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Management of Impacted Mandibular Lower Canine Associated with Odontoma: Interdisciplinary Approach

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ABSTRACT

Odontomas are common benign calcified tumors and the most prevalent type of odontogenic tumors. They can be categorized into complex and compound odontomas. Typically, odontomas do not cause any symptoms and are often incidentally discovered. However, in certain instances, they may present with signs and symptoms. The management of odontomas involves early detection, histopathological examination, and surgical removal of the affected tissues. This case report presents a 12-year-old female patient with delayed eruption of the lower right permanent canine in comparison to the corresponding tooth on the left side. Radiographic examination revealed a radiopaque image surrounded by a radiolucent area in the right buccal segment between the right lateral incisor and right first premolar. The clinical diagnosis was determined to be a compound odontoma. Interestingly, the radiograph also showed a completely developed impacted right mandibular canine situated horizontally near the lower border of the mandible, beneath the odontoma. This article highlights a case of impacted permanent canine associated with an odontoma and provides a brief overview of odontomas and impacted canines. It emphasizes the interdisciplinary approach between an orthodontist and an oral surgeon for the successful management of such cases. Early diagnosis and proper coordination between these specialists are crucial in achieving optimal outcomes for the patient.

Keywords

Impaction, Odontoma, Interdisciplinary approach, Surgical removal.

Introduction and Review of Literature

Odontoma is classified as a benign odontogenic tumor that belongs to the group of odontogenic epithelial tumors involving the formation of mineralized tissues [1,2]. However, despite its tumor classification, odontomas are clinically regarded as tumor-like formations (hamartomas of dental tissues) or developmental anomalies, rather than true odontogenic neoplasms. They are most commonly identified during the second decade of life and are typically found in the anterior region of the maxilla [3]. Odontomas are frequently asymptomatic and are often linked to the abnormal eruption of neighboring teeth [4]. Among odontogenic tumors, odontomas make up approximately 22% of cases [5].

In a retrospective study conducted by An et al. [3], 73 cases of impacted permanent teeth associated with odontomas were evaluated. The majority of odontomas (84.9%) were treated with surgical removal, and the impacted permanent teeth linked to odontomas were managed through various approaches. Surgical removal was the most common treatment method (53.2%), followed by orthodontic treatment (25.5%) and surgical repositioning (6.4%). In some cases, impacted teeth were successfully saved through orthodontic treatment, surgical repositioning, or allowing for normal eruption, amounting to 23 teeth in total. The study found that all impacted teeth were preserved in patients under 9 years old, whereas all impacted teeth were removed in patients over 30 years old. Only 7% of the cases exhibited spontaneous eruption of impacted teeth. Tooth impaction refers to a situation in which a tooth does not erupt properly due to a mechanical

obstruction, causing it to remain unerupted beyond its expected eruption time [6]. The occurrence of impacted primary teeth in the population ranges from 1.3% to 8.9%, with a notably higher incidence observed among siblings [7-9]. However, the primary mandibular molars are affected more frequently than maxillary molars, with the former being impacted over 10 times as often as the latter [10].

Pediatric dentists encounter the problem of permanent tooth impaction more frequently than that of primary teeth. The occurrence of impaction in anterior primary teeth is exceptionally rare. Similarly, total impaction is an infrequent condition [11-13]. Impaction can be categorized as primary, where the teeth fail to erupt at all (referred to as primary failure of eruption), or as secondary, where previously erupted teeth become impacted again due to various factors. Primary failure of eruption is diagnosed when the unerupted tooth is covered by intact mucosa, and radiographic images reveal the tooth to be deeply embedded in the jawbone [14]. Secondary failure of eruption occurs when a permanent tooth is unable to erupt due to factors such as retained deciduous teeth, odontomas, cystic lesions, or supernumerary teeth. Impaction can be attributed to both systemic and local factors [15].

Local factors encompass developmental abnormalities such as malposition, dilaceration, ankylosis, tumors, odontoma, dentigerous cysts, and supernumerary teeth. On the other hand, systemic-genetic factors may be associated with conditions like cleidocranial dysostosis and hypopituitarism [16,17]. Odontomas have been identified as a significant cause of impacted primary teeth in early reported cases [15]. Odontoma is classified as an odontogenic tumor that frequently leads to disruptions in tooth eruption, including impaction, delayed eruption, or retention of primary teeth [18,19]. The literature has documented various locations of odontomas in association with primary molars, such as between the roots of a lower right second primary molar, between the crowns of the upper first and second primary molars, above the crown of the lower right second primary molar, and above the unerupted upper second primary molar [20].

They are included under the benign calcified odontogenic tumors. Odontomas are basically classified into two types, complex and compound odontomas. Various theories or etiological factors are been quoted for the occurrence of Odontomas. Generally, they are asymptomatic. Occasionally, signs and symptoms relating to their presence do occur. The sole management depends upon the early diagnosis, histopathological examination and excision of these tissues [21-24]. Various treatment options are available for impacted deciduous or permanent teeth, and these include extraction of the primary tooth with subsequent follow-up without intervention. However, it is crucial to closely monitor the eruption process [25]. Another treatment approach involves surgical exposure or surgical repositioning, with or without orthodontic traction. In certain cases, surgical removal of the impacted permanent tooth may be necessary [26].

When odontomas are identified as the cause of impaction, the preferred treatment involves surgical removal in both primary and permanent dentition. Early removal of odontomas without disturbing the underlying tooth germ can result in spontaneous eruption of the impacted teeth. However, in some instances, orthodontic traction may be required [17,26,27]. Additionally, in certain cases, the impacted teeth underlying the odontomas may be extracted concurrently with the removal of the odontomas [28]. Moreover, in patients where only the odontoma is removed, the primary molar is typically kept under observation to monitor its eruption.

In the literature, there have been a few reported cases of complete impaction of permanent mandibular canine caused by odontoma. The objective of this paper is to present the management approach employed for a patient with complete impaction of permanent mandibular canine caused by odontoma.

Case Report

A 12-year-old female patient sought dental care due to a toothache on her lower left side. A pantographic radiograph revealed deep caries on tooth lower left permanent first molar alongside the presence of an odontoma and an impacted lower permanent canine. The lower left permanent first molar tooth underwent endodontic treatment. After finishing the endodontic treatment, the patient was referred to an oral surgeon for the removal of the odontoma and the impacted lower right permanent canine. Following the surgical procedure, the patient was directed to the orthodontic department for closing the space left by the extracted right permanent canine and addressing teeth crowding. Notably, the patient's medical history showed no significant influence on her dental condition. The patient was referred to the first author for completion of the orthodontic treatment. No photograph taken before treatment. Figure 1 showed the time of receiving the case. Revaluation of the case was done and suggesting extraction of upper right permanent first premolar in order to achieve class I molar and canine on the right side (compensatory extraction).

Intra oral examination

Intraoral examination revealed that the patient is in the late mixed dentition stage. All the permanent teeth erupted except 13, 23 and 43. Lower left first molar was endodontically treated.

Radiographic findings

Panoramic image revealed the presence of all permanent teeth in both jaws as well as impacted lower right permanent canine and presence of odontoma surrounded by radiolucent area. Lower left first molar was endodontically treated. Upper right and left permanent canines were in the right path of eruption. All upper and lower third molars roots were not developed. The mandibular right permanent canine with 2/3 of root development was pushed very close to the lower border of the mandible. Based on these radiographic findings, the patient's dental condition is complex and may require a multidisciplinary approach involving an orthodontist, oral and maxillofacial surgeon, and possibly an oral

Figure 1: Illustrate the patient during treatment and canine space closure.

pathologist. The treatment plan will likely involve addressing the impacted lower right permanent canine tooth, evaluating and managing the odontoma, and considering the position of the mandibular right permanent canine Figure 2.

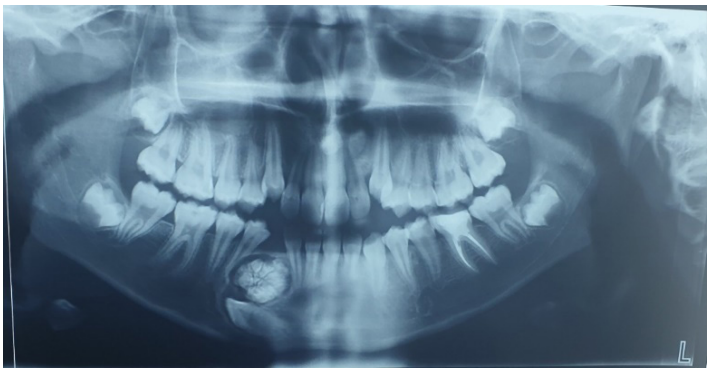

Figure 2:

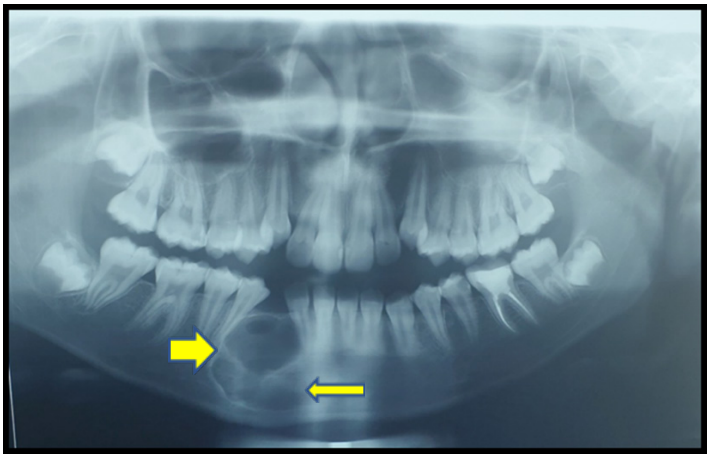

Figure 3:

Figure 3 depicted removal of the odontoma and the impacted lower right canine. There was a round shaped radiolucent area after surgical removal of both the odontoma and the impacted lower right canine.

Diagnosis

The provisional diagnosis was; Class I malocclusion type 1 associated with impacted Lower permanent canine due to presence of odontoma tumor impeding the eruption of the right mandibular permanent canine.

Treatment Objectives

a) Removal of the impacted right mandibular permanent canine and the odontoma.
b) Regular follow-up every 6 months to monitor the new bone formation
c) Orthodontic treatment

Surgical Procedure

Patient was referred to the oral and maxillofacial surgery department. The odontoma and the impacted lower right canine were surgically removed under general anesthesia (Figure 3). It is important for the patient to follow post-operative care instructions provided by the surgeon to promote proper healing and reduce the risk of complications. This may include maintaining good oral hygiene, taking prescribed medications, avoiding certain foods that could disrupt the surgical site, and attending scheduled follow-up appointments.

Post-surgical and follow ups

The recovery was uneventful and intraoral healing was satisfactory. Patient was followed-up regularly to monitor new bone formation. After the odontoma and the impacted canine are removed, the body initiates a healing response. The surrounding bone begins to fill in the space left by the removed structures through a process

called bone remodeling. During this healing phase, the radiolucent area may appear on radiographs as the bone fills in and remodels to restore normal bone architecture. At 9 months follow-up after surgery; another OPG was done. The radiograph revealed the presence of new bone formation Figure 4.

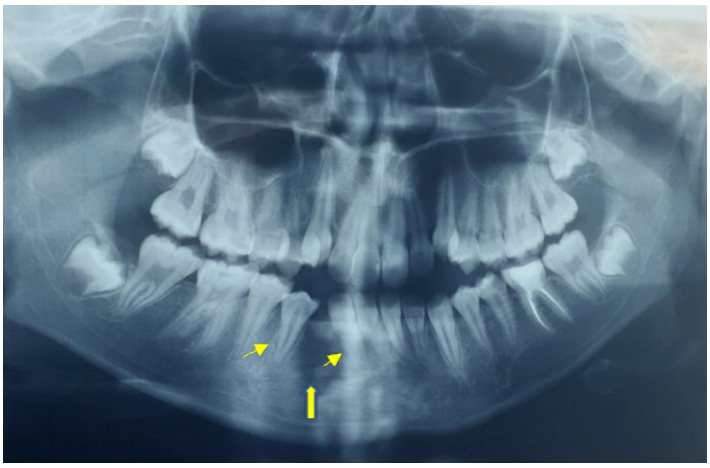

Figure 4: Presence of new bone formation at the surgical site.

Orthodontic Treatment

Orthodontic treatment using the MBT prescription with a 0.022-inch slot size. Specific sequence of arch wires for the different phases as follows:

Leveling and Alignment Phase:

During this initial phase, the primary goal is to align the teeth and level the arches. The two arch wires commonly used are:

A. 0.016 Nitinol Round Arch wire: Nitinol is a flexible, nickel-titanium alloy wire that allows for gentle tooth movement during the early stages of treatment.

B. 0.016 Stainless Steel Round Arch wire: Stainless steel is a stiffer wire that provides more control and helps to further align the teeth.

Space Closure Phase:

In this phase, any spaces between teeth are closed, and further alignment is achieved. The arch wires used in this phase are:

A. 0.016x0.022 Stainless Steel Square Arch wire: This Square-shaped arch wire provides better torque control and is often used for fine adjustments during the space closure phase.

B. 0.017x0.022 Nitinol Rectangular Arch wire: Nitinol is still used in this phase for its flexibility and ability to apply gentle forces during space closure.

Finishing Phase:

The finishing phase is the last stage of treatment where fine adjustments are made to achieve the final alignment and occlusion. The arch wires commonly used are:

A. 0.019x0.025 Nitinol Rectangular Arch wire: Nitinol is still preferred for its flexibility and ability to maintain gentle forces during the final adjustments.

B. 0.019x0.025 Stainless Steel Rectangular Arch wire: Stainless steel provides more stiffness and control, which is beneficial for fine-tuning tooth positions during the finishing phase. It's important to emphasize that the choice of arch wires and the treatment plan can vary depending on individual patient needs.

Retention phase

The patient has been advised to wear both upper and lower vacuum retainers throughout the entirety of the first year, with exceptions made only for eating or consuming hot beverages. Moving into the second year, the patient has ceased wearing the retainers during the day but continues to wear them nightly before bed. However, if the patient encounters resistance when inserting the retainer, it suggests that the bone and periodontal fibers have not fully stabilized. In such cases, it is recommended that the patient resume wearing the retainers throughout the day until they can be inserted without any resistance, indicating proper organization of the bone and periodontal tissues.

Treatment Result

The post-treatment results indicated the following:

a. Closure of the lower right canine space:

The space left by the impacted lower right canine was closed, likely due to the mesial movement (towards the midline) of the adjacent premolars and the first molar. This means that the teeth adjacent to the missing canine (premolars and first molar) were repositioned to fill in the gap left by the impacted tooth.

b. Class III molar relationship on the right side:

A Class III molar relationship means that the lower molars are positioned more forward than the upper molars. This might be the result of the mesial movement of the lower premolars and first molar. The Class III molar relationship is not the ideal occlusion, and it can affect the alignment of the jaw and how the teeth come together during chewing and biting.

c. Class I relationship on the left side:

The upper left canine and first molars were in a Class I relationship, which is the normal and ideal molar relationship. In a Class I relationship, the upper first molar occlude just behind the lower first molar, allowing for proper occlusion and function.

d. Good intercuspation:

Intercuspation refers to the way the upper and lower teeth occlude together when biting down. Good intercuspation means that the upper and lower teeth fit together properly, allowing for effective chewing and proper distribution of biting forces.

e. Normal overjet and overbite:

Normal overjet and overbite indicate that the teeth are properly aligned vertically and horizontally.

The post-treatment photograph findings showed the following:

Figure 5 revealed the result of the treatment as follows:

Front view

showed normal overbite and midline and normal transverse dimension.

Figure 5: Illustrate the result after treatment showing canine space closure on the right side.

Lateral view

The patient displays a Class I molar relationship on the left side and a Class III relationship on the right side. The Canine relationship is Class I on the left and Class II on the right. The overjet is normal on the left side while it is slightly increased on the right side.

Occlusal view

It was observed that both the upper and lower arches exhibit an oval shape.

The Post-Treatment Radiographic Findings Showed the Following:

Radiolucent areas of the Odontoma and impacted canine covered with organized bone. The inclination of the lower right lateral incisor and first premolar were corrected spontaneously after removal of the Odontoma and finishing the inclination after orthodontic treatment. The post-treatment radiographic findings show positive outcomes after the removal of the odontoma and impacted canine. The radiolucent areas observed previously, which represented the spaces left by the removed structures, have now been filled with organized bone. This indicates successful healing and bone regeneration in the surgical sites. Additionally, there was spontaneous correction of the inclination of the lower right lateral incisor and first premolar after the removal of the odontoma and the completion of orthodontic treatment. The correction of the inclination likely resulted from the combined effects of the surgical removal of the odontoma, the orthodontic treatment, and the natural response of the surrounding dental and bone structures.

A radiolucent region that resulted from the removal of the Odontoma and the impacted lower permanent canine has been replaced by new bone growth. Additionally, the roots of teeth lower right first premolar and lower right lateral incisor are now parallel to each other as indicated with the small arrows (Figure 6).

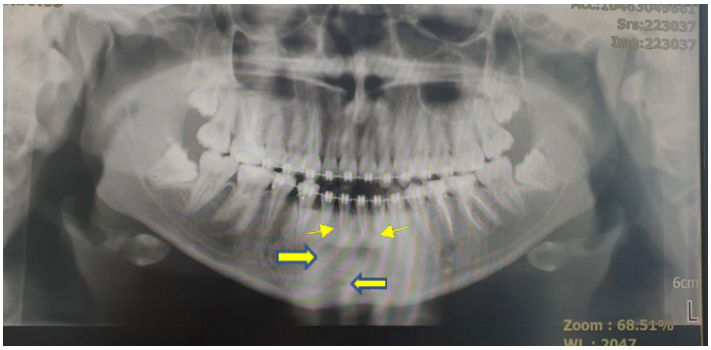

Figure 6: Illustrates the outcome after a 4-year period following treatment.

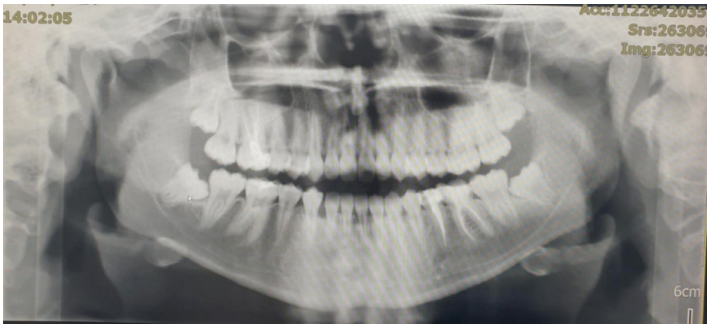

Figure 7: Illustrates the outcome after finishing the treatment.

Figure 7 Exhibited the result after treatment (Five years); that the radiolucent area due to the removal of the Odontoma and the impacted lower permanent canine was completely replaced by new bone growth as well as improvement of the roots of the first premolar and lateral incisor on the right side.

Discussion

Tooth impaction is more commonly observed in permanent dentition and rarely in primary dentition [28,29]. There are limited reports in the literature regarding odontomas associated with

unerupted primary teeth [30,31]. Although CBCT offers several advantages and benefits over periapical and OPG radiographs. It also provides a three-dimensional view of the affected area as well as allowing for better visualization and evaluation of the condition. However, in the present case report, Orthopantomograph (OPG) was only used for diagnostic imaging.

Considering the minimal radiation exposure discussed earlier, it is practical to choose for an OPG examination to promptly detect and localize potential abnormalities such as odontoma, congenital absence of teeth, cystic lesions, and supernumerary teeth. Once diagnosed, an appropriate treatment plan can be formulated. Further and interestingly, orthodontic therapy is not usually necessary because most odontomas are very small and its influence on occlusion is negligible and improvement without orthodontic therapy can take place [32,33]. However, in this case report extraction of the impacted permanent canine and removal of the odontoma were performed followed by orthodontic treatment to close the extraction space.

Katz carried out a comprehensive survey conducted in the United States examined the rates of odontoma detection. The findings of the analysis demonstrated that approximately one-third of all cases were diagnosed in children aged between 11 and 15 years, while the detection rate in children below the age of 5 years was notably low, accounting for only 2% of all cases [34]. However, in the present case report, the age of the patient was 13 years old when the Odontoma was detected. The impaction of primary molars gives rise to various issues within the dental arch, including space loss, tilting of adjacent teeth, over-eruption of the opposing teeth, and failure of permanent teeth to erupt [10,14,35].

Odontomas are characterized by their slow growth and non-aggressive behavior. They enlarge during the normal development phase of the dentition and cease to grow after maturation of the associated corresponding teeth [1,36]. Papers on odontomas generally appear in the literature as either case reports or as contributions to studies on larger series of odontogenic tumours. Few studies focus on odontomas only. These include 104 cases reported from Brazil [37] and seventy-three -73- cases from Korea [3], The only comprehensive clinic-pathological study on the African continent featured 19 cases reported from Libya in 2013 [3,37-39].

The above mention studies reported that most odontomas are reported ***as incidental findings*** on radiographs taken for other indications such as delayed eruption of one or more permanent teeth or the retention of a deciduous tooth [3,37-39]. The literature on odontomas occasionally reports cases where patients experience symptoms such as pain, swelling, expansion of the bone cortex, and displacement of teeth [40]. In the present case, the patient sought dental care due to a toothache on lower left permanent first molar, which was endodontically treated.

In the present case, the observed displacement of the lower right permanent canine was unique, as it was horizontally located near the lower border of the mandible. This positioning indicates that the odontoma likely caused a disruption in the typical path of eruption for the permanent canine tooth. Furthermore, the fact that the root apex of the impacted tooth was completely closed suggests that spontaneous eruption of the impacted tooth is not possible. Root apex closure is an essential factor in the eruption process, and once the apex is closed, it hinders the tooth's ability to move and erupt naturally. Given the horizontal position of the impacted tooth and the complete closure of its root apex, it becomes imperative to consider appropriate dental interventions, such as surgical exposure and orthodontic treatment, to facilitate the proper alignment and eruption of the affected permanent canine. These treatments aim to guide the tooth into its correct position and restore proper function and aesthetics. However, in this case the impacted canine was removed surgically under general anesthesia. The surgical procedure completed without any complications. The canine space was closed orthodontically. The patient refused the compensatory extraction of the upper right first premolar. This leads to finishing the upper right canine occlude between lower right lateral incisor and lower right first premolar. As previously stated, the patient's age was 13 years old, which falls within the age ranges investigated in the study conducted by An et al. [3]. According to their findings, all impacted teeth were retained in patients under 9 years old, while all impacted teeth were extracted in patients over 30 years old. Given that the patient in the present case report is 13 years old, their age doesn't exactly align with either age group outlined in An et al.'s study. Consequently, our case report presents a distinct and divergent situation from the observations made by An et al. [3].

It's important to note that case reports often describe individual experiences or observations that may not fully align with larger studies or general trends. Individual variations and factors specific to the patient may have influenced the treatment decision in this particular case. To draw more definitive conclusions about the optimal management of impacted teeth in patients of different ages, further research and larger studies considering a broader age range would be necessary.

The correction of the distally inclined lower right first premolar and mesially inclined lower right lateral incisor appears to be a direct outcome of both Odontoma removal and subsequent orthodontic intervention. Orthodontic procedures are designed to correct dental misalignments and optimize tooth positioning. Through the removal of the Odontoma and the application of orthodontic techniques, it is probable that the orthodontist successfully addressed the misaligned orientations of teeth lower right first premolar and lower right lateral incisor, leading to enhanced alignment and a more favorable occlusal relationship. The healing process (Figure 8) can take several weeks to months or years, depending on the individual's healing capacity and the extent of the surgical procedure. Regular follow-up visits with the oral surgeon or oral and maxillofacial surgeon will be necessary to monitor the healing progress and ensure there are no complications.

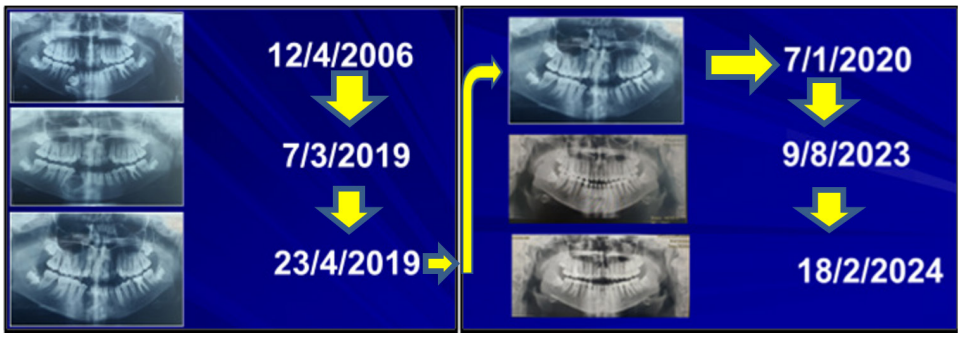

Figure 8: The healing process after removal of the Odontoma and the impacted canine as well as canine space closure.

In most cases, the radiolucent area gradually becomes less apparent over time as the bone continues to heal and remodel. Follow-up imaging, such as panoramic X-rays or Cone-beam computed tomography (CBCT), may be taken at specific intervals to assess the healing and bone regeneration accurately. If the radiolucent area persists or if there are any concerns during the healing process, the patient should promptly inform their oral surgeon for further evaluation and management. The surgeon will determine if any additional measures or interventions are necessary to ensure a successful outcome and optimal healing.

Overall, the treatment appears to have successfully closed the impacted tooth space and achieved satisfactory alignment and occlusion on the left side. A Class I molar and canine relationship is evident on the left side, whereas on the right side, there is a Class III molar relationship and a relative Class II relationship of the canine. This occurs as a result of the patient's decision to decline extraction of the upper right first premolar. This intended compensatory extraction, aimed at achieving a normal overjet and a Class I molar and relatively class I canine relationship on the right buccal segment, which was not carried out. However, due to the surgical removal of the impacted lower right canine, proper positioning of the upper right canine is impeded. Instead of occluding between the lower canine and first premolar, the upper canine occludes in the embrasure between the lower right lateral incisor and lower right first premolar. Ultimately, the goal of treatment is to not only achieve good alignment and occlusion but also to ensure the patient's long-term oral health, function, and overall well-being. This may involve a comprehensive and interdisciplinary approach to address all aspects of the malocclusion effectively. The successful resolution of this patient indicates the effectiveness of the treatment plan and the collaboration between the oral surgeon and orthodontist. Regular follow-up visits and post-treatment monitoring will still be necessary to ensure the stability of the treatment outcomes.

In summary, it appears that the patient has had a successful and positive treatment experience, with the desired alignment achieved after the surgical and orthodontic interventions. However, it is essential for the patient to continue practicing good oral hygiene, wearing his retainers and attending regular dental check-ups to maintain the results and ensure long-term dental health.

Conclusions

- The management of this patient condition emphasizes the interdisciplinary approach between an orthodontist and an oral surgeon for the successful management of such cases.
- Early diagnosis and proper coordination between these specialists are crucial in achieving optimal outcomes for the patient.
- It is essential to report any impacted teeth and dental abnormalities like Odontomas to ensure proper oral health and function.
- In this case, the combined approach of Odontoma removal and orthodontic treatment contributed to positive changes in tooth alignment and bone healing.
- Regular follow-up visits and post-treatment evaluations are necessary to monitor the stability and long-term success of the treatment outcomes.

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