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## **SURGICAL-ORTHODONTIC SYMBIOSIS IN THE TREATMENT OF MAXILLARY IMPACTED CANINES**

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### **Abstract**

*The maxillary permanent canine is the dental organ whose intra-osseous retention is frequent. The objective of our study was to describe the surgical-orthodontic symbiosis in the treatment of impacted maxillary canines. This is a cross-sectional retrospective descriptive study relating to a literature review including articles published from 2012 to 2021. The study was carried out from November 2019 to January 2021. We collected 15 recent articles. The pre-surgical and surgical orthodontic stages with the use of open and closed techniques have been described. Orthodontics with fixed appliances linked the treatment. Success was judged by dental alignment. Techniques and therapeutic means allow a better implementation of surgical and orthodontic protocols. This involves a complete and multidisciplinary clinical examination.*

**Key words :** *Surgery, Orthodontics, Canine.*

## INTRODUCTION

An impacted canine is defined as "a tooth retained in the maxillary or mandibular arch beyond its eruption date, surrounded by its pericoronal sac and without communication with the oral cavity" [1].

The canine plays a role in occlusion (release during lateral movements, support of arch width...) and its positioning on the arch is essential to ensure occlusal function. In order to limit the consequences of inclusion, particularly root resorption in adjacent teeth, diagnosis must be early and precise, so that appropriate treatment can be initiated [2].

Worldwide, maxillary canines rank third among dental inclusions, with a frequency of 0.92-4%, far behind mandibular (22%) and maxillary (18%) wisdom teeth. This compares with a frequency of 0.10% to 0.35% for mandibular canines [3].

The overall aim of this study was to describe the surgical-orthodontic symbiosis in the treatment of maxillary impacted canines.

## METHODOLOGY

This is a descriptive, retrospective, cross-sectional study using a literature review during the period from January 2012 to December 2021.

Our study included articles on the surgical-orthodontic management of maxillary impacted canines, published from 2012 to 2021 and written in French or English.

We excluded all articles on the surgical management of maxillary impacted canines published before 2012 and not in English or French.

We opted for exhaustive sampling, reaching a sample size of 15 articles.

The variables studied were: year of publication, type of article, radiological examinations, pre-surgical orthodontics, surgical techniques, orthodontic means and treatment success.

Searches were carried out using PubMed, Google Scholar, Science direct and the Medline and Cochrane databases, using the following keywords and the Boolean operators "and", "and", "or", "or", "except", "not".

Data were collected in a pre-tested and validated data extraction form corresponding to each article. The data obtained was then analyzed.

**RESULTS****Table 1 :** Distribution of year of articles

| <b>Years of articles</b> | <b>Number (n)</b> | <b>Pourcentage (%)</b> |
|--------------------------|-------------------|------------------------|
| 2012                     | 1                 | 6,7                    |
| 2013                     | 1                 | 6,7                    |
| 2015                     | 5                 | 33,3                   |
| 2016                     | 2                 | 13,3                   |
| 2017                     | 2                 | 13,3                   |
| 2018                     | 4                 | 26,7                   |
| Total                    | 15                | 100                    |

**Table 2 :** Distribution of type of articles

| <b>Types of articles</b> | <b>Number (n)</b> | <b>Pourcentage (%)</b> |
|--------------------------|-------------------|------------------------|
| Original articles        | 13                | 86,7                   |
| Clinical case            | 1                 | 6,7                    |
| General revue            | 1                 | 6,7                    |
| Total                    | 15                | 100                    |

**Table 3** : Distribution of articles by radiographic examination

| <b>Radiography</b> | <b>Number (n)</b> | <b>Pourcentage (%)</b> |
|--------------------|-------------------|------------------------|
| Retroalveolar      | 1                 | 6,7                    |
| Occlusal           | 1                 | 6,7                    |
| Teleradiography    | 1                 | 6,7                    |
| Panoramic          | 6                 | 40                     |
| Scanner            | 5                 | 33,3                   |
| Others             | 1                 | 6,7                    |
| Total              | 15                | 100                    |

**Table 4** : Distribution of items by pre-surgical orthodontics

| <b>Pré-chirurgical orthodontics</b> | <b>Number (n)</b> | <b>Pourcentage (%)</b> |
|-------------------------------------|-------------------|------------------------|
| Levelling, space opening            | 8                 | 53,3                   |
| Space maintenance                   |                   |                        |
| Not specified                       | 7                 | 46,7                   |
| Total                               | 15                | 100                    |

**Table 5** : Distribution of items by surgical technique

| <b>Surgical technique</b> | <b>Number (n)</b> | <b>Pourcentage (%)</b> |
|---------------------------|-------------------|------------------------|
| Open closed               | 8                 | 53,3                   |
| Others                    | 2                 | 13,3                   |
| Not specified             | 5                 | 33,3                   |
| Total                     | 15                | 100                    |

**Table 6 :** Distribution of items by orthodontic appliances

| <b>Orthodontics appliances</b> | <b>Number (n)</b> | <b>Pourcentage (%)</b> |
|--------------------------------|-------------------|------------------------|
| Amovible                       | 1                 | 6,7                    |
| Fixed                          | 10                | 66,6                   |
| Mini-implant                   | 2                 | 13,3                   |
| Others                         | 1                 | 6,7                    |
| Not specified                  | 1                 | 6,7                    |
| Total                          | 15                | 100                    |

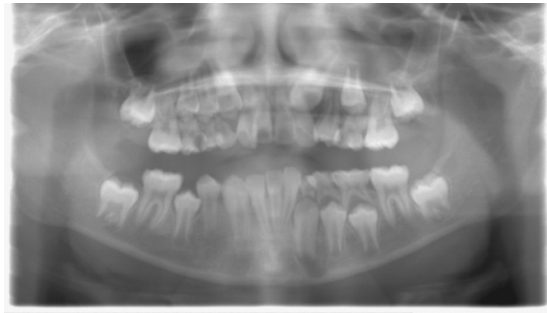
**Table 7 :** Distribution of articles according to therapeutic success

| <b>Therapeutic success</b> | <b>Number (n)</b> | <b>Pourcentage (%)</b> |
|----------------------------|-------------------|------------------------|
| Parodontal health          | 1                 | 6,7                    |
| Teeth vitality             | 1                 | 6,7                    |
| Teeth alignement           | 2                 | 13,3                   |
| Not specified              | 11                | 73,3                   |
| Total                      | 15                | 100                    |

## DISCUSSION

The most advanced radiological examinations were panoramic (40%), followed by CT (33.3%). Retroalveolar, occlusal, teleradiography and others were equally important (6.7%). In the case of impacted teeth, the clinical examination can be used to hypothesize the presence of an impacted tooth, but it is really only the various radiological examinations that can confirm the diagnosis of an impacted canine. According to Fleury (1985) and Messaoudi: "The diagnosis of impacted canine is almost always made radiologically, since 79% of inclusions are asymptomatic. X-rays allow us to observe the general dental condition (caries, coronal and root fillings, pulpal or apical lesions, displacements) and the relationship between the impacted tooth and the other teeth, as well as the various anatomical elements (sinuses, nasal cavities, inferior dental nerve)". [4,5]. The recommendation put forward by the Société Française de Stomatologie, de Chirurgie Maxillo-Faciale et de Chirurgie Orale (SFSCMFCO)

and the Société Médicale d'Orthopédie Dento-Maxillo-Faciale in July 2015 states that: "Classically, in order to assess the position of the canine, it is proposed to take 2 conventional radiographs using the horizontal and vertical parallax technique. For the horizontal parallax technique, 1 anterior occlusal X-ray and one or 2 retroalveolar X-rays are recommended. For the vertical parallax technique, one anterior occlusal and one panoramic or one retro-alveolar and one panoramic are recommended, and the Cone Beam can be proposed to improve patient management." [6,7].



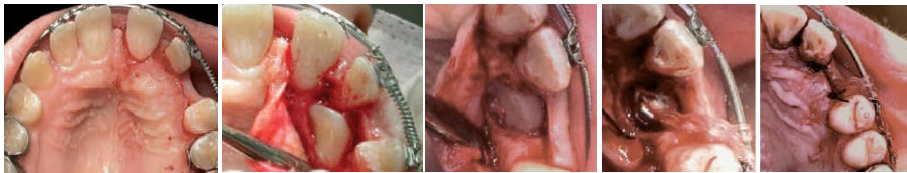
**Figure 1:** Panoramic radiography (Source : Randrianarimanarivo Henri Martial)

Pre-surgical orthodontics is dominated by levelling, space opening and space maintenance (53.3%). According to Boileau in 2012: "Before any intervention, treatment most often begins with an orthodontic phase that has two main objectives: to create the necessary, or even slightly greater, space for the pulled tooth to take its place on the arch (mesio-distal diameter of the tooth to be pulled + approx. 2mm), this space can be measured using a caliper directly in the mouth, or on a plaster model from a study impression; and to prepare the arch to withstand the reaction induced by orthodontic traction on the impacted tooth." [8].



**Figure 2 :** Pre-surgical orthodontic preparation (Source : Rakotoson Mariette)

Open and closed surgical techniques were the most explained (53.3%); however, other techniques were also put forward (13.3%). According to the Société Française de Stomatologie, de Chirurgie Maxillo-Faciale et Chirurgie Orale in 2015: Two main techniques, "open" and "closed" are proposed for canines included in the palatal position. The so-called "open" technique involves surgically exposing the tooth, prior to orthodontic treatment, by removing a window of tissue around the tooth and then placing a dressing to cover the area for around ten days. A surgical dressing is then removed and the canine can erupt spontaneously. Once sufficient eruption has taken place, an attachment is placed on the tooth to enable it to be properly positioned on the arch. The "closed" technique also involves surgically exposing the tooth and pulling it after repositioning the palatal flap. The closed technique requires the necessary emergence space for the canine to be prepared prior to traction [9,10].



**Figures 3-4-5-6-7 :** Closed surgical technique (Source : Delsol, 2008)

The orthodontic appliance most frequently mentioned was the fixed appliance (66.6%), followed by the mini-implant (13.3%). Removable appliances and other means were also cited, with equal percentages (6.7%). Lecomte (2018) points out that orthodontic appliances are designed to retain the space created, prevent loss of anchorage and limit or even cancel parasitic movements that may occur in the anchorage teeth. Orthodontic appliances may include continuous archwires attached to other teeth with brackets, Nance palatal archwires, transpalatal archwires, Quadhelix, extra-oral force or lingual archwires [11].



**Figure 8 :** Fixed appliance fixe (Source : Rakotoson Mariette)

Treatment success was judged mainly by dental alignment (13.3%), followed by periodontal health and dental vitality at 6.7% respectively. The eruption success rate is more favourable in younger patients; clinical results conclude in better periodontal health, shorter operating time, reduced perception of post-operative pain and improved canine aesthetics [9,12].

## CONCLUSION

A total of 15 papers were reviewed, dominated by original papers of European origin, with a predominance of young women. Diagnosis remained complete before surgical decision, panoramic radiography was most recommended, pre-surgical orthodontics enabled surgical preparation, surgical techniques were most represented by open and closed techniques, fixed orthodontics was the most used means and treatment success depended mainly on dental alignment.

Treatment of maxillary impacted canines using surgical-orthodontic symbiosis is a complex procedure requiring multidisciplinary expertise. We intend to broaden our scope of investigation through a clinical case study using mini-screws as an anchoring device in Madagascar

## REFERENCES

1. Delsol L, Orti V, Chouvin M, Canal P. . Canines et incisives maxillaires incluses. Diagnostic et traitement. Encyc Med Chir (Paris). 2008 ; 28-635-G-10.
2. Auclair AC, Baralle MM, Bery A, Blanchard PY, Bourdillat MC, Fusari JP, et al. Management of an impacted canine tooth. Recommendations for good practice. Société Française de Stomatologie, Chirurgie Maxillo-Faciale et Chirurgie Orale.2015 ; 1 – 43.
3. Dersot JM. Periodontal surgery of the maxillary impacted canine for orthodontic purposes : Proposal for a surgical decision tree. Elsevier Masson SAS, Paris, France. Intern Orthod. 2017 ; 15 : 221-37.
4. Fleury J, Deboets D, Assad-Auclaire C, Maffre N, Sultan P. The impacted canine: update on 212 observations. General principles of treatment. Rev Stomatol Chir Maxillofac.1985 ; 86 : 122-31.
- 5.Messaoudi Y, Coudert JL, Akin JJ. Contribution of three-dimensional reconstruction using 3DNEO software in the surgical-orthodontic treatment of impacted teeth.EDP Sciences. 2013 ; 84 : 147-55.



6. Blanchard PY, Kerbrat JB, Paulus C, Saint-Pierre F. Management of impacted cuspid july 2015. Elsevier Masson SAS. 2018 ; 2-5.
7. Cloitre A, Lemoine S, Lesclous P. Orthosurgical management of impacted maxillary canines. Clinical realities.2018 ; 29 : 2-5.
8. Boileau M-J, Canal P. Orthodontics for children and young adults. Volume 2.Issy-les-Moulineaux: Elsevier Masson; 2012. 312.
9. French Society of Stomatology, Maxillofacial Surgery and Oral Surgery. Management of an impacted canine. Recommandations de Bonne Pratique.2015 ; 1-43.
10. Bagard G. Orthosurgical traction failures: transplantation or implantology.Open Sciences. 2017 ; 3-141.
11. Lecomte N. Maxillary and mandibular impacted canines: anatomical setting and surgical techniques.Open sciences ; Sciences du vivant. 2018 ; 1-151.
12. Zerouaoui MF, Bahije L, Zaoui F, Rerhrhaye W. Orthodontic-surgical placement of impacted canines: ways of predicting failure.EDP Sciences. 2012 ; 1-13.