MANAGEMENT OF PSEUDO-TRANSPOSITION OF CANINE WITH SEGMENTAL MECHANICS - A CASE REPORT.

Rasiga Gandhi[1*], Sangeetha Duraisamy[2], Krishnaraj Rajaram[3], Ravi Kannan[4], Jeyaram Palanivel[5]

Article History: Received: 12.12.2022 **Revised:** 29.01.2023 **Accepted:** 15.03.2023

Abstract

Management of pseudo transposition of canine could be very challenging with conventional continuous arch mechanics due to the lack of root control. Segmented arch mechanics involves retraction canines into the extraction space using retraction springs which provide adequate root control. A case report of 13 years old female patient with severe crowding and pseudo- transposition of canine treated using segmental mechanics with 0.017x0.025" TMA PoulGjessing (PG) spring for retraction is presented. The treatment results showed correction of canine position with ideal alignment of crown and root.

Keywords: Pseudo-transposition, PG spring, segmented arch mechanics, canine retraction, and ectopic canine.

[1]Senior Lecturer, Department of Orthodontics and DentofacialOrthopaedics, SRM Dental College, Ramapuram, Chennai, Tamilnadu, India.
[2,3] Professor, Department of Orthodontics and DentofacialOrthopaedics, SRM Dental College, Ramapuram, Chennai, Tamilnadu, India.
[4]Dean and HOD, Department of Orthodontics and DentofacialOrthopaedics, SRM Dental College, Ramapuram, Chennai, Tamilnadu, India.
[5]Former Post graduate, Department of Orthodontics and DentofacialOrthopaedics, SRM Dental College, Ramapuram, Chennai, Tamilnadu, India.

DOI: 10.31838/ecb/2023.12.s2.086

1. Introduction

Ectopically erupted canine is a condition frequently encountered in an orthodontic practice. A rare and an extreme case of ectopic eruption is transposition, where a permanent tooth forms and emerges in the space of another permanent tooth.[1]Peck *et al* described transposition as the positional interchange of two adjacent teeth, particularly of the roots.[2]Pertz*et al* classified transposition as complete or incomplete based on the involvement of both crown and root or only the crowns.[3] Pseudo transposition is the incomplete transposition where only the crown of the involved teeth is transposed. The most prevalent transposition is that of canine and lateral incisor, females are more affected than males.[4] Unilateral left side transpositions are more common than bilateral transpositions with a predilection for maxillary arch. In the mandibular arch, tooth transposition is uncommon with a prevalence rate of 0.003%.[4]

The etiology of transposition is not completely understood and few documented etiologies in literature include retained deciduous teeth which deflect the erupting permanent tooth to migrate and erupt in a transposed location, interchange of dental lamina of involved teeth[5], trauma exerted on the teeth by an external force, which is likely to result in an exchange of tooth germs.[2, 5] However the high frequency of association with anomalies like peg laterals, congenitally missing teeth and the bilateral occurrence of transposition of same teeth suggest a genetic etiology.[2]

The orthodontic alignment may include correction or transposition if the root positions are favorable or retaining the transposed position of the teeth.[6]Extraction of permanent first premolars as dictated by arch length tooth material discrepancy may facilitate correction of transposed teeth. If predicted early, extraction of the retained deciduous teeth and guiding the emergence of a transposed tooth to its normal location could be an ideal treatment option.[5,6]

The alignment of transposed canine can be done with friction mechanics in a continuous arch or with a retraction spring in a segmented arch.[7] Segmented arch mechanics facilitates creation of a determinant force system imperative for controlling the position of the root during canine alignment in contrast to friction mechanics where force system is indeterminant and a considerable amount of force is lost due to the friction generated during the sliding of canine brackets over the archwire.[8-10]PG canine retraction spring was introduced in 1985 by PoulGjessing The efficient design lends good stability to this retraction spring for use in segmented orthodontic mechanics to deliver a predetermined force with a constant moment to force ratio required for root control.[7,8]

A case report of partial transposition of mandibular right canine corrected by using segmented arch mechanism is described below.

Case Report

A 13 years old female patient reported to the orthodontic clinic with a chief complaint of irregularly arranged upper and lower front teeth. Extra oral examination revealed a convex profile and normal lower facial height and an acute nasolabial angle.(Figure 1) Severe crowding of the anterior teeth was observed in the maxillary and mandibular arch with space deficiency of 9 mm with an overjet of 5mm , an overbite of 2mm with upper dental midline shifted from the facial midline to left by 1mm and lower midline shifted to right by 5mm. (Figure 1)Pseudo transposition of the maxillary left canine and mandibular right and left mandibular canine with the lateral incisor was noted. All the three transposed canines were buccally placed and mesially tipped with a severe mesio-labial rotation.(Figure 1)Panoramic radiography confirmed the root position of transposed canines and

lateral incisors in all the three quadrants. (Figure 2)

Cephalometric analysis indicated a class I skeletal with an orthognathic maxilla and mandible. The lower anterior facial height was average with a proclination of upper and lower incisors (Table 1). The treatment objective was to correct the transposition, resolve crowding in upper and lower arch and to obtain an ideal overjet and over bite. Extraction of all first premolars and maximum anchorage was required to alleviate the crowding and proclination in the upper and lower arch.

Treatment was carried out in four phases, individual retraction of canine followed by aligning and leveling of arch , closure of residual extraction spaces by friction mechanics and detailing of occlusion. The first phase was started with placement of fixed maxillary trans palatal arch and mandibular lingual arch for anchorage. Only second premolars and canines were bonded in the quadrants where retraction of transposed canine was required. 0.022 slot MBT prescription bracket system was used.

Maxillary left and both mandibular canines in pseudo transposition were retracted into the extraction space using PoulGjessing retraction spring custom fabricated from 0.017x0.025" Beta Titanium (TMA) wire. (Figure 3) The PG springs were calibrated to generate forces and moments required for the retraction of the transposed canines without tipping the roots as recommended by the Gjessing P.[7,8]

After canine retraction the incisors were bonded, leveling and aligning was carried out using a continuous archwire following the traditional arch wire sequence of 0.016 Niti wire,0.016 x 0.022”Niti wire, 0.016 x 0.022” Stainless steel wire, 0.017 x 0.025”Niti wire, 0.017 x 0.025” Stainless steel wire, 0.019 x 0.025”Niti wire, 0.019 x 0.025” Stainless steel wire.(Figure 3) The midlines were corrected using intraoral light elastics, the residual extraction spaces were closed with friction mechanics and finishing and detailing of the occlusion was carried out along with occlusal settling.

A significant profile and dentoalveolar changes was noted at the end of the treatment. (Table 1, Figure 4)Orthopantomograms showed a good root parallelism including that of the transposed canines and lateral incisors. (Figure 4)The treatment duration took 16 months and debonding was carried out followed by upper removable Begg’s retainer and lower fixed spiral wire retainer. (Figure 5)

2. Discussion

It is advised that the transposed teeth be relocated to their normal place in the dental arch for aesthetic and functional reasons.[11] In patients with pseudo-transposition of canine where the root apices are in normal position with only the crowns transposed, uprighting and rotating the teeth into its original position after creating required space can restore the canine guided occlusion. In this patient all the three canines in transposition were placed buccal to the lateral incisors and roots positioned in their ideal positions in the arch. The width of the attached gingiva in relation to transposed canines were adequate,which is an important soft tissue factor for successful alignment of impacted , ectopically erupted or transposed canines into its ideal position in the arch. [12]

The crowns were tipped mesially with a distal inclination of root. A severe arch length tooth material discrepancy of 9mm was noted in both arches warranting extraction of first premolars. Based on the above factors a segmental arch mechanics with retraction of transposed canines with PG spring was decided. PG springs was calibrated to achieve controlled tipping of the canines into the extraction space followed by derotation and further uprighting of roots.

Canine retraction is a very important step in most orthodontic procedures involving extraction of premolar teeth and individual

canine retraction has several advantages over enmasse retraction.[13] Proffit describes the PG spring to be an efficient design for retraction of severely tipped and rotated canine.[14]The spring can generate required moment-force ratio for uprighting and derotation followed by translation. The low deflection rate, and good stability provided by the rectangular wire with overlapping ovoid loops produce a controlled retraction of the canine into the extraction space without the need for additional anchorage preparation like extraoral devices and orthodontic mini-implants.[15] It can be economically made, easily constructed and placed in the routinely used MBT brackets and activated. It has some drawbacks, such as the fact that it is not failsafe in the event of inadvertent distortion and that initially, it may irritate the sulcular mucosa.[16]

This segmented approach in the first stage of the treatment preventing early engagement and incisors resulting in unwanted tipping and proclination of incisors thereby reducing the additional treatment time needed to correct them. The retraction spring induced controlled and sequential alignment of the transposed into the extraction space without the need for complex anchorage preparations.[17,18]This mechanics allowed controlled tipping of canine from the lateral incisor crown into the extraction space without causing mesial tipping of molars with the help of appropriate bends in the spring design.[18] The canine retraction was completed 6 months' and was followed by a continuous arch mechanics of 10 months. The treatment approach used in the current patient combined the sophistication of segmented arch approach with the simplicity of continuous arch-wire mechanics to achieve the desired results without a prolonged treatment period.

3. Conclusion

A detailed orthodontic assessment must be done to determine the best course of action for correction of transposition of teeth for the best possible aesthetic as well as functional outcomes. Pseudo transposition and ectopic eruption are often associated with arch length tooth material discrepancy and extraction of first premolars can aid in correcting the transposed crowns. The combined segmental mechanics and continuous archwire could achieve the most desirable results while preventing undesired tooth movements.

4. References

Shapira Y, Kuftinec MM. Tooth transpositions—a review of the literature and treatment considerations. Angle Orthod.1989;59(4):271–6.

Peck L, Peck S, Attia Y. Maxillary canine-first premolar transposition, associated dental anomalies and genetic basis. Angle Orthod.1993;63(2):99–109.

Peretz B, Arad A. Bilateral transposition of maxillary canines and first premolars: case report. Quintessence Int. 1992 May;23(5):345-8.

Muhamad A, Nezar W, Abdulgani A. Prevalence of tooth transposition in Arab Israelian (Arab48) population; a retrospective study. Int Org Sci Res J Dent Med Sci. 2015;1:65–71.

Stafne EC, Gibilisco JA. Oral roentgenographic diagnosis. WB Saunders Company; 1975.

Qamar CR, Riaz M. Transposition of teeth: A review of literature.Pak Orthod J.2010;2(2):72–5.

Gjessing P. Biomechanical design and clinical evaluation of a new canine-retraction spring. Am J Orthod. 1985;87(5):353–62.

Gjessing P. A universal retraction spring. J Clin Orthod.1994;28(4):222–42.

Ravi K, Balasubramaniam M R, George M, Duraisamy S. Comparison of canine retraction using slide friction less

ligature modules with conventional modules - An in vivo study.SRM J Res Dent Sci. 2010;1:150-155.

Parameswaran T Mani, Dilip Srinivasan, Priya kalidass, Davis S, Ravi Kanan, Srinivas Sivakumar. Comparison of the rate of orthodontic space closure, with and without probiotic supplements: a randomised control trial. Int. J. Res. Pharm. Sci. 2020 Dec.1;11((SPL 4):1042-50.

.Shapira Y, Kuftinec MM, Stom D. Maxillary canine-lateral incisor transposition--orthodontic management. Am J Orthod Dentofacial Orthop. 1989 May;95(5):439-44.

Charles A, Duraiswamy S, Krishnaraj R, Jacob S. Surgical and orthodontic management of impacted maxillary canines. SRM J Res Dent Sci. 2012 Jul 1;3(3):198.

Ramesh B, Srinivasan D, Duraiswamy S. Analysis of stress in bone with orthodontic mini-implants during en-masse retraction of maxillary and mandibular anterior teeth: a finite element analysis. J. Pharm. Sci. 2021 May 1;13(5):302-12.

.Proffit WR, Fields Jr HW, Sarver DM. Contemporary orthodontics. Elsevier Health Sciences; 2006.

Figures

Gnaneswar SM, Sridhar P. Comparison of dual-dimensional and rectangular wires in terms of space closure and anchorage loss during retraction with miniimplants: A prospective clinical study. J Dent Res Dent Clin Dent Prospects. 2020;14(1):54.

.Sengupta J, Sharma S, Sahu D. PG Canine Retraction Spring. Med J Armed Forces India.2003 Oct;59(4):337–8.

17 Vickram, A. S., Samad, H. A., Latheef, S. K., Chakraborty, S., Dhama, K., Sridharan, T. B., ... & Gulothungan, G. (2020). Human prostasomes an extracellular vesicle–Biomarkers for male infertility and prostrate cancer: The journey from identification to current knowledge. International journal of biological macromolecules, 146, 946-958.

Mishra HA, Maurya RK. An Approach with Hybrid Segmental Mechanics. J Clin Diagn Res. 2016 Jun;10(6):ZD18-21.

El-Bialy T. Segmented and sectional orthodontic technique: review and case report. J Health Spec. 2013;1(2):90–6.

Figure 1: Pretreatment Intra-oral and Extra-oral photographs

Figure 2: Pretreatment orthopantomogram and Lateral Cephalogram

Figure 3: Treatment progress with segmental and continuous mechanics

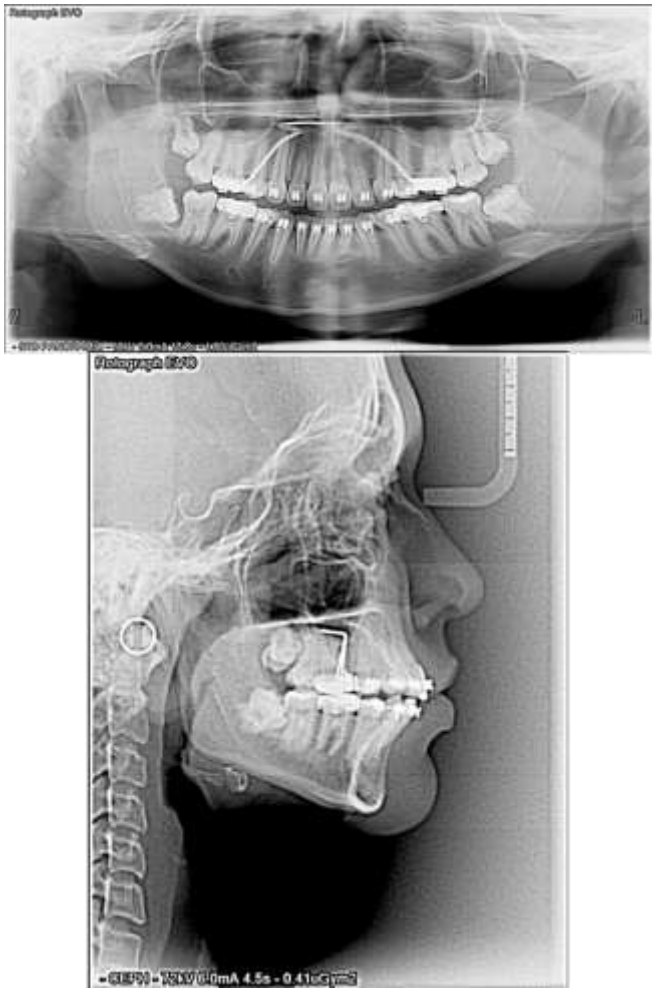

Figure 4: Post treatment orthopantomogram and Lateral Cephalogram

Figure 5: Post-treatment Intra-oral and Extra-oral photographs

TABLES

Table 1: Comparison of initial and post treatment cephalometric values

Parameter	Average value	Initial	After treatment
SKELETAL			
SNA	82°± 2	81^{O}	80^{O}
SNB	80°± 2	78^{O}	78^{O}
ANB	2°± 2	3^{O}	2^{O}
Go Gn to SN	31°± 2	29^{O}	29^{O}
PP-SN	7°± 2	6^{O}	6^{O}
Occl. Pl to SN	14°± 3	14^{O}	13^{O}
DENTAL			
U1 to N-A(mm)	4mm	10mm	7mm
U1 to N-A (Angle)	22°± 4	35^{O}	31^{O}
L1 to N-B(mm)	4mm	9mm	5mm
L1 to N-B(Angle)	25°± 4	30^{O}	30^{O}
Inter Incisal Angle	131°	110^{O}	116^{O}
U1 to SN	102°	115^{O}	111^{O}
SOFT TISSUE			

S line-upper	-2mm	2mm	1mm
S line-lower	0mm	4mm	1mm
Nasolabial angle	110°	86°	93°