

Orthodontic Traction After a Proper Compound Odontoma Surgical Exposure at Impacted Maxillary Canine – A Literature Review

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Abstract

Background: Maxillary canine impaction becomes the second most often tooth impaction case, most of them caused by the inhibitory feature such as compound odontoma. Compound odontoma is a benign tumor emerging inside the periodontal tissue which may inhibit the growth of anterior permanent teeth across the dentition, such as maxillary canine, so the teeth become impacted. Surgical exposure and orthodontic traction usually are being used as treatment of tooth impaction, but as a separate procedure. **Aim:** To observe and evaluate the potency of orthodontic traction after compound odontoma surgical exposure to improve the eruption process of maxillary canine. **Discussion:** Many past studies revealed that surgical exposure by minimally-invasive method using piezosurgery could be applied to remove compound odontomas. Usage of orthodontic traction can also applied to improve and help the pulling process of the impacted canine to across the dentition after the surgical wound was prepared into a form of perfectly closed flap to increase the power of periodontal tissue to resist the tension from erupting canine that pulled out by orthodontic appliances so the canine may erupt perfectly. **Conclusion:** Orthodontic traction procedure after surgical exposure could help canine eruption at the right direction and position perfectly and effectively.

Keywords: compound odontoma, tooth impaction, orthodontic traction, surgical exposure

1. Introduction

Odontomas are the most commonly found odontogenic tumors by prevalence of more than 70% and considered to be hamartomas rather than neoplasms which consist of native tissues of teeth such as enamel, dentin, pulp tissue, and cementum as well (Gedik and Müftüoğlu, 2014; Erdogan et al., 2014). One of odontoma types named compound odontoma is determined as an orderly-patterned of all dental tissues malformation compared to complex odontomas so that the lesion tends to be seen as supernumerary teeth in a small group growing and resembling in the abnormal dentition (Mazur et al., 2022).

Compound odontoma itself is signed with delaying a tooth eruption process that could be observed in more detail in radiographic imaging which appears as radiolucent at initial phase and becoming radiopaque at progressive state (Bueno et al., 2020). Statistically, compound odontoma could happen in varying age groups, from children until adults, with the mean age 14.8 years old and slight predilection of gender factors which males tend to have compound odontomas than females with prevalence of 59%. Compound odontomas also commonly occur in the maxillary anterior teeth instead of maxillary posterior and mandibular teeth with prevalence of 81.8% (Mazur et al., 2022). In case of canine impactions due to compound odontomas, it is revealed that prevalence of this abnormality could be in the percentage of 0.8-5.2% with the incidence more often at maxillary arch compared to mandible arch. Most of the impacted canine could be palatally with the incidence rate of 66.67% of maxillary canine impaction and 33.33% of them happened labially or within the alveolar. In regard to gender preferences, maxillary canine impaction, especially caused by odontoma compounds, happens more often in females than males (Aslan and Üçüncü, 2015).

Deciduous teeth persistency and odontoblastic hyperactivity could be observed and associated with infection alterations signed with inflammation and lymphadenopathy at compound odontoma cases, even hereditary disorder such as Gardner and Hermann's syndrome could manage its pathogenesis. Diagnosis can be decided through its clinical appearance and radiographic imaging interpretation, which histopathology examination could also be conducted to ensure the diagnosis of odontoma compounds (Mazur et al., 2022).

Compound odontoma itself has similar features with another pathological structure in dentition such as dentigerous cyst, supernumerary tooth, ameloblastic odontoma, and complex odontoma; but it closely misinterpreted with supernumerary tooth which shown as an extra tooth developing in jaw and complex odontoma which shown as non-descript masses of dental tissues and tends to favor the mandibular posterior teeth while compound odontomas are characterized by multiple, well-formed tooth-like structures (Gedik and Müftüoğlu, 2014; Mazur et al., 2022).

Many past studies have revealed two options of curative method to compound odontoma case such as surgical removal which is followed by orthodontic traction immediately to boost and facilitate the impacted tooth, as the effect of odontomas, being able to grow well (Khan et al., 2014; Nammalwar and Moses, 2014) and surgical resection which will be continued with clinical follow-up and radiological check-up (Bereket et al., 2015).

2. Purpose

This study will enhance our knowledge about many compound odontoma case reports so the knowledge will ease us to manage the most effective treatment method for the patients with compound odontomas at maxillary canine. Beside good clinical skills, it definitely requires good clinical comprehension

due to this abnormality so the treatment is conducted while handling patients with impacted teeth caused by compound odontomas could be planned very well.

Surgical exposure method in order to treat this abnormality became very hyped until this moment, but orthodontic traction actually could be considered as a treatment to be helpful in compound odontoma cases, especially if it is being applied after the surgical exposure procedure to open the gingival mucosal barrier. Based on intersection study between literature research and case study, it is hoped that orthodontic traction could give better results of maxillary canine eruption after a proper surgical exposure of the impacted teeth consisting of compound odontomas.

3. Method

This literature review was made by article/case reports meta-researching from PubMed, ScienceDirect, ResearchGate, Springer, and WoltersKluwer using keywords that are conducted due to Medical Subject Headings (MeSH) criteria to optimize literature researching with further exception and gradual selection based on eligibility criteria until 17 articles are obtained and used in this study. The exception criteria in this study consists of irrelevant abstract, articles/case reports that are not published in international reputed journals, and limited access–full paper. Extraction of relevant data also conducted based on researchers, reviewer, and analyzer publication credibility and reputation with a criteria of article published from 2013–2022 to maintain the relevancy of the articles/ case reports with nowadays conditions. Data extracted includes scientific evidence with a relevant theory and accurate data analysis with high level of confidence about related topics so the data presented in this literature review is clear.

4. Review

4.1 Etiology of Compound Odontoma

In dentistry, there are many misinterpretations which lead to misdiagnosis of odontomas and supernumerary teeth since their structure seemed similar to each other. Actually, based on their etiologies, it can be defined precisely from its pathogenesis. Odontomas etiology is rarely known specifically, but the structure grows and arises from tooth germs or growing deciduous teeth which gets offended with either external or internal disturbances and sometimes can be caused by both of them. Those external disturbances include local trauma which may lead to infection at the traumatic side and surroundings. Internal disturbance for this case usually be brought in inheritance mode (Pippi, 2014). Differ from odontomas, supernumerary teeth pathogenesis based on its etiology has not been known and revealed precisely since many contradictory theories explaining about this phenomenon being introduced over time which one of the most famous theory revealed that supernumerary teeth begins with local hyperactivity of dental lamina and causing dichotomy of tooth bud (Pippi, 2014).

4.2 Clinical Findings of Compound Odontoma

Compound odontomas are usually asymptomatic and being detected under the radiographic imaging. At clinical level, compound odontomas can be predicted over the findings as their association

such as anterior teeth misalignment, tooth eruption disorder which leads to tooth impaction, and delaying of tooth eruption processes (Mazur et al., 2022). This odontoma type is also shown as “not more than 10 mm”–masses which grows slowly and limited since its growth waiting until development of all dental tissues is done (Levi–Duque and Ardila, 2019; Kämmerer et al., 2016; Park et al., 2018). Radiographically, compound odontomas appear as multiple calcified structures but some of them resemble normal teeth (Mazur et al., 2022). Specifically, an uninformed radiopaque lesion with radiodense area will be seen to be left in the premaxilla and the impacted tooth will be localized apical to it (Picture 1).

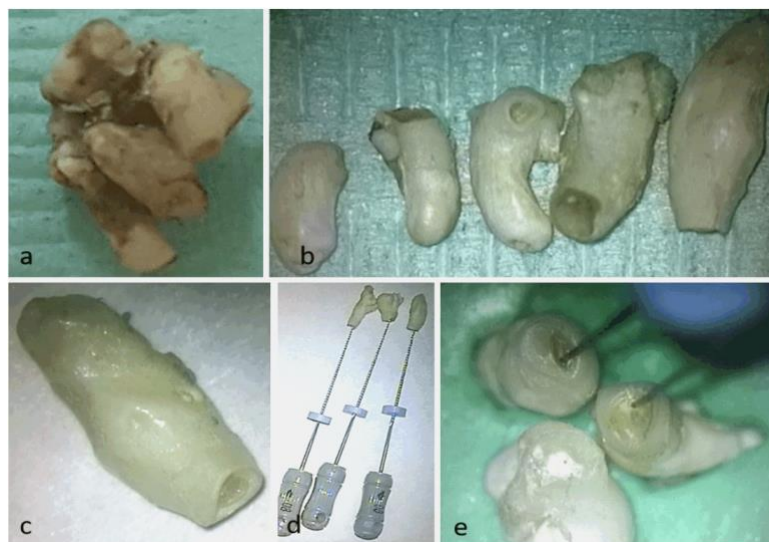


Picture 1 shows (a) radiographic aspects of compound odontoma captured in periapical perspectives; (b) captured in occlusal perspectives.

The odontomas usually emerge intraosseously so it is located within the bone and rarely can erupt into the oral cavity (Sun, Sun and Ma, 2015). Based on location, compound odontomas are commonly found at the anterior part of the jaw (Levi–Duque and Ardila, 2019).

4.3 Morphology and Microscopic Feature of Compound Odontoma

Macroscopically, it has been shown as similar as normal teeth but in the smaller version resembled conglomerate form with various shapes such as monoradicular, conical, fairly straight or slightly angulated (Preoteasa and Preoteasa, 2018). Microscopically, it has shown a feature as same as normal teeth which consists of crown and root, opened apices signs that the root formation was incomplete, a root canal, and important compartment such as dental tissues, enamel, dentine, and cements were also successfully distinguished and identified to each other as shown in Picture 2.



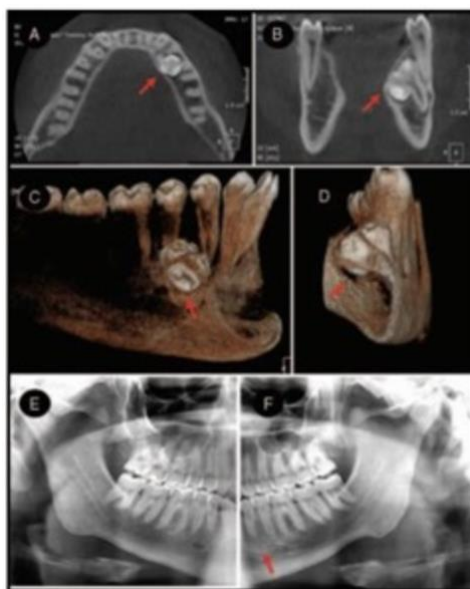
Picture 2 shows compound odontoma morphological feature such as: (a) conglomerate form of calcified structure; (b) calcified structures resembles mini-teeth structure; (c) irregularities in mini-teeth structure surfaces with incomplete root formation and perfect differentiated dental tissues; (d) root canal of mini-teeth structures; (e) magnified version of root canal.

4.4 Surgical Exposure of Compound Odontoma Treatment and Followed by Orthodontic Traction Procedure

A classic treatment that can be used to remove compound odontomas is surgical removal which must be followed by histopathological examination to confirm the diagnosis (Pacifici et al., 2015; Mazur et al., 2022; Salgado and Mesquita, 2013). The surgical removal mechanism is pretty simple as the tumors are encapsulated and adopting the technique of surgical resection which should notice many requirements so the conservation and repositioning of the impacted teeth can be allowed in order to erupt perfectly (Pacifici et al., 2015).

Usually, the surgery technique that being used for the compound odontomas named piezosurgery that adopt the principle of minimally invasive surgery using ultrasonic vibration to cut through bone without damaging soft tissues, even being able to provide a sensible use in osteotomy especially in vulnerable anatomic regions such as nerve or sinus (Momesso et al., 2017). It is also revealed that uses of piezosurgery may lead to decreasing damage to dental tissue and its neuro-vascularization; reducing the level of inflammation; even may lead to the improvement of bone healing process compared to conventional osteotomy surgery method using bur (Momesso et al., 2017). Steps involved in the surgical exposure procedure consist of anesthesia; surgical approach; tumor exposure; tumor removal;

and wound closure, respectively. A specific local anesthesia may be given to the patient in order to numb the area surrounding compound odontomas and also relieve the pain during the surgery (Momesso et al., 2017). After that, surgical approach will be made by creating an incision line at the area surrounding compound odontoma so the mass can be accessed and approaching for the further process of surgery will be made depending on tumor specification in aspects of size and location. Next procedure is tumor exposure by removing tissues surrounding the tumors to ease the work of operators to access the tumors specifically. Lately, the piezosurgery will be playing a role in tumor removal precisely and gently by minimally invasive as explained before. Last step that must be done is wound closure by closing the incision line and irrigating the wound with a physiological solution to remove any blood and debris left on the treated area and surroundings (Momesso et al., 2017). Post-operative medication can be obtained by giving some medicines that may consist of antibiotics to inhibit and kill the microorganisms that may grow at the treated site; pain relievers to relieve the pain; and mouth rinses to promote healing processes (Pacifici et al., 2015). The preparation and post-operative results of surgical exposure of compound odontomas using piezosurgery could be seen at Picture 3.



Picture 3 (a) CBCT imaging of pre-operative compound odontoma axially; (b) CBCT imaging of pre-operative compound odontoma sagittally; (c and d) lesion further elaboration shown by 3D reconstruction from CBCT imaging; (e) operational aspect of bone shop after 1 month follow up shown by radiograph imaging; (f) large bone defect shown by panoramic radiograph imaging.

The process of orthodontic traction post surgical exposure could be done under certain terms and conditions since the traction may guide and align the tooth in the arch (Cruz, 2019). Other considerations also must be counted in orthodontic traction development since many further complications can manage and take role such as bone loss, root resorption, and gingival recession surrounding the pulled tooth. For treatment planning using orthodontic traction post surgical exposure, it is better to use a closed surgical exposure approach for the tooth impacted around the middle third of the alveolar or higher in the anterior nasal spine's vicinity to provide the better aesthetic and periodontal results (Cruz, 2019). Many techniques were also used and developed to retain and enhance the aesthetic of patients' dental arches even after the eruption of the impacted canine. Although it has complicated skills and risky possibility, in order to remove the little bone tissues as possible, the usage of orthodontic appliances as bonding of traction accessory should be done after giving surgical exposure to impacted canine crown and the way to be tracting it must follow the positioning according to the gingival position which can sometimes be very high so the traction procedure from the palatal side should be done followed by special care regarding the traction direction (Cruz, 2019). Differ to palatally impacted canine cases, it needs three surgical method that may be used for this case by noticing other considerations about tooth position related to mucogingival junction which consist of gingivectomy, apically rotated flap, and closed surgical approach as used in palatally impacted canine which is made to access the crown and facilitate bonding followed by immediate closure afterwards (Cruz, 2019). Overall, the best preferred surgical method to be used in the case of impacted canines that followed by orthodontic traction is closed flap technique since it can perform an aesthetic eruption of impacted canines with beautiful appearances as shown in Picture 4 and Picture 5.



Picture 4 Orthodontic appliance that used to align and tract impacted canine into the lateral position which was prepared in a closed flap surgical method.



Picture 5 Follow-up result of orthodontic traction treatment on impacted canine after closed flap surgery.

There is a reason why open surgery is not advised and even being avoided right now in treating the case and similar. It is revealed that open surgery through non keratinized gingival could cause an absence of adequate attached gingiva band surrounding the erupting impacted canine and may lead to periodontal inflammation which may increase risk in moving teeth by the presence of inflammation (Aslan and Üçüncü, 2015). Caprioglio et al. (2013) also stated that conservative surgical techniques such as closed flap surgery combined with orthodontic appliances for tooth traction will be mimicking the natural pattern of eruption and achieve an excellent periodontal status. The possible risk at open surgery became the closed flap surgery through keratinized gingival tissue also being chosen and well-recommended. While applying closed flap surgery, many people will have different thickness of the periodontal tissues. Although many people may have a tendency to have thin periodontal tissue, it can be manipulated by dissection process as a partial thickness graft, laterally repositioned pedicle graft, and free gingival graft in order to increase the thickness of keratinized gingiva so aesthetic and good periodontal results can be obtained (Aslan and Üçüncü, 2015).

5. Discussion

Orthodontic traction as the post-treatment after compound odontoma surgical exposure could be done under certain terms and conditions in order to traction the impacted canine especially in maxillary arches for both palatal and labial impaction cases. It is revealed by two past studies that the combinations of these two treatment methods can be effectively managed to the perfect eruption of the impacted canine since canines have some tendency to develop and erupt misdirectional which may lead into teeth crowding at the anterior region (Cruz, 2019; Aslan and Üçüncü, 2015). One of the most reasonable reason about why canine might erupt and grow in a misdirection is the non keratinized gingival will cause the resistance becomes less adequate to resist the tension from the erupting impacted canine which having a sharp structure and thick chamber so the growth of canine usually tends to protrude (Aslan and Üçüncü, 2015).

Many etiologies can play role in the presence of canine impaction, one of them could be compound odontomas that inhibit the growth of impacted canine This odontomas actually show a clinical feature as similar as normal teeth but it has a smaller size and tends to have many imperfect nanoscopic feature as the enamel and dentin has not mineralized perfectly yet (Preoteasa and Preoteasa, 2018). This inhibition could give people disturbance in the masticatory system and aesthetic purposes since canine plays a significant role in processing animal protein that contains dense fibres and also related to aesthetic purposes since it is anterior teeth. The odontomas itself is a benign tumor and does not have any tendencies to become a malignant tumor.

Process of removing the tumors can use the procedure of surgical exposure in orderly phases, starting from giving local anesthetic to relieve the pain and decrease the flow of blood into the treated site and followed by surgical planning to make an incision line at the treated site to give a good accessibility for the surgeon to access the tumor and surrounding. Next, the tumor removal could be using a minimally-invasive surgery method named piezosurgery that applies principle of ultrasonic vibration to cut the bone and other dental tissue by producing less adverse effects and other benefits such as reducing the inflammation rate and potency of nosocomial infection (Momesso et al., 2017; Pacifici et al., 2014). Lately, the wound that is caused by surgical exposure procedure must be closed and resulting closed flap with a neat stitching so the gingival and periodontal tissues can resemble themselves very well at the healing processes (Momesso et al., 2017). Some medicines also can be given post-surgical treatment such as supplementary and supportive medicines in order to promote the healing processes.

After that, further clinical follow-up and examinations should be done to manage the next process which is orthodontic traction. Orthodontic traction must be done carefully since it can result in bone resorption and loss of alveolar bone level so the examinations of impacted canine conditions should be examined well. The examination results will decide how the orthodontic traction will be aligned to obtain the perfect eruption of impacted canine. Before the application of the orthodontic appliances, we should pay attention that the past surgical site has been perfectly closed as a flap. A perfectly closed flap will enhance the adequacy level of the attached gingival fibres to resist the strong tension given by the erupting canine (Aslan and Üçüncü, 2015). Otherwise, the perfectly closed flap will reduce the inflammation rate and potency of nosocomial infections so the healing process could be done effectively and efficiently.

The orthodontic appliances and accessories that are used to pull out the impacted teeth into the dentition should be not too loose which may be less effective to pull the impacted canine into the dentition in the right direction and position. The orthodontic stuff also should not be too tight which can pull out other

teeth to leave the dentition because of overforce from the tension to pull out the impacted canine in the proper positions and directions as the orthodontic stuff applied along dentition in the affected arches which in this case is maxillary arch. Follow-up results after the whole treatment with the proper terms and conditions will result in a perfect erupted maxillary canine that impacted before the treatment.

6. Conclusion

Orthodontic traction as the post-treatment of surgical exposure at impacted maxillary canine cases due to compound odontomas can give desired results as the impacted canine eruption being perfectly, under certain terms and conditions in the clinical and histological aspects. Besides precise interpretation of clinical and histological aspects, the surgical exposure must follow the procedure as minimally-invasive to result in a perfectly closed flap to give an additional power to resist the tension of erupting canine. Lately, in order to bring and pull out the canine into a proper arrangement over dentition, orthodontic appliances with a proper size could effectively do its job in traction the impacted teeth to achieve desired results.

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8. Conflict of Interest and Funding Disclosure

All authors do not have conflict of interest. This research was completed without any financial contribution from any sources.

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