

Transposition of Maxillary Canine and Premolar: A Case Report

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Abstract: *The permanent maxillary canine–premolar transposition is the most frequently observed transposition in the human dentition. It is characterized by a relatively low prevalence and an unclear cause, although genetic factors have been implicated. Additionally, a combination of localized factors, including malformation of neighboring teeth, tooth absence, retention of the deciduous canine, and a history of localized trauma, may be associated with this transposition. It is generally not recommended to correct the order of the transposed teeth after the eruption of the permanent tooth. However, there have been several articles published in the last decade that discuss the non - extraction treatment of transposition using fixed mechanics. This article presents a detailed case study of the non - extraction treatment of maxillary left canine and first premolar transposition. It discusses the diagnosis, treatment planning, orthodontic interventions, and outcomes, emphasizing the importance of dental placement and interdisciplinary collaboration for successful outcomes. The case concluded with functional inhibition, an optimal bite relationship, and aesthetic enhancement. So, the purpose of this article is to present a comprehensive case study on the transposition of maxillary canine and premolar, including the treatment approach, challenges encountered, and the final outcomes achieved.*

Keywords: fixed appliance, transposed canine, esthetic smile, orthodontic treatment

1. Introduction

Tooth transposition, a condition where teeth change position during development, can be explained by the exchange of positions between growing tooth buds.^{1, 11, 12} This occurrence is often accompanied by the retention of deciduous canines, leading some researchers to propose that these primary teeth are the main cause of the anomaly.^{10 - 13} Furthermore, other factors such as the migration of the canine within the bone¹⁴, trauma to the deciduous tooth, and the presence of cysts and pathologies¹⁵ have also been suggested as potential contributors¹⁶. However, based on the available data, it is strongly believed that genetic influences play a significant role in the development of tooth transposition, following a multifactorial inheritance model.^{6, 17 - 2} In many cases of maxillary canine transposition, the deciduous canine remains in place, resulting in a lack of space for the permanent canine to properly erupt. This often leads to the ectopic positioning of the permanent canine within the upper arch. In situations where the first premolar is transposed with the canine, the permanent canine is typically rotated towards the mesio - buccal direction, while the first premolar is tipped distally and rotated mesio - palatally. The transposed canine is usually found in a buccal position, although palatal positioning is rare. The prevalence of maxillary permanent canine transposition can be attributed to the long eruption path of the maxillary canine¹⁸, which makes it more susceptible to abnormal movement. The bud of the permanent maxillary canine initially forms at the border between the developmental areas of the lateral incisor and the first premolar, located superiorly and towards the palate, just below the orbital ridge. As the maxillary canine follows its eruption pathway, it gradually shifts towards the buccal and mesial directions, eventually becoming palpable in the labial sulcus. Transposition occurs when the eruption pathway of the upper canine is disrupted due to genetic and/or environmental factors. In cases where canine and first premolar transposition occurs, the canine is

typically displaced in a mesio - buccal direction between the first and second premolars, while the first premolar is frequently tipped distally and displaced mesio - palatally. Additionally, the deciduous canine often remains present, contributing to temporary space limitations. It is crucial to diagnose transposition at an early stage to ensure better prognosis. Maxillary canine transposition is often associated with aesthetic and functional issues that should be addressed early on.¹⁹ Prompt diagnosis of developing transposition is key in enabling preventive interventions aimed at restoring the normal tooth order. Early intervention significantly improves treatment prognosis and minimizes the risk of damage to the teeth and their supporting tissues.²⁰

Clinical and radiographic examination

A 14 - year - old girl and 3 months old, came to us with the primary complaint of having her maxillary right canine and first premolar in transposition. This patient presented a Class I pattern with favorable facial relationships, exhibiting a slightly convex profile and a Class I skeletal relationship, along with a moderate deviation of the maxillary midline. In terms of cephalometric characteristics, there were no clinically significant skeletal deviations, indicating normal findings. Upon clinical examination, it was observed that the canine was positioned buccally in relation to the first premolar. To further assess the situation, a panoramic radiographic examination was conducted, revealing that the transposition affected both the crown and root of the teeth. As a result, both the crown and root of the transposed teeth require correction, which can complicate and prolong the treatment process.⁴ Moreover, there is an increased risk of experiencing damage to the teeth and their supporting tissues due to occlusal interferences, as well as the development of gingival recession, root resorption, and bone loss in the supporting structures. The most common site for bone loss is the buccal alveolar plate.^{4, 21, 23} Considering the specific case of maxillary canine transposition, it is crucial to carefully plan the treatment, taking into account factors such as treatment duration, difficulty, risks of side effects, dental

and facial aesthetics, occlusal function, stability, professional experience, and patient preferences. The primary objective of treatment is to orthodontically reposition the transposed teeth to their normal locations, as this has significant benefits for dental and occlusal aesthetics, function, and stability.^{4, 21, 22, 23, 24.} In this particular case, a non-extraction orthodontic treatment approach was chosen, and fixed appliances were utilized on all upper teeth. Once the natural order of the maxillary teeth was restored, another phase of teeth leveling was carried out. The active orthodontic treatment lasted for a period of 23 months. Upon completion, a Hawley type retainer was employed to maintain the position of the upper arch. The patient's occlusion was stable, oral hygiene was good, and the patient was satisfied with the aesthetic result.

2. Discussion

There is a wider range of therapeutic options available for the maxillary arch when compared to the mandibular arch, mainly because the maxilla offers greater potential for orthodontic management. From both an aesthetic and functional perspective, ^{11, 12} it is more favorable to reposition the affected tooth to its normal position within the dental arch, particularly if the transposition only affects the coronal part of the tooth. In such cases, it is often necessary to perform uprighting and correct any rotation of the affected tooth, as long as there is enough space for the proper alignment of the surrounding teeth. However, when the decision is made to retain the transposed tooth order, several factors need to be taken into account. These include differences in root prominence, varying heights of the gingival scallops, as well as the shape and size of the premolar. Additionally, other factors that require evaluation include the potential for prolonged treatment time, the impact on aesthetics and function, the stability of the final outcome, any potential biological sacrifice or damage, the need for mechanical devices, and the professional preference and experience of the orthodontist.^{13.} In situations where transposed teeth are affected by caries or exhibit poor periodontal support, or in cases where there is a significant tooth - size discrepancy, the extraction of a permanent tooth, usually a premolar, becomes a more appealing option. Numerous recent reports have highlighted that recession at the gingival margins of the repositioned canines is a common occurrence due to the lengthy journey of the canine through the dense buccal compact bone. In our treatment approach for maxillary canine and premolar transposition, we employed similar mechanics that resulted in a similar occurrence of gingival recession at the gingival margin of the canine.^{12, 13, 18} Although the gingival recessions were primarily seen as an aesthetic concern, it is important to note that the supporting bone structure remained intact according to these recent reports. However, upon further examination through CT scans, we observed labial triangular bone resorption, which is a more severe issue than mere aesthetics. Despite the fact that gingival recession can be considered as a predictor of labial cortical bone loss, the CT scans revealed that the extent of bone loss was actually larger than initially anticipated. Another challenge encountered in restoring the natural tooth order was the extended duration of treatment, mainly due to difficulties encountered in moving the roots and the potential risk of

forcibly pushing the premolar root against the canine root. While we utilized fixed biomechanics to control the movement of the teeth, it is apparent that completely safe movement does not exist, with torque being one of the most detrimental contributing factors in this regard. Canines possess a wider and higher gum contour in comparison to lateral incisors, resulting in an enhanced aesthetic outcome for individuals exhibiting a high smile line. Consequently, it becomes imperative to conduct a comprehensive radiological analysis to facilitate treatment planning and evaluate the repositioning of teeth. Nonetheless, following orthodontic treatment, the patient presented with a significantly elevated displaced gingival contour. Therefore, in order to attain a pleasing smile and achieve a satisfactory outcome, the implementation of a periodontal connective tissue graft was deemed necessary.

3. Conclusions

Tooth position and the collaborative efforts between different disciplines have a crucial impact on the process of planning treatment and the ultimate triumph of implanted teeth. This comprehensive approach ensures that not only the functional aspects of the teeth are addressed, but also the visual appeal of the individual's facial features and the overall appearance of their smile. The case study illustrates the effectiveness of a non-extraction orthodontic approach in managing maxillary canine - premolar transposition. The successful treatment led to improved dental aesthetics, functional bite relationships, and patient satisfaction, highlighting the importance of careful treatment planning and interdisciplinary collaboration in dental care.

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