

Canines substitution for congenitally missing maxillary lateral incisors– An interdisciplinary case report

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Abstract

Orthodontic treatment for patients with unilateral or bilateral congenitally missing lateral incisors is a challenge. Comprehensive treatment planning is required to achieve a satisfactory result, keeping in mind the aesthetics, function and periodontal stability. An interdisciplinary treatment approach is beneficial and involves orthodontic closure of the space with maxillary canine substitution or space opening for single-tooth implants, bridges and tooth-supported restorations. This case report presents a 18 year old male patient with Class II Division 1 malocclusion who reported with an over-retained maxillary deciduous left lateral incisor, missing permanent maxillary lateral incisors bilaterally, generalized upper anterior spacing and bilateral end-on molar relation with increased overjet and overbite. The patient was treated by extraction of deciduous lateral incisor in the maxillary arch and second premolars in the mandibular arch. Congenitally missing maxillary lateral incisors were substituted with canines bilaterally and the maxillary premolars were substituted as canines with an interdisciplinary approach. A remarkable improvement in the facial profile, smile esthetics and a favourable functional Class I occlusion with normal overjet and overbite was achieved.

Keywords: Congenitally missing teeth, Canine substitution, Esthetic re-contouring.

Introduction

Agenesis of the permanent teeth that replace the primary teeth, the succedaneous teeth, is found in children whose both parents have peg lateral incisor teeth. The trait of small/ pegged/ missing maxillary lateral incisor teeth is inherited in an autosomal dominant manner. Agenesis of succedaneous teeth is most likely an autosomal recessive trait due to the homozygous state of the gene for small-pegged-missing maxillary incisor teeth.⁽¹⁾ The incidence of missing maxillary lateral incisors is 1% to 2% in white population and 2% in Indian population.⁽²⁻³⁾ Often they are associated with retained deciduous lateral incisors, spacing in maxillary anterior region and drifting and rotation of the central incisors and the canines. In unilateral cases, the asymmetric drift can result in a midline shift. The common treatment approach in this case is canine substitution of the missing lateral incisors with esthetic re-contouring of the canines to resemble lateral incisors and also premolar re-contouring to resemble canines both esthetically and functionally. The other approaches are lateral incisor replacement with implants or canine implants after re-contouring canines to resemble lateral incisors or auto-transplantation.

The most satisfactory results are achieved when the spaces are closed with mesial movement of the canines. However, canine substitution may present a difficulty in achieving acceptable esthetic results because of the differences in inherent size and shape of the maxillary canines and the lateral incisors.⁽⁴⁻⁸⁾ A careful case selection is of utmost importance which should take into consideration the age of the patient, the type of malocclusion and other associated findings. In cases with missing lateral incisors and proclined maxillary

anterior teeth, the spaces of the congenitally missing lateral incisors can be used for retraction. So the purpose of this case report is to present and discuss the treatment of a patient with Class II division 1 malocclusion presenting with convex profile, incompetent lips, bilateral end-on molar relation and increased overjet and overbite, missing permanent maxillary lateral incisor and retained deciduous lateral incisors, generalised upper anterior spacing. The patient was treated with canines substituting the bilateral missing maxillary lateral incisors and their esthetic re-contouring, premolars substituting the canines and extraction of lower second premolars to obtain a class I molar relation bilaterally.

Diagnosis and Etiology: An 18 year old male patient presented with the chief complaint of spacing and forwardly placed upper front teeth. The patient had a convex profile and incompetent lips (Fig. 1). On intraoral examination he had proclined maxillary anterior teeth with spacing, increased overjet and overbite with end-on molar relationship bilaterally, missing maxillary lateral incisors bilaterally and over retained deciduous maxillary left lateral incisor (Fig. 1). There was a shift in the upper dental midline to the left by 3mm. Cephalometrically, the patient had a skeletal Class II Division 1 malocclusion with a retrognathic mandible and proclined upper and lower incisors and prominent lips (Fig. 1).



Fig. 1: Pre-treatment records

Treatment objectives: The treatment objectives were to correct the dental protrusion, closure of the spaces in upper anterior segment, correction of dental midline shift, obtaining a favourable overjet, overbite, a Class I molar and canine relation and improving the soft tissue facial profile and lip competency.

Treatment plan: Extraction of the deciduous lateral incisor and substituting canines for missing maxillary lateral incisors by esthetic contouring and substituting maxillary first premolars for canines was planned. Interdisciplinary case discussion was done with the department of Conservative dentistry. Extraction of lower second premolars was planned to achieve a Class I molar relationship by using Group B anchorage.

Treatment alternatives

1. Extraction of the deciduous lateral incisors and opening up space for lateral incisor implants or a fixed bridge.
2. Crowns on the existing deciduous maxillary lateral incisor and closure of the space.

The treatment option of canine substitution was chosen along with extraction of mandibular second premolars to facilitate mandibular molar mesialization to achieve Class I molar relationship bilaterally. Closure of remaining space after canine substitution was done by en-masse retraction of anterior teeth to aid in achieving favourable overjet and improving the profile.

The second option was opening up space for lateral incisor implants or a fixed bridge. The patient had a protrusive profile and increased overjet. If the space was planned to be restored with implants the only option for reducing the protrusion and overjet would be extraction of first premolars and subsequent retraction of the anterior teeth along with correction of the dental midline. But this procedure requires unnecessary removal of more teeth in a patient already having agenesis of two teeth.

The root length of the retained deciduous maxillary lateral incisors was not suitable for supporting crowns and may show resorption in future, due to which this option was not considered.

The patient was informed about the options and the first option was chosen.

Treatment progress: A diagnostic set-up of the chosen treatment plan was done to demonstrate and verify the end-result. This set-up showed the final occlusion that would be achieved. The surfaces that required functional and esthetic reshaping could be identified to provide the optimum functional and esthetic outcome.

Treatment was started with extraction of mandibular second premolars and maxillary deciduous lateral incisors. Both the arches were bonded with MBT 0.022" slot brackets (3M Unitek) and all the first molars were banded with MBT pre-welded bands. The maxillary canines were bonded with maxillary lateral incisor brackets at a level 0.5 mm incisal to the value used for central incisor, for the effective expression of the tip and torque values required for the conversion of canine to lateral incisor. The maxillary first premolars were bonded with canine brackets for incorporating the tip and torque values required to convert it to canine.

Treatment was progressed with subsequent arch-wire changes starting from 0.016" Nickel-Titanium wires, proceeding to 0.019" x 0.025" Nickel-Titanium and progressed through 0.019" x 0.025" and 0.016" stainless steel wires. The remaining anterior spaces were closed with elastic chains. In the mandibular arch, anchorage requirement was Group B⁽⁹⁾ wherein half of the extraction space was to be closed by molar protraction to correct molar relationship and the remaining half by retraction of the anterior teeth simultaneously. For protraction of the mandibular molars, the entire lower arch was consolidated as one segment from first premolar on one side to the other in the rectangular 0.019 x 0.025" stainless steel wire stage and the wire distal to the first premolar was thinned down to allow protraction of molars.⁽¹⁰⁾ The arch-wire was thinned to allow for molar protraction. Protraction was performed with changing active tiebacks from first premolars to the first molars. After space closure, the OPG showed mesial tipping of the mandibular first molar. Since it was a second premolar extraction case and heavy forces were applied to protract the molar, it could have resulted in the mesial tipping of the molars. Thinning of the arch-wire in the molar region could also have contributed to this mesial tipping effect. However, gable bends were given distal to the first premolars along with retraction forces to generate counter moments to the moment of force.⁽¹⁰⁾ Later, towards the end of treatment, 30° gable bends were given to upright the mandibular first molars. (Fig. 2).



Fig. 2: Post space closure

The active treatment time was 24 months. The occlusal results were retained with a maxillary circumferential Begg's retainer and a mandibular canine-to-canine bonded retainer. Pre-finishing radiographs were made to check for the inclination of the teeth and for any need of further retraction (Fig. 3). OPG was made to check root inclinations and/or any pathology caused by the orthodontic treatment. It showed good root parallelism of all the teeth except mandibular first molars (Fig. 3). Gable bends were given to up-right the mesially tipped mandibular first molars. However, since no major tooth movements were done during the settling phase, no post de-bonding radiographs were made. The favourable change in the inclination of the mesially tipped mandibular first molars was verified clinically by the inclination of the mesial and distal buccal cusps and by the good occlusion achieved after up-righting.

Treatment results: A remarkable change in the profile was achieved. The lips became competent with no lip strain (Fig. 3). The patient was satisfied with the change in his dentition and profile. The intraoral photographs revealed a final Class I occlusion with a Class I molar and canine relationship and normal overjet and overbite (Fig. 3). The maxillary canines were reshaped with composite resin and grinded off 0.5 mm from their cusp tips to resemble lateral incisors. The premolars were recontoured to resemble canines and their palatal cusps were reshaped to help in lateral excursions and anterior guidance. The upper dental midline was coinciding with the facial midline and the lower dental midline. The pre and post treatment cephalometric values are shown in Table 1.

Table 1: Comparison of pre and post treatment Cephalometric values

Parameters	Pre-treatment	Post-treatment
SNA angle	83°	82°
SNB angle	79°	79°
ANB angle	7°	3°
FMA angle	32°	29°

Basal Plane angle	30°	29°
U1 to Palatal plane	118°	112°
U1 to TVL	-5	-8
IMPA	98°	92°
Inter-incisal angle	114°	129°
Lower lip to E-line	4mm	2mm



Fig. 3: Post-treatment records

Discussion

Before planning more extractions in a patient who already has agenesis of teeth, the clinical and cephalometric findings should be carefully evaluated to decide the treatment plan. This patient had a Class II Division 1 malocclusion with increased overjet and lip protrusion. Bi-maxillary dento-alveolar proclination, lip incompetency and the spacing in the maxillary anterior quadrant were the determining factors to decide on the chosen option.

The most important treatment decisions must be linked to the long-term outcome, since change over time is normal in biologic systems. The treatment which is completed in young adulthood should be reflecting a natural dentition over a long time, which might span 60 or more years. Conventional space closure for missing maxillary lateral incisors is a viable and safe procedure that provides satisfactory esthetic and functional long-term results.^(11,12) Further esthetic dentistry procedures including tooth reshaping and restorative treatment with individual tooth bleaching, porcelain veneers and hybrid composite resin build-ups for the canines and premolars can be undertaken after space closure.⁽¹³⁻¹⁵⁾ The results obtained can almost mimic natural dentitions in esthetic and periodontal aspects and are likely to remain so in a life-long perspective.⁽¹⁶⁾ Properly made ultra-thin enamel-bonded ceramic veneers have proved to be esthetic and extremely durable.⁽⁵⁾ A cantilevered lateral pontic bonded to a canine can be used with bondable translucent ceramics which have adequate strength.⁽¹⁷⁾ In comparison, although high survival rates for implants and implant-supported crowns have been reported, biologic and technical complications leading to hard or soft tissue changes around the implant-supported porcelain crowns can appear even after only a few years.⁽¹⁸⁻²¹⁾ Progressive infra-occlusion of the implants due to continued growth of the surrounding alveolus

which can be evident even in older population, bluish discoloration of the surrounding gingiva, gingival recession and dark margins along the implant-supported porcelain crowns and bone loss of neighbouring teeth are some complications reported over a period of time.^(4,21-23)

The major advantages of orthodontic space closure for young patients with lateral incisor agenesis and a co-existing malocclusion are the permanence of the finished result and the possibility to complete treatment in early adolescence.^(11,15,23,24) The disadvantage of this treatment option is the tendency of the space re-opening in a young patient. However, this can be prevented with long-term fixed retention with a bonded lingual retainer and proper restorations of the teeth adjacent to the substituting canines and premolars to provide retention of the result, supported by a well-balanced functional occlusion.^(12,25)

The presence of major malocclusion serves as the primary criterion for either space opening or space closure in some cases. Mandibular extractions may be indicated in these cases to relieve arch length deficiency, to reduce dento-alveolar protrusion or to compensate for a Class II molar relationship. The choice of extraction depends upon all these factors along with anchorage requirements for molar relationship correction.

The replacement of lateral incisors with cuspids usually creates a maxillary anterior tooth size excess. The extent of this inter-arch excess can be detected and calculated by a modified Bolton's analysis.^(26,27) With the closure of maxillary lateral incisor spaces, the most ideal esthetic balance will be achieved if the cuspids are narrow mesio-distally relative to the central incisors. However, if cuspids are large, an acceptable result can be achieved by proximal cuspid reduction. So in modified Bolton's analysis, the width of the lateral incisors is taken relative to the central incisors and added to get the Bolton's anterior discrepancy.⁽²⁷⁾

In the present case, there was an increased overjet and bilateral end-on molar relationship. The extraction of the mandibular second premolars and mesialization of molars along with space closure with canine substitution allowed achievement of Class I occlusion bilaterally, retraction of teeth and reduction of increased overjet and a remarkable change in soft tissue profile. The inclination of the maxillary incisors w.r.t the palatal plane and to the true vertical line was well within the prescribed range as given by McLaughlin and Bennett⁽²⁸⁾ (112° and -8 mm). The mandibular anteriors were proclined and their retraction was required to reduce the lip prominence and incompetency. After retraction, the IMPA was reduced by 6° and to ensure its stability, a lingual bonded retainer was placed.

Cases in which the cuspids erupt in close proximity to central incisors are best treated by space closure. The extensive distal bodily movement of such cuspids is both mechanically difficult and biologically unsound due to the presence of the alveolar concavity between the cuspid and the first premolar roots. In the present case,

the pre-treatment scenario showed that the canines were closer to the central incisors which made it easier for space closure. If an option for space opening was to be considered the correcting the overjet would have posed a problem.

Canine protected occlusion was missing but it was mutually protected occlusion without balancing side interferences. Rinchuse et al⁽²⁹⁾ found that balanced occlusion was more prevalent than canine protected occlusion and that this was particularly true for subjects with normal static occlusion.

Disharmonious marginal gingival levels resulting from infra-positioned implant crowns are a disadvantage for patients with a high smile line. A gummy smile is a contraindication for implants in the anterior maxilla,⁽¹⁶⁾ which was applicable in this patient.

Summary and Conclusions

This case report demonstrates successful substitution of maxillary permanent lateral incisors with canines. A functionally stable occlusion was achieved with improved macro and mini-esthetics. A remarkable improvement in the facial profile, smile esthetics and a favourable functional Class I occlusion with normal overjet and overbite was achieved. The greatest advantage of this treatment option is the elimination of the need for prosthetic replacement. The patient was immensely satisfied with this cost-effective treatment outcome.

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