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Retained upper canines: Physiopathology, diagnosis and treatment. Report of a clinical case and literature review

Blanca Delgado Galíndez[1], Alfredo Calderón Durán[2], Alexis Eduardo Zavala Santiago[3], Liliana González Luna[3]

[1] Surgeon Professor, Anahuac University North of Mexico, Master's Degree in Administration Health Institutions UNAM Mexico City, Mexico

[2] Surgeon Profesor, UNAM Mexico City, Oral and Maxillafacial Surgeon Attached to the General Hospital Medical Tower Tepepan, Mexico City Mexico

[3] Intern, General Hospital La Perla of the Health Institute of the State of Mexico, University Health Clinic UNAM, Mexico City, Mexico

Abstract
The Canine impactation is usually a cause of medical consultation. Untreated impacted canines may result in several complications such as shortening of the dental arch, formation of folicular cysts, canine tooth anquilosis, recurrente infections, internal or external resorption of the canine and adjacent or combinations. Surgical extraction should be the last option, taking into account the shape of the routs (root dilaceration, ankyloisis), position of the dental crown (horizontal, buccopalatal, intra – alveolar, palatal, ectopic or inverte position), relation to neighboring anatomical structures, resorption of neighboring teeth and presence of the other associated pathology. We must make a careful treatment plan for each particular case. Informing the patien of their real expectations.

Keywords: Retained upper canines, pathophisiology, surgery treatment

Introduction

Canine teeht play a very important role in the functioning and facial aesthetics of individuals. The causes of retention can be local o general, being more frequent the local ones, which can be found as biochemical alterations in the tooth germ, trauma, dentomaxillary discordance or even premature los of temporary teeth [1]. The formation of the upper canine begins at four to five months of age and the enamel is fully formed between six and seven years of age, erupts on average at 11.6 years of age and its root is fully formed by 13.6 years of age [2]. According to Dewel, the maxillary canines have the longest period of development, as well as the most tortuous path from their lateral formation to the piriform fossa, where the germ forms in a very high position on the anterior wall of the nasal antrum and below the orbit.

However, both canines are very similar even in their functions. Their root is the longest of the dental organs, because of their shape and position they are the ones that guide the teeth to their intercuspid position. Finally, dental retentions are those that remain beyond their normal eruption period, as they can be retained by osseous (intraosseous structures), by mechanical action (obstacles such as other dental organs), or submucosal (under the mucosa or gingival).

This article carries out a documentary review of the pathological aspects, diagnosis and surgical treatment of retained upper canines. It is also ilustrated with the surgical management of a clinical case of a retained upper canine near the nasal floor tha.

Physiopathology

Eruption is the movement of the tooth into the oclusal plane. It beging when crown formation is complete and roof formation has begun. The mechanism of tooth eruption is related to aspects su: #ch as: root growth, hydrostatic presssure, selective bone resorption and periodontal membrane traction. Root growth does not seem to be very determinant, since they can erupt with very Little root developtment, or because the eruptive trejectory is usually larger than the root as in the case of the permanent upper canine.

The factor most closely linxed appears to be metabolic activity at the level of the periodontal ligament. The process of tooth eruption is a complex physiological phenomenon, which leads, the dental organs from an intraosseous position to the occlusion with its antagonist and beyond, to maintain that position in the arch throughout the life of the individual [3].

According to Rodríguez M [4]: "the eruption process is governed by endocrine control, and begins when the calcification of the crown has finished and inmediately after two thirds of the root begings the calcify due to the action of the periodontal forcé, which provides the forcé eruptive.

Phases of tooth eruption:

1. Pre-eruptive pase: it begins with the formation of the germens and ends when a third of its root has been formed, the tooth moves vertically towards the gun.
2. Pre-functional eruptive pase: it begins with the formation of the rooth and ends when the tooth contacts its antagonist
3. Functional eruptive phase: it begins at the moment of oclusal contact with its antagonist and the masticatory function begins.

When the dental eruption is delayed or there is a clinical absence in the case of the permanent upper canine, once its normal eruption stage has passed, it is usual for the patient

to come for consultation. We then face a dental retention. The main causes of delayed dental eruption are classified into system and local. The first usually occur as a consequence of some syndrome (Down, Gardner, Dysostosis, Cleidocraneal, Hypothyroidism, etc.). The latter are the most frequent and may be due to lack of space in the arch or premature los of primary teeht, ankylosis, pathologies such as cysts and tumors and deviation of the eruptive line. The maxillary canine is the most frequently retained tooth, after the mandibular third molar. It may have an ectopic eruption or become embedded and retained intraosseously or submucosally.

Clinical evaluation

Retention of the canine can be considered when its eruption has been delayed and there is radiographic or clinical evidence of lack of space in the dental arch. According to Hurme, cited by Radi and Villegas [6], "the eruption of the upper canine delayed after 12.3 years in women and 13.1 years in men. At this stage, 80 percent of the canines should already have erupted".

Undoubtedly, the upper canine plays a very important role in facial aesthetics, since its correct position in the arch contributes to the proper contour of the face, facial symmetry and aesthetic appearance, as well as proper occlusal function.

The presurgical clinical evaluation includes the physical examination and clinical examination. The pre-surgical protocol includes clinical history, imaging studies, pre-operative laboratories and, if necessary, the pre-operative evaluation. It is important to consider the informed consent, the surgical authorization and the complete medical history. Undoubtedly, management is multidisciplinary including the dental surgeon oral and maxilofacial surgeon, orthopedist, orthodontist, and in case of management under general anesthesia, the anesthesiologist. The conscientious study of each particular case will define the type, technique and post-surgical management.

Radiographic evaluation

Imagin studies are a diagnostic method of great support, when are going to carry out a surgical procedure to extract a retained dental organ. Each radiographic image provides an aspect of size, shape, position of the crown and root, depth of retention, proximity to neighboring dental organs and anatomical structures, such as the nasal floor and maxillary sinus, root resorption and the presence or not of associated pathology. The periapical radiography offers a two dimensional view, in the frontal and mesiodistal. The oclusal image, locates the canine in a vestibule-lingual plane and its relationship with other teeth.The panoramic radiography offers a general view of both jaws, being able to bserved the retention of the canine and its proximity to other teeht. Finally, Cone Beam Computed Tomography (CBCT); provides a view in three dimensions (axial, sagital and coronal). Allows a more accurate diagnosis, providing predictable surgical management and treatment; reducing the associated risks allowing to plan a minimally invasive surgery. It is very useful for impacted maxillary canines, since it provides exact information on the size of the follicle, its labial or palatal position, amount of bone that covers it, angulation of its main axis, size of the root and resorption of incisors. The KPG index created by Kau *et al*., predicts the degree of difficulty of maxillary canine treatment and the degree of retention, locates with exact precisión the position of retained canines by three-dimensional images. Locate the canine in three spatial planes: X, Y, and Z. Eje X: the X axis, is evaluated in a panoramic view, determines the mesiodistal position of the crown and root, in relation to the adjacent teeth. Eje Y: the Y axis determines the position of the cusp tip or ápex of the canine, and the Z axis is displayed in axial slices, distances are measured perpendiculary from the cusp or ápex tip to the occusal plane in increments of two millimeters, helps diagnose the severity of the retention. The sum of the scores will determine the complexity of the treatment: simple from 0 to 10, moderate from 10 to 14, difficult from 15-19, 20 and more extreme difficulty [7]. Cone Beam tomography allows a more accurate diagnosis, providing predictable surgical management and treatment; reducing the associated risks and allowing to plan a minimally invasive surgery. It is very useful for impacted upper canines since the image obtained is more precise.

Surgical treatment

The canines are considered important teeth for the stomatognathic system, being essential for laterality movements and vital for the continuity of the dental arches, responsible for the function and occlusal harmony [8].

Radi and Villegas [6] affirms that: "surgical procedures related to the retention of the canine can be classified according to the age of the patient, his dental development and possibilities of eruption". They may include early conservative procedure, late or radical procedure whose objective is the removal of the canine. The latter is used in cases where root formation has completed and there is no space available in the dental arch for its eruption, is in an ectopic position or associated with cystic or tumor pathology. However, in surgical extraction, the angulation of the canine root, size, position and shape of the root, depth in the bone, even age, sex, and emotional stability of the patient must be considered.

The Bishara criteria, cited by Radi and Villegas (6), included: Ankylosis, Internal or external resorption, Curved or dilacerated root, Severe retention, Acceptable occlusion, the premolar tooth, takes the place of the canine and Pathological changes The principles for perfoming a surgical extraction in a general way are: an adequate design, incision and carving of the flap and correct osteotomies. When necessary, odontosections must be performed, we must also ensure adequate management of the flap and control of bleeding. Follow—up, posoperative control, pharmacological treatment and hygienic – dietary indications, must be considered in the comprehensive management of the patient.

Clinical case

Female patient, 25 years old. Native and resident of Mexico City. Without systemic history of importance for the current condition, which begins with development and growth, presenting clinical absence of the upper right permanente canine, she went to the University Clinic, requesting dental care for basic sanitation. The first time assessment is carried out, taking the medical history and, in the examination clinical absence of the upper right permanente canine is observed, severa gyroversión of the upper lateral incisor on

the same side and dental malocclusion, mouth opening is nomal. In the tomography study, in a mid-sagittal cut, the retention of the upper right canine can be observed, located in the buccal vestibule and close to nasal floor, in the tomographic image in coronal section, the position of the canine and its proximity to the adjacent teeth can be appreciated (Fig. 1a and b). The three-dimensional reconstruction shows the retained upper canine and its proximity to neighboring anatomical structures, especially the nasal floor. In another deeper cut at a depth of 3cm, the trajectory of the retained canine and the arrangement and angulation of the dental root can be seen (Fig. 2a and b).

The preoperative laboratory studies were whithin normal parameters, once the surgical authorization sheet and the informed consent were signed, the surgery was scheduled and carried out under regional anesthesia. After asepsis and antisepsis and placement of fields in the usual way, the surgical procedure begins. The incision was designed with a sterile gentian violet nib and the contouring incision was made with a liberator in a single intention (Fig. 3a and b). A total thickness flap was dissected exposing the operative field. After osteotomy, the retained canine is located, odontosection is carried out (Fig. 4a and b), carefully removing the root, subsequently, the crown is avulsed and extracted (Fig. 5a and b). Once the retained canine is extracted, the surgical bed is washed and healed, hemostasis is performed and the surgical wound is sutured with 3 zero poliglycolic acid, with isolated stitches (Fig. 6 a and b). The postoperative control shows the surgical wound completely healed and with a satisfactory evolution (Fig.7). The patient is discharged from surgery and is sent to the orthodontic department to continue her management.

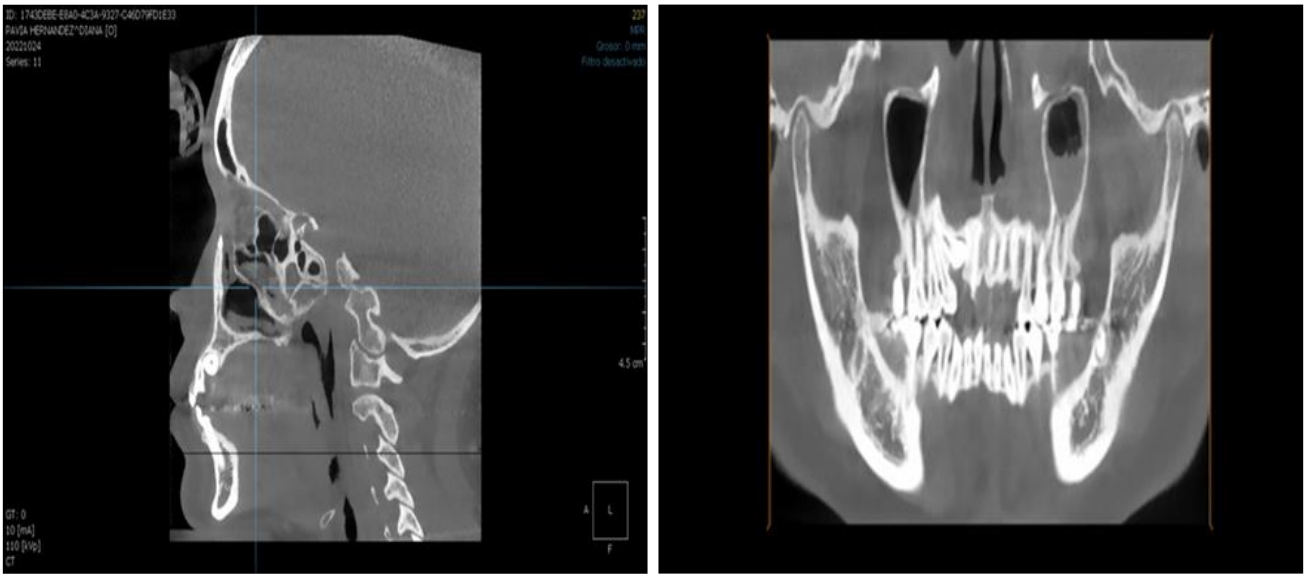

Fig 1: a) Tomographic image in mid-sagittal section, where the retained upper canine can be seen, close to the nasal floor, b)Tomographic image in coronal section, showing the position of the upper canine

Fig 2: a) Cone beam digital volumetric tomography shows retained canine with vestibular location, its relationship with adjacent teeth and neighboring anatomical structures, b) Cone Beam, coronal section that shows the trajectory of the upper canine, its shape and size of the root, which is dilacerated

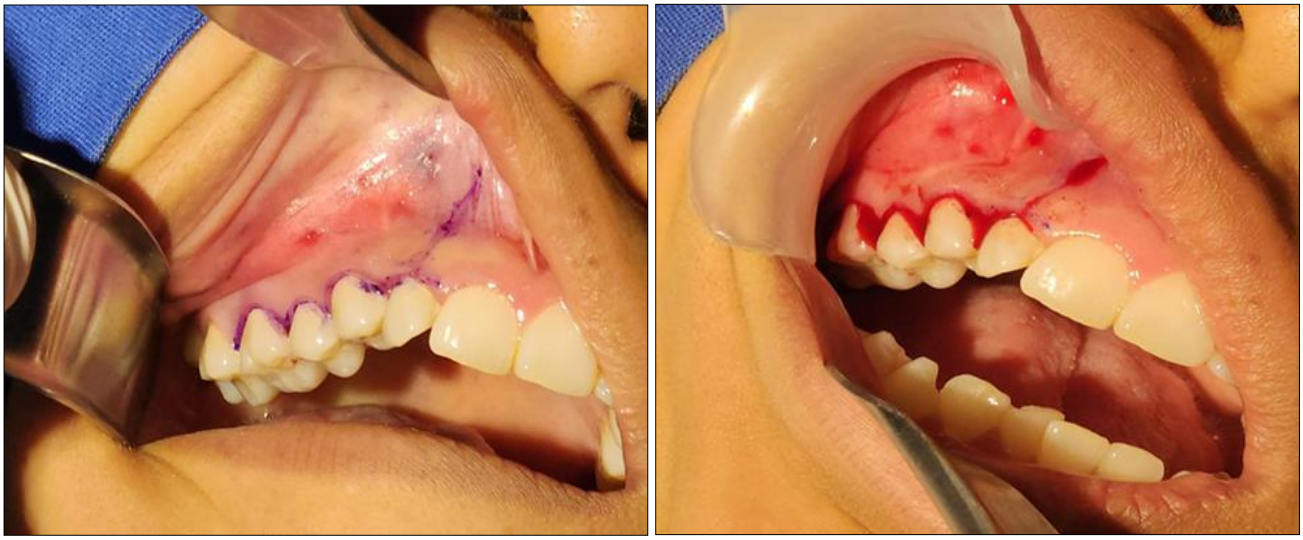

Fig 3: a) The incision is designed with a sterile gentian violet nib, b) Single intention incision is performed

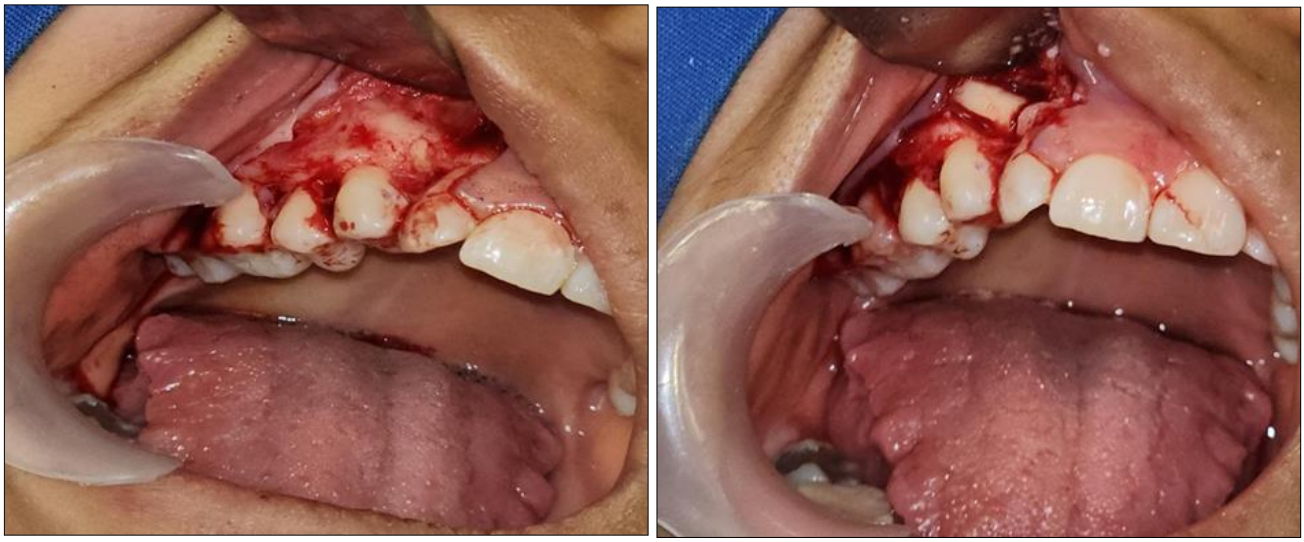

Fig 4: a) The full-Thickness (mucoperiosteal) flap is carve and carefully mirrored, b) The root is sectioned with the SS White 702L surgical drill

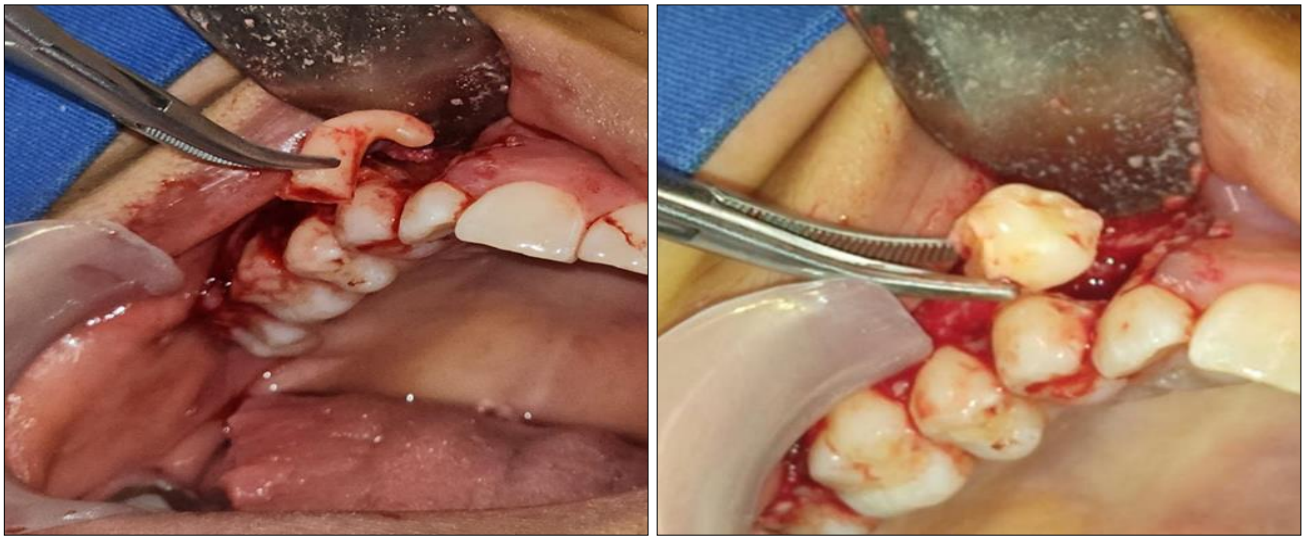

Fig 5: a) Once the tooth root has been sectioned, it is removed from the surgical site, b) The entire crown is avulsed and extracted

Fig 6: a) Shows the fully extracted tooth organ b) The surgical wound is sutured with polyglycolic acid three zeros, with isolated stitches

Fig 7: Shows the control of the patient one month postoperatively, the surgical wound is completely healted

Discussion

The eruption of permanent teeth is part of a complex series of genetically controlled events. Through these phenomena a germ develops and the tooth appears in the arch in its functional position, according to the established times. However, during this evolutionary process, numerous alterations can occur, than can interfere with dental eruption causing inclusion, which is the most common pathological picture more frequently [9].

The maxillary canine has the longest period of developtment, the deepest área, and a complicated path, until it reaches its oclusal position in the dental arch. Currently, the oral and maxilofacial surgeon must take advantage of three-dimensional imaging studies, since they offer and accurate diagnosis and safe surgery. The CONE BEAM study allows us to determine the degree of difficulty of the surgical procedure.

Conclusion

Without a doubt, the KPG index is very useful to determinate the degree of complexity in maxillary canine surgery, making it possible to plan an accurate and adequate surgical treatment in each case. This case was within the score of zero to ten, according to the KPG index with an easy degree of complexity; however, the great angulation of the dental apex should be considered.

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