incisors resorbed, as a result of canine ectopia. Resorption of lateral incisor root is more common than the central incisor. Lateral incisors are more commonly resorbed palatally and at the midroot level than at the cervical or apical regions.[16]

Late resorption of the unerupted canine itself can occur. Loss of vitality and cystic degeneration is an uncommon sequelae and the prevalence is not known. Orthodontic treatment is not without risks which include root resorption, decalcification, periodontal damage and failure to complete treatment. Surgical risks include damage to adjacent teeth and need for re-exposure sometimes.[4,5,13,15,16]

Localization of the unerupted canine involves inspection, palpation and radiographic evaluation. The position of the crown of the lateral incisor can give a clue as to the position of the unerupted canine; that is the crown of the lateral incisor may be proclined if the canine is lying on the labial aspect of the lateral incisor root.[17]

Often the crown of the unerupted canine can be palpated either in buccal position or in palatal position. There is a possibility of ectopic or impacted canine, if the canine is not palpable in the buccal sulcus by the age of 10- 11 years or if the palpation indicates an asymmetrical eruption pattern. Ericson and Kurol recommend inspection and palpation in canine region annually from 8 years for early identification of impacted canine.[3]

In selected cases, computerized tomograms are helpful in accurately assessing the location and identifying root resorption of adjacent teeth however this method is rarely used because of the high cost of the equipment.[2,3,8,9]

After mandibular third molars, the maxillary canines are the second most commonly impacted teeth [1], with palatal impactions prevailing over buccal impactions [2, 3]. Treatment approaches are aimed at the canines' correctocclusion, as well as function and esthetics of the dentition and can be divided into preventive and surgical. The preventive approach involves diagnosing the early signs of palatal displacement of permanent canines and early extraction of primary canines in order to achieve self- correction of the improper eruption [4]. If diagnosis is belated and prevention of impaction is impossible surgical- orthodontic treatment should be performed.

**Various surgical techniques for exposing palatally impacted canines exist** [4,5]: 1. technique of open eruption; 2. technique of closed eruption; 3. open eruption through a window; 4. tunnel extrusion, etc. Within the different approaches there exist two main options for the subsequent eruption of the impacted teeth [6]: natural autonomous eruption and forced eruption under orthodontic traction.

The choice of a surgical approach still remains a question of personal preference for the surgeon and orthodontist because the scientific literature lacks satisfactory evidence in favor of one of the techniques [7, 8, 9]. Additional studies comparing directly the various methods and their advantages as regards the periodontal status of the impacted teeth are needed [10, 11]

## **II. Materials and Methods**

This study included 82 orthodontic patients (46 female, 36 male) who were followed for 18-21 months after the surgical exposure of canines. The patients were 10 to 39 years old (mean . A total of 82 impacted maxillary canines were treated according to a standard protocol. 65 (80%) teeth were palatally impacted and 17(20%) teeth were labially impacted. At the time of surgical exposure, all the teeth had at least one-third to two-thirds of root formation completed. All the crowns of the impacted teeth were covered by bone.

Prior to surgery, the position of the impacted tooth was determined clinically (by palpation), radiographically (panoramic, lateral cephalogram, two periapicals and maxillary occlusal films) and Cone Beam Computerized Tomography.

For bilateral palatally impacted canines, a full thickness mucoperiosteal flap was raised from the mesiopalatal aspect of the second premolars. In unilateral cases, the flap extended to the mesiopalatal aspect of the contralateral lateral incisor.

For labially impacted canines, a full thickness mucoperiosteal flap was raised, initially without vertical incisions, from the mesiobuccal aspect of the second premolar to the distolabial aspect of the lateral incisor. Vertical releasing incisions were placed mesially and distally. Sufficient bone was removed from around the crown in order to place a bonded orthodontic appliance. An apically positioned flap was fashioned if the tooth was coronally placed. For deeper impactions, a closed eruption technique was employed.

Currently the most common procedure is bonding of an attachment directly to the enamel surface of the impacted tooth at the time of surgery.

A curved base bracket is used, with a soft wire ligated to the attachment before bonding. The wire protrudes through the palatal tissue with a pig tail hook for attachment of the elastic.

The oral surgeon should expose enough of the canine to prevent the infiltration of the granulation tissue, but the position of the canine will determine whether the orthodontist can isolate, etch, and bond with a

conventional composite resin. Most of the tough impactions are up far enough, that bonding is rendered rather difficult by the proximity of the adjacent tissues and the lack of really good moisture control.

The enamel was etched for 20 seconds using 37% phosphoric acid. At this point the field was kept as dry as possible using suction and gauze or bone wax. A light cured orthodontic resin cement (Unitek, Transbond XT) was used for bonding (light cured at 470 nm for 40 seconds). The appliance used was a bonded orthodontic traction hook with a Titanium Button with chain by Watted (Dentaurum) ligation chain.

If the primary canine was present, it was extracted and the wire was passed through the extraction socket. The Titanium Button with chain by Watted (Dentaurum) was wrapped around the existing labial archwire, or held in place within the periodontal dressing until the orthodontic appliance was placed.

The flap was then repositioned. Labial flaps were apically repositioned ensuring that the full amount of keratinized gingiva was maintained cervical to the crown. Palatal flaps were repositioned to their original site and windows were placed in the mucoperiosteum, for the more medially placed palatal canines, to allow for passage of the wire. Flaps were held in place by means of resorbable sutures.

Subsequently, a light cured periodontal dressing was placed over the area. The dressing assured patency of the window, aided flap immobilization, and provided protection and comfort for the patient.

Patients were then evaluated 7-14 days after surgery, when the dressing and sutures were removed. Clinical evaluation included assessment of bracket attachment, eruption status, gingival tissue response, recession, periodontal pocket depth and infection. A radiographic examination with one standard periapical film was performed to assess the status of adjacent structures, as well as the presence of root resorption, ankylosis or periodontal defects.

The patients then had orthodontic traction forces activated within seven to 21 days. At subsequent orthodontic appointments, the same clinical examination was performed with radiological evaluation occurring every three months. Progress was noted and complications were recorded.

### **III. Results And Discussion**

Of the 82 cases treated in this study, none came seeking treatment for the impacted canine as all patients were not aware of the presence of any abnormality. Accidental discovery of the impaction was through routine screening in the **Center for Dentistry research and Aesthetics, Jatt/Israel**.

Thirty-six (54.5%) cases had the canines buccally situated while thirty (45.5%) were palatally impacted. Intraoral examination revealed that 65 cases were unilaterally impacted while bilateral impaction was present in only one case. Forty cases (60.6%) showed retained deciduous canines. As a prominent clinical finding, there was a bulge of the mucosa either labial or palatal that determined the position of the impaction[17,18,19]. Although this was not a common finding, it was, more often than not, accurately determined radiographically. In those cases which could not be detected by palpation or by the presence of a bulge, lateral cephalometrics helped in locating the impacted canine. Intraoral occlusal films were merely confirmatory to the cephalometrics[20].

Different devices can be applied to the crown of an impacted canine, including a wire, pins, crown formers and orthodontic bracket. For many years, cervical neck wires (lasso) were a popular technique to secure a tooth, but such wires injured the root of the tooth. Securing pins into the tip of the canine damaged the crown of impacted tooth. Crown forms snapped or cemented over the crown of an impacted tooth was also popular for many years. The crown forms act as a foreign body, causing erosion of overlying tissue with ultimate exposure of the impacted tooth[19,20,21].

The device of choice is an orthodontic bracket. Once the orthodontic attachment has been placed on impacted canine, orthodontic traction is applied to move the canine into proper alignment. Various methods have been described for applying traction, these usually include the use of fixed appliances with a transpalatal bar and or headgear to control vertical anchorage. The maintenance of adequate space in the canine area is essential prior to application of traction[21,22,23].

Application of force can be in the form of elastic or wire traction. "The ballista spring" system for impacted teeth has been described by Harry Jacoby. It employs a wire loop constructed using a 0.014", 0.016" or 0.018" round wire[20].

Robert Harry and Harridane described a sectional approach to maxillary canine using transpalatal arch for anchorage. They used a 0.017" x 0.025" TMA sectional archwire from first molar to canine providing low force over a long range[20].

Cantilever mechanics for treatment of impacted canines has been described by Fischer et al.[21] Australian helical archwire for assisting eruption of impacted canine was described by Hauser et al. It comprises of three helices bent in 0.016" special plus Australian wire. The Australian wire is bent with helices that serve as stops against the brackets of adjacent teeth to maintain space for erupting canine. An additional incisal helix increases the resilience of the system and anchors the stainless steel ligature running to the canine

attachment. K-9 spring for alignment of impacted canines was described by Varun Kalra, it comprises of a spring made of 0.017 x 0.025 inch TMA wire[20,21,22].

Bowman and Carano designed monkey hook as well as kilroy spring for guiding the eruption of impacted tooth., [24] They described two types of kilroy springs. Kilroy I applies lateral and vertically directed forces to direct the impacted tooth. Kilroy II spring was designed to produce more vertical eruptive forces for eruption of buccally impacted tooth[24]. Magnetic forces have also been advocated by some authors to align impacted tooth. Regardless of the method of traction used, the direction of applied force should initially move the impacted tooth away from roots of the neighbouring teeth. In addition, Bishara recommends - a) use of light force(< 60gms) to move the impacted tooth b) creation and maintenance of sufficient space within the arch c) the use of base archwire of sufficient stiffness (0.018"x0.022") to resist deformation by the tractional forces applied[24]

The purpose of our study in **Center for Dentistry research and Aesthetics, Jatt/Israel** was to analyze the indications of surgical methods according to the clinical status of each Case.

In deep impactions, because the gingival tissue cannot be positioned in the vestibule in order to uncover the tooth and to bond the auxiliary orthodontic device, it is recommended the use of muco-periosteal repositioned flap with passive guidance of the impacted canine. The apical translation flap has the purpose of assuring the uncovering of the teeth and provides the amount of periodontal tissue for the repositioned canine. Due to the fact that the lower margin of the flap is positioned in direct contact with the tooth, this method contributes to periodontal restoration[20,21,24].

The window flap used in palatal impaction avoids extensive decoliation of the mucosa, allows the attachment of orthodontic devices and minimizes the trauma to the marginal periodontal tissue. Periodontal follow-up 6 month after surgery shows that in the cases in which we used the repositioned flap, apical translation flap and window flap there were no periodontal recessions or dental mobility which could compromise the treatment. Conversely, in the cases in which we used the lateral and apical translation method and meshing, the periodontal tissue was damaged and it needed surgical restoration[20,21,22,23,24].

#### **IV. Conclusions**

We recommend conservatory surgical orthodontic treatment due to its role in alveolar bone formation during the movement of an impacted tooth, with restoration of the periodontium with esthetical and functional implications.

When the treatment was finished, positive changes were achieved by performing the orthodontic traction of the upper right canine and positioning it correctly in the dental arch. In doing so, canine class I was achieved and we improved arch form, the overjet and the overbite as well as the profile and the incisor's inclination.

The radiographic characteristics prior to treatment assessed in the panoramic radiographs are useful indicators for the duration of the orthodontic traction but they are not valid predictors for the final periodontal status of the orthodontically repositioned impacted canine.

Complete fixed appliances are a commonly used alternative in combination with traction applied to the center of the alveolar process and the use of a Titanium Button with chain by Watted and tied to the rigid arch wire. This technique ensures a good control system.

#### **Bibliography**

- [1]. Moyers RE: Handbook of Orthodontics 4th ed. Chicago,IL, Year book Medical Publisher 1988.
- [2]. Becker A., Smith P, Behar R. The incidence of anomalous maxillary lateral incisors in relation to palatally-displaced cuspids. Angle Orthod. 1981 Jan;51(1):24-29.
- [3]. Menamara C.M.: Orthodontic Management Of An Impacted Maxillary Canine With An Abnormal Premolar Root: J.C.O. 2000; 34(12) : 709-711.
- [4]. Ericson S, Kurol J. Radiographic examination of ectopically erupting maxillary canines. Am J Orthod Dentofacial Orthop 1987 Jun;91(6):483-492
- [5]. Ericson S, Kurol J. Early treatment of palatally erupting maxillary canines by extraction of the primary canines. Eur J Orthod 1988 Nov;10(4):283-245. 6.Weaver B, Hornbrook R And Ngan P.: Early Timely Management of Ectopically Erupting Maxillary Canines: Seminars In Orthodontics. 2005; 11(3):152-163.
- [6]. Bedoya M., Park JH. A review of the diagnosis and management of impacted maxillary canines. J Am Dent Assoc. 2009 Dec;140(12):1485-1493.
- [7]. Kokich VG Preorthodontic uncovering and autonomous eruption of REFERENCES:palatally impacted maxillary canines. SeminOrthod. 2010;16: 205-211.
- [8]. Parkin N, Benson PE, Thind B, Shah A. Open versus closed surgical exposure of canine teeth that are displaced in the roof of the mouth. Cochrane Database Syst Rev.2008 Oct 8;(4):CD006966.
- [9]. Swart RJ., Kiekens RM, Berge SJ, Kuijpers-Jagtman AM. Orthodontics in general practice. 2. Treatment of eruption failures. Ned Tijdschr Tandheelkd. 2007Oct; 114(10): 416-22
- [10]. Shafi I. No evidence to support one surgical technique over the other for the management of palatally displaced canines. Evid Based Dent. 2008;9(4):111.
- [11]. Aghaloo T, Felsenfeld, A.L.: Surgical Exposure of Impacted Teeth : Oral & Maxillofacial Surgery Clinics Of North America. 2002; 14(2): 187-199.

[12]. Schmidt AD, Kokich VG. Periodontal response to early uncovering, autonomous eruption and orthodontic alignment of palatally impacted maxillary canines. *Am J Orthod Dentofacial Ortho* 2007 Apr; 131(4):449-455

[13]. Frank CA., Long M. Periodontal concerns associated with the orthodontic treatment of impacted teeth. *Am J Orthod Dentofacial Orthop* 2002 Jun; 121(6): 639-49.

[14]. Magnusson H. Saving impacted teeth. *J Clin Orthod.* 1990; 24(4): 246-249..

[15]. Coulter J, Richardson A. Normal eruption of the maxillary canine quantified in three dimensions. *European Journal of orthodontics* 1997; 18:449-456.

[16]. Ferguson JW, Parvizi F. Eruption of palatal canines following surgical exposure: a review of outcomes in a series of consecutively treated cases. *Br J Orthod* 1997; 24(3):203-207.

[17]. Kokich VG, Mathews DP. Surgical and orthodontic management of impacted teeth. *Dent Clin North Am* 1993; 37(2):181-204.

[18]. Jacoby H. The Ballista spring system for impacted teeth. *Am J Orthod* 1979; 75(2):1143-151.

[19]. Roberts-Harry D, Harridane N. A sectional approach to the alignment of ectopic maxillary canine. *Br J Orthod* 1995; 22:67-70.

[20]. Fischer JJ, Zeigler F, Lendberg C. Cantilever mechanics for impacted maxillary canine. *J Clin Orthod* 2000; 34(11):647-650.

[21]. Hauser C, Lai YH, Karamaliki E. Eruption of impacted canines with an Australian archwire. *J Clin Orthod* 2000; 34(9):538-541.

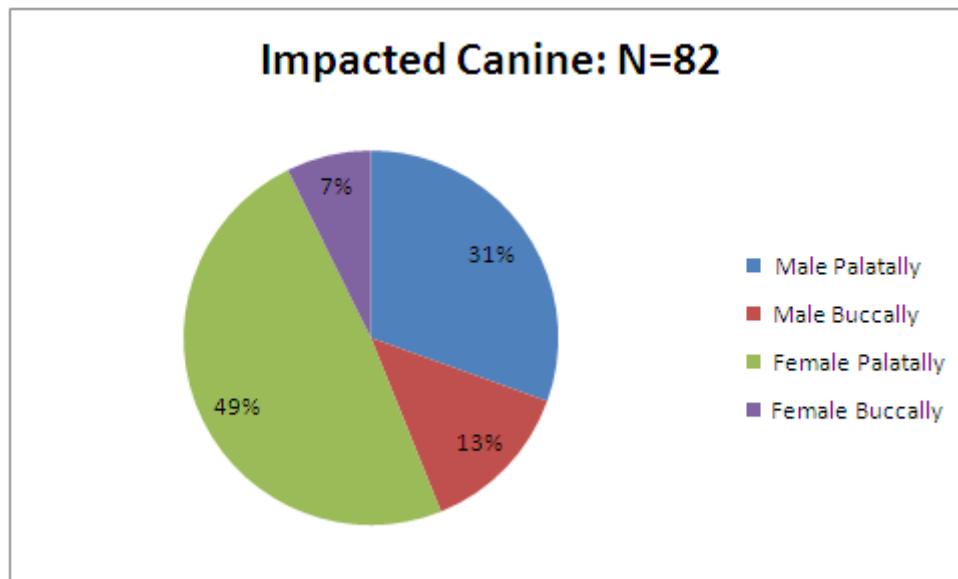
[22]. Kalra V. The K-9 spring for alignment of impacted canines *JCO* 2000; 34(10):606-610.

[23]. Bowman SJ, Carano A. The kilroy spring for impacted teeth. *J Clin Orthod* 2003; 37(12):683-688.

**FIG.**

**Table 1**

Impacted Canine: N=82	
Male Palatally	25
Male Buccally	11
Female Palatally	40
Female Buccally	6
<b>Total</b>	<b>82</b>



**Fig. 1: Distribution of retention by gender and location**

**Table 2**

Impacted Canine: N=82	
Male Unilateral Left	16
Male Unilateral Right	6
Male Bilateral	14
Female Unilateral Left	20
Female Unilateral Right	16
Female Bilateral	10
<b>Total</b>	<b>82</b>

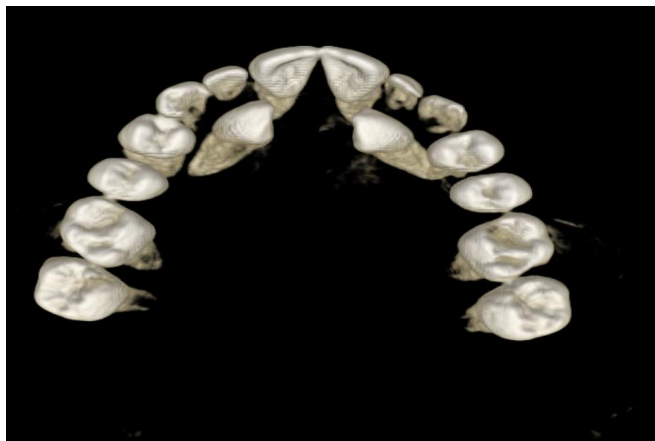


Fig1(a)



Fig1(b)

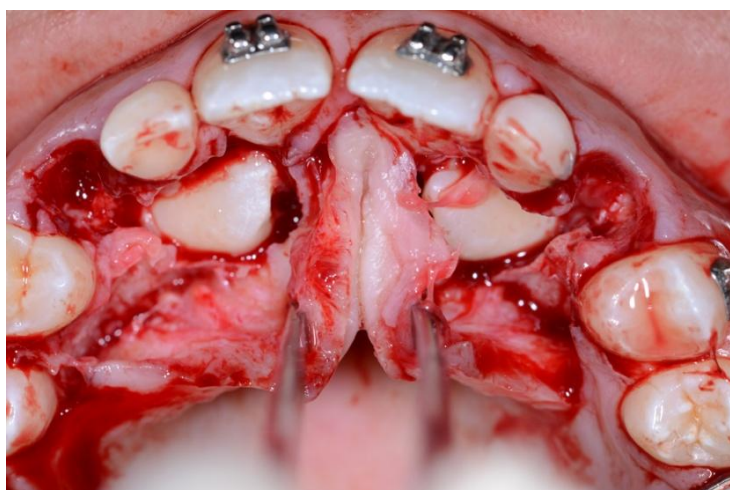


Fig1(c)





Fig2(a)



Fig2(b)

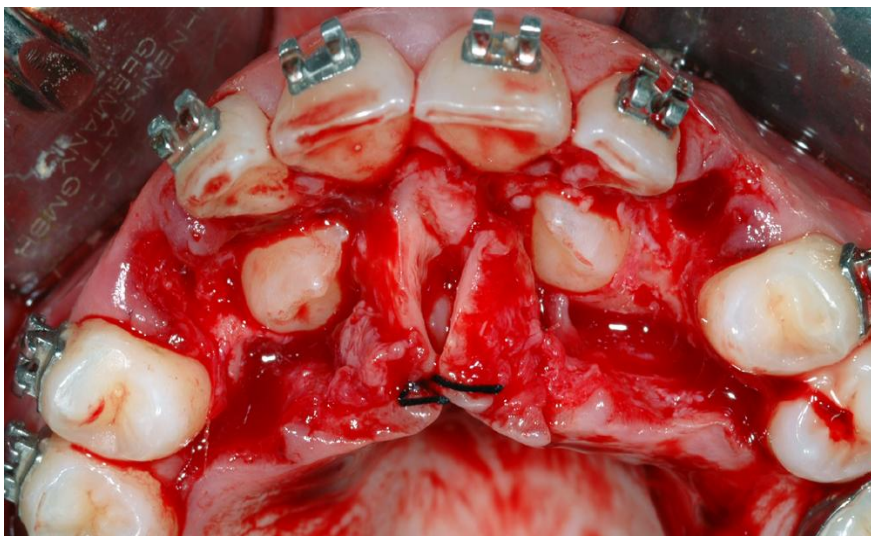


Fig2(c)



Fig2(d)

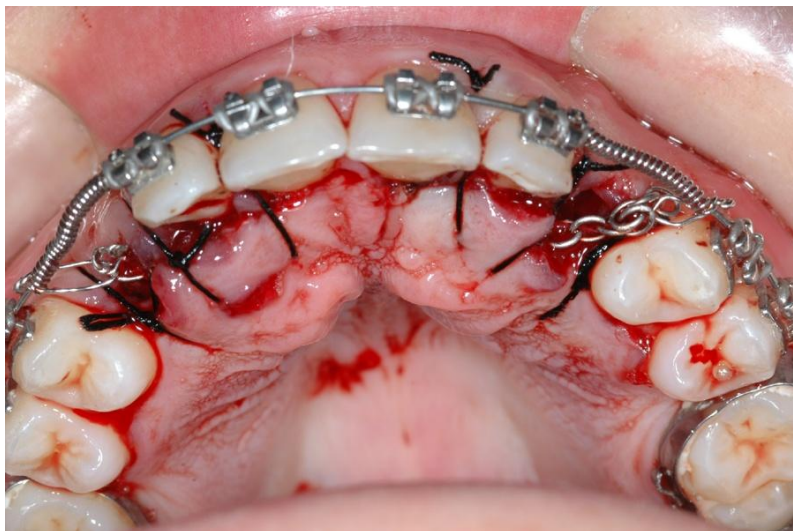


Fig2(e)



Fig2(f)





Fig2(g)



Fig2(h)



Fig2(i)



Fig3(a)



Fig3(b)

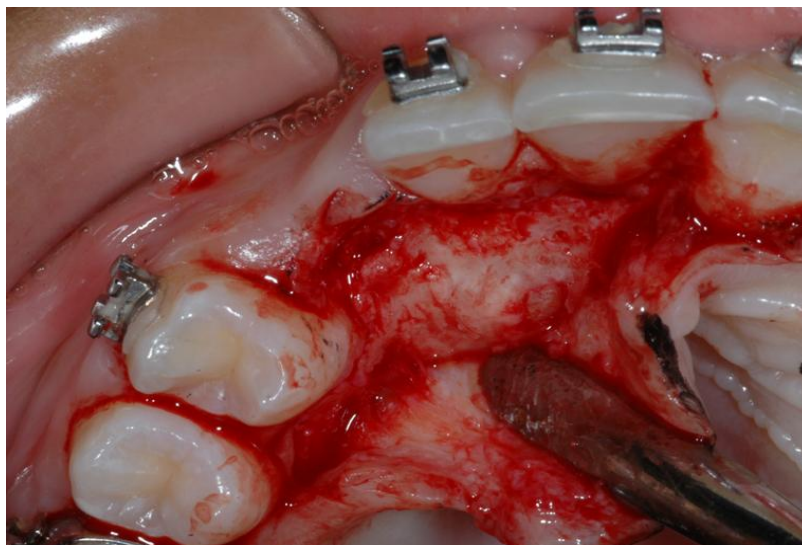


Fig3(c)





Fig3(d)



Fig3(e)

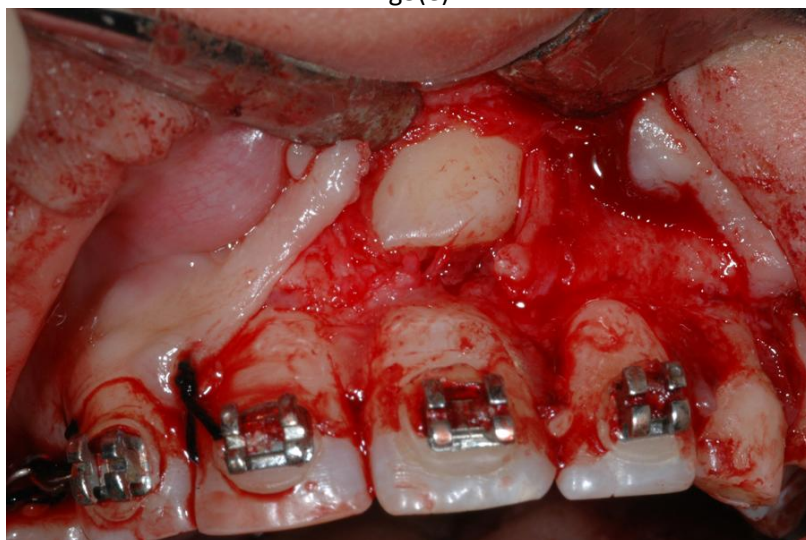


Fig3(f)



Fig3(g)

**Fig. 2a-c:** Bilateral palatally impacted canine: Cone Beam Computerized Tomography shows an accurate visualization of what the surgical field will look like, when the exposure is undertaken.

**Fig.3a:** a patient before the treatment The Orthopantomogram shows the displacement and retention of tooth 13 and 23 with persistence of the tooth 53 and 63

**Fig. 3b:** Clinical situation of the upper dental arch

**Fig. 3c:** Formation of a Mucoperiosteal flap and expose the crown of an impacted canine with substantial protection of the bone.

**Fig. 3d:** titanium chain by Watted (DENTAURUM).

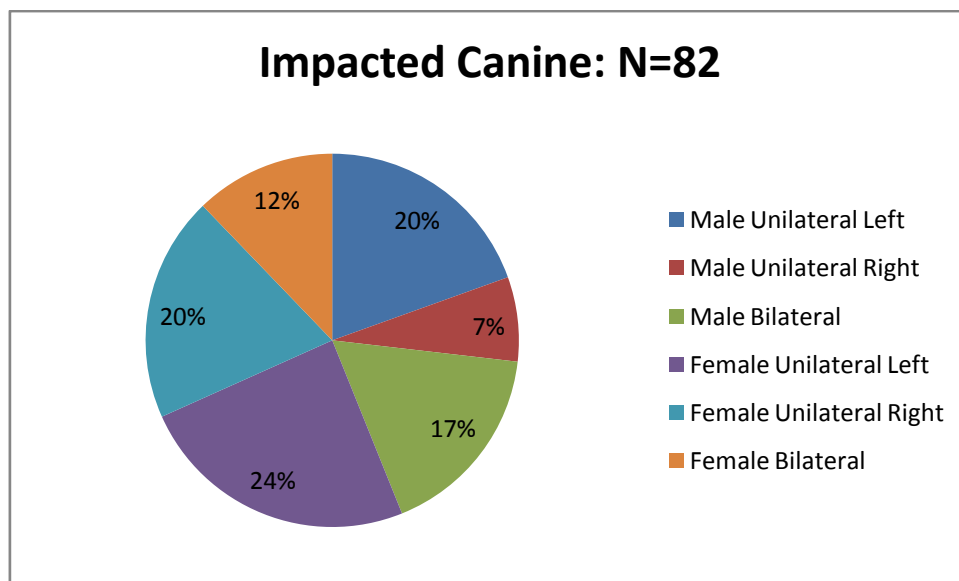
**Fig. 3e:** the full flap is now re-sutured into its former place and the titanium chain may be seen through the flap.

**Fig. 3f-h:** Clinical situation after the treatment

**Fig. 3i:** Orthopantomogram at the end of treatment.

**Fig. 4a,b:** Bilateral impacted canine. a: Palatally impacted , b: Buccally impacted

**Fig. 4c-g** Fixation of the attachment by means of light-curing resin after etching technique and repositioning of the flap (closed elongation). –



**Fig. 5: Distribution of retention by gender, side and location**