

# Surgical-Orthodontic Traction for Impacted Maxillary Canines: A Critical Review and Suggested Protocol

Cassiano Costa Silva Pereira  
Ellen Cristina Gaetti Jardim  
Abrahão Cavalcante Gomes de Souza Carvalho  
Walter Cristiano Gealh  
Natalia Manrique Coursino  
Idelmo Rangel Garcia Júnior

## ABSTRACT

Maxillary canine impaction is a common occurrence, especially in the palate, despite sufficient space in the arch for tooth alignment. A proper approach requires knowledge of different specialties of dentistry, such as orthodontics, surgery, radiology, and periodontology, which are generally not centered on a single professional. The causes for canine impaction may be either generalized or localized, and the diagnosis should be made through specific clinical and radiographic examination. The prognosis of surgical-orthodontic treatment depends on the position of the canine in relation to the neighboring teeth and height of the alveolar process, in addition to careful surgical technique, considering that there are risks involved, such as ankylosis, loss of tooth vitality, root resorption of the involved tooth and adjacent teeth, and damage to supporting tissues. Given the important role played by impacted maxillary canines, their traction is the treatment of choice in orthodontically treated patients. The present study reviews the literature on important factors to be considered when approaching impacted canines, such as therapeutic possibilities, their advantages and disadvantages.

**Keywords:** Traction, impacted canines, surgical-orthodontic treatment.

## Tracionamento Ortodôntico-Cirúrgico para Caninos Superiores Impactados: Revisão Crítica e Sugestão de Protocolo

### RESUMO

A impação de caninos superiores é uma ocorrência frequente, especialmente na região palatina, ainda que na presença de espaço suficiente para seu alinhamento na arcada.

---

**Cassiano Costa Silva Pereira, Ellen Cristina Gaetti Jardim** – MSc and PhD students in Surgery and Traumatology Maxillo-Facial – UNESP – Faculty of Dentistry – Araçatuba, SP, Brazil.

**Abrahão Cavalcante Gomes de Souza Carvalho** – MSc and PhD in Surgery and Traumatology Maxillo-Facial – UNESP – Faculty of Dentistry – Araçatuba, SP, Brazil.

**Walter Cristiano Gealh** – MSc in Surgery and Traumatology Maxillo-Facial – UNESP – Faculty of Dentistry – Araçatuba, SP, Brazil.

**Natalia Manrique Coursino** – Private Practice.

**Idelmo Rangel Garcia Júnior** – Professor, Department of Surgery and Traumatology Maxillo-Facial – UNESP – Faculty of Dentistry – Araçatuba, SP, Brazil.

**Corresponding Author:** Ellen Cristina Gaetti Jardim. Faculdade de Odontologia de Araçatuba – UNESP. Rua José Bonifácio, 1193 Bloco 10A – Araçatuba-SP. Tel.: 18. 36363237. E-mail: ellengaetti@gmail.com

Stomatol	Canoas	Vol. 18	Nº 34	p.78-83	Jan./Jun. 2012
----------	--------	---------	-------	---------	----------------

A abordagem exige conhecimentos de diferentes especialidades da odontologia, tais como a ortodontia, cirurgia, radiologia e periodontia e que, em geral, não se centram em um único profissional. Pode ser causada por fatores de ordem geral ou local, sendo que seu diagnóstico deve ser realizado por meio de exames clínico e radiográfico específicos. O prognóstico do tratamento ortodôntico-cirúrgico irá depender da posição do canino em relação aos dentes vizinhos e da sua altura no processo alveolar, além de técnica cirúrgica cuidadosa, haja vista que envolve riscos, como: anquilose, desvitalização, reabsorção radicular do dente envolvido e dos dentes adjacentes e dano aos tecidos de suporte. Em virtude das importantes funções desempenhadas pelos caninos inclusos superiores, o seu aproveitamento através do tracionamento é o tratamento de eleição nos pacientes assistidos ortodonticamente. O presente trabalho traz uma revisão bibliográfica acerca de importantes fatores a serem considerados na abordagem dos caninos impactados, tais como as possibilidades terapêuticas, suas vantagens e desvantagens.

**Palavras-chave:** Tracionamento, caninos impactados, tratamento ortodôntico-cirúrgico.

## INTRODUCTION

The canine is considered one of the most important teeth in the dental arch, both aesthetically and functionally. However, canine impaction is a common occurrence, second only to impaction of the third molars (2).

According to Puricelli et al. (17), the presence of a canine provides a smooth transition between the anterior and posterior arch segments, playing a specific role in mastication. According to Dewel (7), canine teeth determine the shape of the dental arch, defining the contour of the mouth, maintain the harmony and symmetry of the occlusal relationship, and support lateral movements and masticatory load. Rodrigues & Tavano (18) described the canine as the largest tooth in the arch, with the longest root, being supported by bone tissue that is structured specially to distribute forces among the craniofacial elements.

There are reports that maxillary canines have a longer eruption path, in terms of time and distance, in addition to a more tortuous path of eruption than any other tooth (5). Thus, several treatment suggestions can be found in the literature, including methods to guide or move the impacted teeth into proper position for occlusion. Removal of mechanical interference, such as supernumerary teeth or any pathology, and even the creation of space in the arch to allow spontaneous eruption have been described in the literature (8). However, in most cases, surgical exposure and orthodontic traction of the unerupted tooth are required to move the teeth to their correct arch position.

Several factors should be taken into account when surgical-orthodontic traction of an unerupted tooth is chosen, including meticulous surgical technique with complete flap closure, minimal removal of bone and dental follicle, avoiding manipulation of the root until the application of orthodontic mechanics, and application of light forces, with a reliable anchorage unit that is resistant to the applied load. Adverse effects on periodontal tissues and unfavorable aesthetic and functional results have been associated with inadequate diagnosis and treatment planning.

This study presents an objective review of the literature on the main factors that lead to successful treatment of impacted canines. Diagnosis, surgical-orthodontic treatment planning, therapeutic approaches and their advantages and disadvantages are emphasized in order to optimize the overall treatment time.

## **LITERATURE REVIEW**

The etiology of canine impaction may be related to general factors, such as inheritance, endocrine deficiencies, febrile diseases, and irradiation. Regarding local factors, the causes include tooth size-arch length discrepancy, prolonged retention, premature loss of primary canines, abnormal position of the tooth germ, presence of alveolar cleft, agenesis, ankylosis, supernumerary teeth, deleterious oral habits, trauma, disruption of the root structure, iatrogenic and idiopathic causes (1,3,10), and ectopic path of eruption (15). The incidence of canine impaction ranges from 0.92 to 2.2% (3), and may reach 2.56% of cases (14), occurring more frequently in the palatal than in the labial region (2:1). The condition affects females more than males (3:1), exhibiting left-sided predominance of unilateral occurrence (11).

The main signs observed on clinical examination to diagnose the presence of impacted canines are: delayed eruption after 14 years of age, prolonged retention of a primary canine, elevation of the palatal or labial mucosa, and distal migration of the crown of the maxillary lateral incisors with or without a midline shift (3).

The calcification process of maxillary permanent canines begins between 4 and 12 months of age, and the canines are complete at 6-7 years of age. The canine develops in the frontal process of the maxilla, near the infraorbital rim (19). This long path of eruption, starting at a high position beneath the orbital floor, contributes to the high frequency of eruption problems. After 8-9 years of age, the presence of canines may be diagnosed by palpation, which helps identify their general position and crown angulation. The canine only emerges into the oral cavity when  $\frac{3}{4}$  of the root is formed (5).

Dental crowding is regarded as a factor causing an ectopic path of eruption in permanent canines. There is sufficient space for eruption of palatally impacted canines in 85% of cases, whereas 83% of labially impacted canines exhibit dental crowding (10).

Radiographic examination is essential for the diagnosis, confirming the presence of an impacted canine in the upper jaw at buccolingual, cervico-occlusal and mesiodistal directions, as well as its relationship with adjacent structures. On radiographs, other aspects related to the canine should also be observed, such as root formation and morphology, presence of crown or root resorption, and cysts, among others. Lateral, panoramic, occlusal, or periapical radiographs can be performed (using Clark's technique for buccolingual localization), and computed tomography (CT) as deemed necessary.

Clark's technique extends the versatility of the diagnosis by using two intraoral periapical films. The first film (orthoradial projection) enables mesiodistal and cervico-occlusal assessment. The second film (with a mesial or distal shift) adds the possibility

of diagnosis at the buccolingual position. Periapical radiographs associated with clinical evaluation are sufficient to determine the exact position of the canines in 92% of cases (9).

In the presence of an unerupted canine in the permanent dentition, the orthodontist, supported by orthodontic records and reliable clinical evaluation, should determine the actual need for orthodontic treatment. At first, extraction is not recommended, given the great importance of the maxillary canine in the dental arch, both aesthetically and functionally. The prognosis of surgical-orthodontic traction depends on many factors, including the position of the canine in relation to the adjacent teeth and height of the alveolar process (3). The orthodontist, the patient and/or parents should be aware of the advantages and risks of treatment, such as ankylosis, loss of tooth vitality, possible root resorption of the canine and adjacent teeth, and damage to supporting tissues.

As a rule, after dental age assessment (from the beginning of the calcification process of the canine until complete formation of the root apex), correlating it with chronological age at each stage, the appropriate moment for surgical-orthodontic treatment is defined.

Before the introduction of bonding materials (composite resin and ionomer), orthodontic appliances and the development of more conservative surgical techniques, the failure rate was particularly high in the treatment of impacted teeth. Alternative approaches, such as circumferential steel wires around the crown, perforation in the crown, and cementation of threaded pins, provided poor and ineffective results regarding orthodontic movement and especially regarding the health of teeth and supporting tissues. The excessive and traumatic removal of bone tissue may result in ankylosis and external resorption. Perforation in the crown is not recommended due to risk of pulp damage and crown destruction (20).

Currently, the most widely used technique involves surgical exposure of the crown, with a full-thickness flap involving the keratinized gingiva and alveolar mucosa, with one or two relaxing incisions, and minimal removal of bone and dental follicle (sufficient to attach an orthodontic appliance). Then, the tooth is etched with 37% phosphoric acid, and with a clean and dry surgical field, an orthodontic appliance (bracket, mesh, or button) is bonded with a composite resin or glass ionomer adhesive. Bond strength should be tested before complete flap closure to prevent detachment and the need for further surgery.

There are several methods for traction and alignment of impacted canines, including fixed or removable appliances, anchorage in the same or in the opposite arch, and mini-implants used for orthodontic anchorage. In general, fixed orthodontic appliances offer greater and more effective control of the traction force applied. In addition, in most cases there is a need to correct some type of associated malocclusion and to open and maintain space for the tooth to be erupted (20).

Use of a rectangular orthodontic wire, with a minimum thickness of 0.018" x 0.022", is recommended to support the forces moving the impacted canine and considered sufficient to resist to the traction movement together with the anchorage effort (upper lingual arch supported on the first molars or the posterior teeth wired together).

There is controversy regarding the amount of load applied to surgical-orthodontic traction. Bishara et al. (3) suggest a load not exceeding 60 g, Odegaard (16) recommends 75 to 100 g, and Crescini et al. (6) 100 g. Forces should be applied by means of springs, elastics, stainless steel ligatures, or a helical-shaped device attached to the orthodontic arch (12,13).

In surgical planning, extraction of the primary canine, if present, should be considered during surgery for traction (6) or at a later stage after movement of the permanent canine is observed (4). Likewise, when extraction of the first premolar is indicated to gain space, it should not be performed until movement of the impacted canine is observed, thus ruling out the possibility of ankylosis (3).

## CONCLUSIONS

1. Extraction of impacted canines is recommended with a 45-degree inclination, high position, close to the midline and the roots of the adjacent teeth.

2. Traction of impacted canines involves surgical exposure, acid etching, an orthodontic appliance bonded to the crown of the involved tooth, and finally the application of orthodontic forces.

3. The closed eruption technique should be the choice of treatment, with conservative removal of bone tissue and complete flap replacement, producing better aesthetic and periodontal results, with preservation of the attached gingiva.

4. Fixed orthodontic appliances should be used as a basis for traction, due to better resistance to reactive forces and distortions.

5. The canine should be moved using light forces, resulting from elastics, springs or stainless steel ligatures, not exceeding 100 g.

6. The basis for traction forces should be anchored on a rectangular wire, providing minimum deflection and fewer unwanted effects on the anchorage unit.

7. Maintaining space should be a priority, aided by acrylic resin space maintainers, springs, or tubes.

8. Before extraction of the first premolar, it is essential to check whether the impacted canine has responded positively to surgical-orthodontic traction, thus minimizing further sequelae.

## REFERENCES

1. Becker A, Birnstein E, Shteyer A. Interdisciplinary treatment of multiple unerupted supernumerary teeth. *Am J Orthod Dentofac Orthop.* 1982; 81(5): 417-422.
2. Boyd RL. Clinical assessment of injuries in orthodontic movement of impacted teeth. *Am J Orthod.* 1982; 82(6): 478-486.
3. Bishara SE. Management of impacted canines. *Am J Orthod.* 1976; 69(4): 371-387.
4. Bishara SE. Impacted maxillary canines: A review. *Am J Orthod Dentofac Orthop.* 1992; 101(2): 159-171.
5. Broadbent BH. Ontogenic development of occlusion. *Angle Orthod.* 1941; 11: 223-241.
6. Crescini A, Clauser C, Giorgetti R, Cortellini P, Pini Prato GP. Tunnel traction of infraosseous impacted maxillary canines. A three-year periodontal follow-up. *Am J Orthod Dentofac Orthop.* 1994; 105(1): 61-72.
7. Dewel BF. The upper cuspid: Its development and impaction. *Angle Orthod.* 1949; 19 (2): 79-90.
8. Duncan WR, Ashrafi MH. Management of non-erupted maxillary anterior tooth. *J Am Dent Assoc* 1983; 106 (5): 640-644.
9. Ericson S, Kurol J. Incisor resorption caused by maxillary cuspids: a radiographic study. *Angle Orthod.* 1987; 57(4): 332-346.
10. Jacoby H. The etiology of maxillary canine impactions. *Am J Orthod.* 1983; 84(2): 125-132.
11. Johnston WR. Treatment of palatally impacted canine teeth. *Am J Orthod.* 1969; 56(6): 589-596.
12. Kornhauser S, Abed Y, Harari D, Becker A. The resolution of palatally impacted canines using palatal-occlusal force from a buccal auxiliary. *Am J Orthod Dentofac Orthop.* 1996; 110(5): 528-534.
13. Magnusson H. Saving impacted teeth. *J Clin Orthod.* 1990; 24(4): 246-249.
14. McKay C. The unerupted maxillary canine an assessment of the role of surgery in 2500 treated cases. *Brit Dent J.* 1978; 3: 207-210.
15. Newcomb MR. Recognition and interception of aberrant canine eruption. *Angle Orthod.* 1959; 68: 161-168.
16. Odegaard J. The treatment of a Class I malocclusion with two horizontally impacted maxillary canines. *Am J Orthod Dentofac Orthop.* 1997; 11(4): 357-365.
17. Puricelli E, Friedrich CC, Horst SF. Canino retido por anquilose. *RGO.* 1993; 41(6): 360-368.
18. Rodrigues CBF, Tavano O. Os caninos e os seus envolvimento no equilíbrio estético. *Rev Assoc Paul Cirurg Dent.* 1991; 45(4): 529-534.
19. Silva Filho OG, Fugio N, Capelozza Filho L, Cavassan AO. Irrupção ectópica dos caninos permanentes superiores: soluções terapêuticas. *Ortodontia.* 1994; 27(3): 55-66.
20. Tanaka O, Daniel RF, Vieira SW. O dilema dos caninos superiores impactados. *Ortodontia Gaúcha.* 2000; 4(2): 121-128.