
A skeletal Class III malocclusion with agenesis and canine-bicuspid transposition: a non-surgical approach

Carlos Bellot-Arcís, Verónica García-Sanz and Vanessa Paredes-Gallardo

Stomatology Department, University of Valencia, Valencia, Spain

Background: The present case report describes the orthodontic management of a patient who presented with a skeletal Class III malocclusion combined with other dental anomalies. The malocclusion was complicated by agenic maxillary lateral incisors and a lower right second premolar, in company with the transposition of the maxillary canines and premolars.

Methods: Dentoalveolar compensation of the anteroposterior jaw relationship was performed. The upper deciduous lateral incisors were extracted and the spaces closed, so that the first premolars replaced the missing lateral incisors while the canine transposition was maintained

Results: Satisfactory results were obtained which provided an improvement in function and occlusal stability, as well as smile and profile aesthetics.

Conclusion: This case demonstrates the importance of an accurate diagnosis when many treatment options are available and clearly addressed.

(Aust Orthod J 2018; 34: 94-102)

Received for publication: July 2017

Accepted: November 2017

Carlos Bellot-Arcís: carlos.bellot@uv.es; Verónica García-Sanz: veronique_hd@hotmail.com; Vanessa Paredes-Gallardo: vanessa.paredes@uv.es

Introduction

The incidence of a skeletal Class III malocclusion varies between 1% and 19% depending on ethnicity and the population studied.¹⁻³ The incidence in Caucasians is 1–5%.^{4,5}

Treatment options for a skeletal Class III in non-growing patients may involve orthognathic surgery, orthodontic dentoalveolar compensation, or a combination of both. The decision regarding which type of treatment is suitable for a particular patient depends on the severity of the discrepancy, the inclination and position of the anterior teeth, and dental and facial aesthetics.⁶

Dentoalveolar compensation is often a valid option when the malocclusion is not severe. Compensation is usually achieved by the retroclination of the lower incisors and mesial advancement of the maxillary teeth, which causes upper incisor proclination.⁷ A

camouflage option makes the underlying skeletal problem less evident, and the treatment usually leads to an improvement in occlusion, function, and aesthetics.⁸ This procedure often results in a slight retraction of the lower lip, as well as deepening of the mentolabial fold.⁹

Lateral incisor agenesis is often associated with a skeletal Class III relationship¹¹ and is the second most commonly absent tooth after the lower second premolar.¹⁰

The treatment of patients with agenic lateral incisors is controversial,¹² and presents a challenging problem. Treatment planning depends on numerous factors including, among others, the anteroposterior jaw relationship and arch discrepancy.¹³ One treatment option consists of opening or maintaining the anterior space and placing a suitable prosthetic restoration. However, tooth-supported restorations can compromise periodontal status, which can present



Figure 1. Pretreatment facial and intraoral photographs.

further aesthetic limitations.¹⁴ Closing the space by placing the canines adjacent to the central incisors is an alternative treatment, although in some cases it is necessary to perform canine enameloplasty in order to achieve optimal aesthetics. This option has been described as stable and acceptable to the patient.¹⁵

Agenesis of the mandibular second premolar is commonly associated with other dental anomalies such as maxillary canine and first premolar transposition.^{10,16} Maxillary transposed teeth can be left uncorrected or moved to their correct position, the second option being advantageous when the canine is not fully erupted.¹⁷

Case report

Pretreatment evaluation

A 17-year-old female presented wishing to improve her smile aesthetics, with a particular concern regarding her anterior crossbite. Her dental and medical histories were unremarkable.

Facial photographs showed an unaesthetic smile with insufficient exposure of the upper anterior teeth, asymmetry as the chin had shifted slightly to the left,

mild mandibular protrusion, a straight profile and an increased lower facial third (Figure 1).

An intraoral examination and dental cast analysis determined that the anteroposterior dental relationship was a molar Class I and a canine Class III. There was an anterior reverse overjet of 3 mm. No maxillary transverse deficiency or posterior crossbite were evident. The upper deciduous lateral incisors and the lower right second deciduous molar were present but the corresponding permanent replacement teeth were agenic. There was a 1.5 mm diastema between the upper central incisors, and the lower dental midline had deviated 2 mm to the left. A bilateral transposition of the maxillary canines and first premolars was also noted (Figures 1 and 2).

A panoramic radiograph verified the agenesis of both upper permanent lateral incisors and the lower right second premolar. It was evident that the transposition of maxillary canines and premolars was complete by the involvement of both the crowns and the roots (Figure 3).

A lateral cephalometric analysis indicated a skeletal Class III relationship with a Wits appraisal of -8 mm and an ANB of -2.3°. The maxillary incisors were

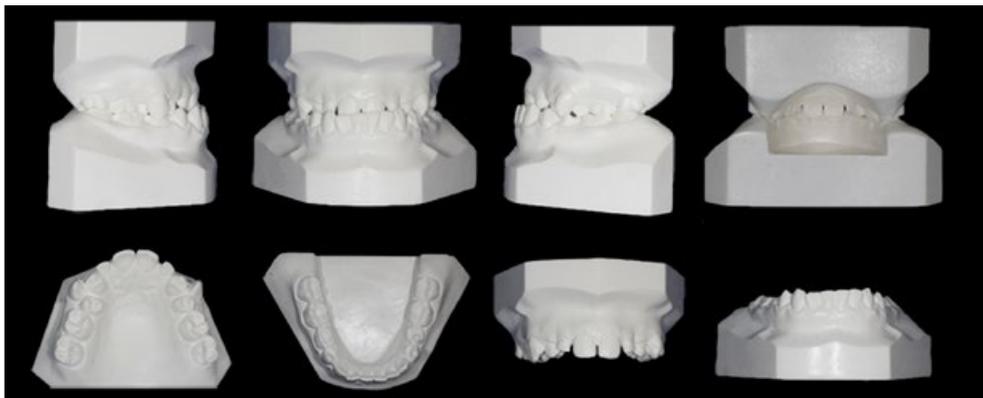


Figure 2. Pretreatment dental casts.

retroclined and formed an angle of 102.9° with the palatal plane. The lower incisors were also retroclined (85.5°) in relation to the mandibular plane (Figure 4 and Table I).

Treatment objectives

The main treatment objectives were to: (1) enhance the smile aesthetics by achieving an acceptable overjet and improving exposure, position, and morphology of the upper anterior teeth, and (2) obtain an acceptable dental relationship for improved function and stability.

Treatment alternatives

Several treatment alternatives were considered and discussed with the patient and her mother. To manage the dental and skeletal anteroposterior relationships, orthognathic surgery involving dentoalveolar compensation and maxillary advancement were considered. The surgical approach was dismissed because there was a functional component, created by an edge-to-edge incisal relationship in centric occlusion, and the patient was reluctant to undergo surgery.

A second consideration was whether to maintain the spaces created by the missing lateral incisors or elect to close the spaces and avoid prosthetic involvement. As there was posterior crowding, it was finally decided to close the spaces in order to achieve better aesthetics and adequate periodontal status.

As the maxillary canines were fully erupted and their transposition complete, the option of correcting the position of the premolars and canines was rejected.

Lower extractions were also considered to facilitate the management of the anteroposterior dental relationship. Extractions of the mandibular right



Figure 3. Pretreatment panoramic radiograph.

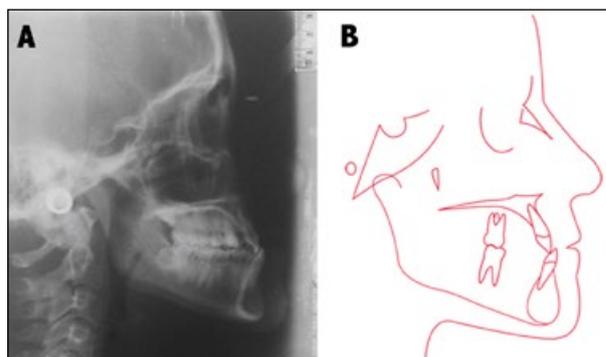


Figure 4. Pretreatment lateral cephalogram (A) and cephalometric tracing (B).

second deciduous molar and left second premolar were therefore proposed. However, the patient refused to have healthy teeth removed and so this option was discarded. The patient agreed to use Class III elastics to manage and correct the anteroposterior relationship.

After the initial treatment plan was designed based on an accurate diagnosis and the patient’s requirements, working models with a diagnostic set-up helped visualise and verify the treatment outcomes.

Treatment Progress

Tip-Edge Plus® 0.022 × 0.028” bracket appliances (TP Orthodontics Inc, IN, USA) were bonded to the

Table 1. Pretreatment and post-treatment cephalometric measurements.

Cephalometric analysis	Initial	Norm	Final
SNA angle (°)	78.2	82	78.8
SNB angle (°)	80.5	80	79.1
ANB angle (°)	-2.3	2	-0.3
Wits appraisal (mm)	-8	0	-4.3
U1-palatal plane (°)	102.9	110	105
IMPA (L1-MP) (°)	85.5	95	84.4
Interincisal angle (°)	140.1	130	138.3
Overjet (mm)	-3.4	2.5	1.5
Overbite (mm)	1.6	2.5	1
Facial axis (NABA-PTGN) (°)	94.1	90	90.9
FMA (MP-FH) (°)	27.6	26	29
Mandibular length (GO-GN) (mm)	79	78	81.2

upper and lower permanent teeth. The brackets have a special feature that allows the teeth to tip distally due to their slot morphology. The maxillary canines and premolars received brackets usually placed on contralateral teeth in order to allow mesial tipping, which would contribute to Class III correction (Figure 5). Composite resin build-ups were bonded to the upper first premolars to produce disocclusion and so facilitate anterior crossbite correction.

The palatal cusps of the upper first premolars were reduced to avoid interferences. Subsequently, 0.014" superelastic nickel-titanium (SE NT) archwires were placed for levelling and aligning of the dental arches. Metallic ligatures were passed through the vertical slots of the upper second premolar brackets to hasten alignment.

Elastic thread was tied from upper right to upper left first premolar to begin anterior space closure (Figure 6).

After alignment was achieved, upper and lower 0.016 × 0.025" SE NT archwires were placed. At this stage, the upper deciduous lateral incisors were extracted and elastic chain was used for space closure. The extractions had been delayed to avoid aesthetic disadvantage. Class III elastics were used by the patient 24 hours a day. Once the anterior crossbite had been corrected, uprighting springs were placed through the vertical slot of maxillary canines and first premolars in order to correct unwanted mesial tipping (Figure 7).

After eight months of intermaxillary elastic wear, a complete molar Class II relationship was achieved and the anterior crossbite was corrected. The posterior

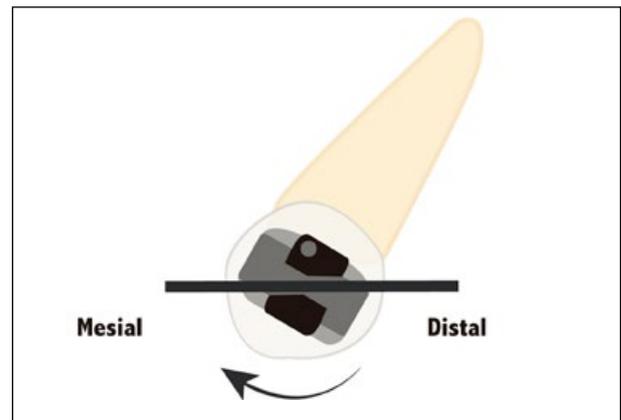


Figure 5. Illustration of a Tip-Edge Plus® bracket belonging to the upper right quadrant bonded on an upper left tooth to allow mesial tipping.

build-ups were therefore removed. To attain acceptable interdigitation, interproximal enamel reduction was performed on the lower right deciduous molar. Stainless steel 0.0215 × 0.028" archwires along with 0.016" SE NT archwires were placed, which passed through the auxiliary tunnels to upright the teeth and achieve optimal torque and tipping. Finishing bends were incorporated into the archwire to improve the position of individual teeth. Auxiliary hooks were crimped to the archwires mesial to the canines, and an elastic chain was placed to the hooks on the first molar tubes in order to prevent spaces from opening (Figure 8).

Finally, 0.016" SE NT archwires were inserted along with short triangular intermaxillary 1/8" elastics (Super thread, Rocky Mountain Orthodontics, CO, USA) to provide posterior interdigitation.



Figure 6. Treatment progress intraoral photographs. First treatment stage.



Figure 7. Treatment progress intraoral photographs showing uprighting springs.



Figure 8. Treatment progress intraoral photographs. Last treatment stage.



Figure 9. Post-treatment facial and intraoral photographs.

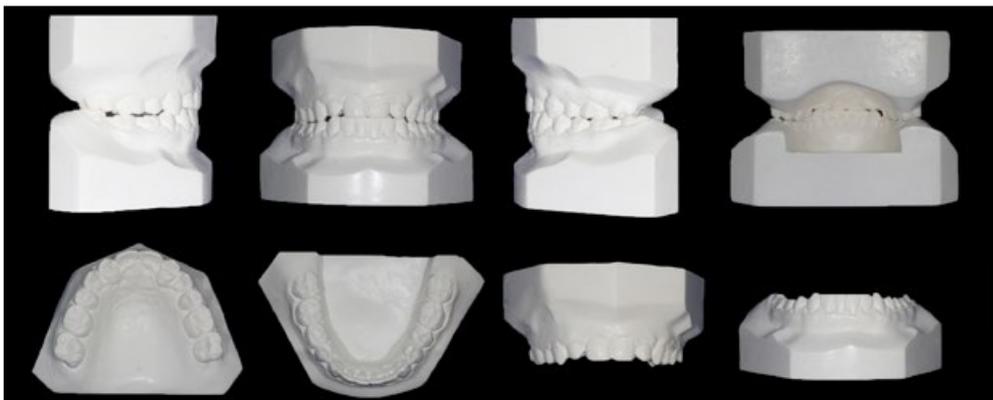


Figure 10. Post-treatment dental casts.

After 24 months of treatment, all appliances were removed and canine-to-canine fixed lingual retainers were placed on both upper and lower arches, and thermoplastic removable retainers were provided to be worn at night.

Treatment results

All treatment objectives were achieved. The facial photographs show a more attractive smile and an improvement in the patient's profile, which was slightly less straight after treatment (Figure 9).

Intraoral photographs and a dental cast examination showed a complete molar Class II and canine Class I. Overjet and overbite were considered to be adequate. Molar and premolar interdigitation was acceptable, although less precise on the right side due to the presence of the deciduous molar. The frontal view shows full closure of the interincisal diastema. The lower midline was corrected, and the upper first premolars adjacent to the central incisors created acceptable and harmonic dental aesthetics (Figures 9, 10). The restoration and reshaping of the upper bicuspid to resemble lateral incisors as

well as gingivectomies were suggested to the patient. However, she was happy with the aesthetic results and declined further treatment.

From the panoramic radiograph, good root parallelism was achieved and only minimal resorption was detected in the upper left first premolar root (Figure 11).

The cephalometric tracing and superimpositions showed a decrease of 2° in the ANB angle and 3.7 mm in the Wits appraisal, which indicated an improvement in the anteroposterior relationship. The upper incisors were slightly proclined, showing an increase of 2° in the upper incisor long axis to the palatal plane. The facial axis decreased by 3° (Figures 12, 13 and Table I).

Discussion

Dentoalveolar compensation of the skeletal Class III was the treatment of choice in the present case. A contributing reason for this option was the diagnosis of a functional anterior displacement of the mandible. According to previous reports, if an end-to-end anteroposterior relationship can be reached when approaching centric relation, and when a forward position of the mandible with normal mandibular length is found, then the malocclusion can be classified as pseudo-Class III, and may be treated by dentoalveolar compensation.^{18,19} These characteristics were present in the current case as an edge-to-edge relation could be achieved and the mandibular length was 79 mm (Gonion-Gnathion).

Following Class III camouflage treatment, the upper incisors invariably present excessive proclination, which can result in an unattractive smile and diminished incisor exposure. In the present case, the upper incisors reached an acceptable inclination due to the extraction of upper teeth followed by space closure. In this way, tooth display at rest and in smiling were appropriate and the smile arch was harmonic.

The patient presented with agenesis of the upper lateral incisors. Space closure was performed leading to satisfactory aesthetic and periodontal results. Nordquist and McNeill²⁰ compared patients with lateral incisor agenesis who had been treated by space closure with those who received prosthetic replacements. It was found that the space closure group showed better periodontal health, but no differences in occlusal function were found. Robertsson and Mohlin¹⁵ concluded that, aesthetically, lateral incisor space closure was more acceptable to patients than a prosthetic solution.



Figure 11. Posttreatment panoramic radiograph.

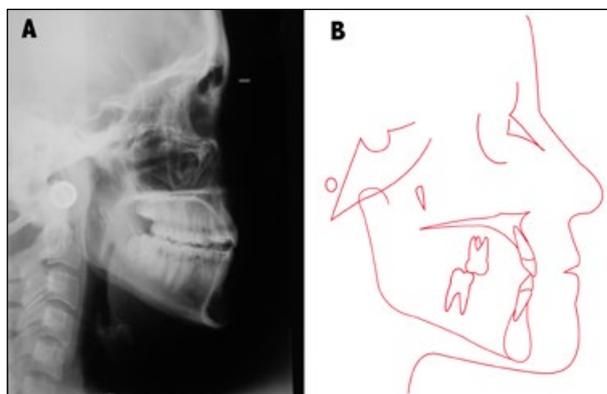


Figure 12. Post-treatment lateral cephalogram (A) and cephalometric tracing (B).

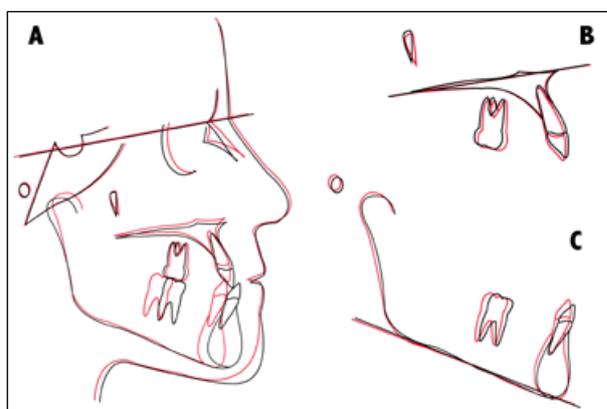


Figure 13. Superimposed pretreatment (black line), post-treatment (red line) cephalometric tracings. (A) Superimposed on the Sella-Nasion plane at Sella. (B) Superimposed on the palatal plane at Anterior Nasal Spine. (C) Superimposed on the mandibular plane at Menton.

By closing the patient’s lateral incisor spaces, a final anteroposterior relationship of a complete molar Class II was obtained, with good interdigitation in the left buccal segment. Although interdigitation was acceptable, optimal results could not be attained in the right segment due to the presence of the lower right second deciduous molar. As the patient had agenesis of the permanent second premolar, it was decided not

to extract the deciduous molar in order to maintain arch symmetry. These teeth have been proved to have a good prognosis of long-term survival.²¹ Some interproximal enamel reduction was performed on this tooth to enhance the occlusion.

The case presented an additional dental anomaly in the transposition of the maxillary first premolars and canines. The transposition was maintained and, as a result, an acceptable occlusion was obtained as the canines were placed in their correct position in the arch, which technically achieved a canine Class I relationship. The first premolars therefore replaced the missing lateral incisors, which resulted in a compromised but acceptable aesthetic result. Replacing maxillary anterior teeth with bicuspid is a treatment alternative that can be considered when there is a combination of lateral agenesis and premolar transposition, or if an anterior tooth is missing and premolar autotransplantation is performed. Both procedures have been reported to result in satisfactory outcomes.^{17,22}

In the present case report, the transposed teeth were fully erupted. This situation contributed to the decision to maintain the transposition. According to Ciarlantini and Melsen, satisfactory results can be obtained through this option, provided that the teeth involved are fully erupted.¹⁷

Orthognathic surgery was proposed to the patient as the ideal solution but she was reluctant to undergo an invasive procedure. The patient also declined having mandibular teeth extracted. It was made clear that the wearing of elastics was important in order to achieve acceptable results and she proved compliant in this respect.

Uprighting both maxillary canines was challenging since their roots were tipped distally, which was unfavourable considering the direction of the planned mesial movement. Good root parallelism was finally achieved by using full-size archwires and uprighting springs.

According to the cephalometric measurements, treatment brought about a significant improvement in the skeletal anteroposterior relationship as the Wits appraisal reduced to -4.3 mm. A substantial change was also observed in the facial axis, which showed a decrease of 3°. Both anteroposterior and vertical cephalometric changes were attributed to the correction of the functional anterior displacement of the mandible.

Summary and conclusions

In the presented case, a precise diagnosis was crucial to successful treatment planning. After discarding the option of surgery, Class III camouflage was undertaken with additional key decisions due to the anomalies of transposition and agenesis.

An attractive smile was achieved by improving maxillary incisor display and obtaining a positive overjet.

The anteroposterior dental relationship provided acceptable functionality and occlusal stability.

The correction of the functional anterior displacement of the mandible contributed to the enhancement of the anteroposterior skeletal relationship and the patient's profile aesthetics.

Corresponding author

Verónica García-Sanz
Orthodontic Department
5st floor
Dentistry Clinic
University of Valencia
C/ Gascó Oliag,1. 46010
Valencia
Spain
Email: veronique_hd@hotmail.com

References

1. Chan GK. Class III malocclusion in Chinese (Cantonese): etiology and treatment. *Am J Orthod* 1974;65:152-7.
2. Silva RG, Kang DS. Prevalence of malocclusion among Latino adolescents. *Am J Orthod Dentofacial Orthop* 2001;119:313-5.
3. Baik HS, Han HK, Kim DJ, Proffit WR. Cephalometric characteristics of Korean Class III surgical patients and their relationship to plans for surgical treatment. *Int J Adult Orthodon Orthognath Surg* 2000;15:119-28.
4. Thilander B, Myrberg N. The prevalence of malocclusion in Swedish schoolchildren. *Scand J Dent Res* 1973;81:12-21.
5. Haynes S. The prevalence of malocclusion in English children aged 11-12 years. *Rep Congr Eur Orthod Soc* 1970:89-98.
6. Stellzig-Eisenhauer A, Lux CJ, Schuster G. Treatment decision in adult patients with Class III malocclusion: orthodontic therapy or orthognathic surgery? *Am J Orthod Dentofacial Orthop* 2002;122:27-37.
7. Lin J, Gu Y. Preliminary investigation of nonsurgical treatment of severe skeletal Class III malocclusion in the permanent dentition. *Angle Orthod* 2003;73:401-10.
8. Proffit WR, Fields HW, Sarver DM. Contemporary orthodontics. 4th edn. St. Louis, Mo.: Mosby Elsevier, 2007; xii, 751.
9. Georgalis K, Woods MG. A study of Class III treatment: orthodontic camouflage vs orthognathic surgery. *Aust Orthod J* 2015;31:138-48.
10. Polder BJ, Van't Hof MA, Van der Linden FP, Kuijpers-Jagtman AM.

- A meta-analysis of the prevalence of dental agenesis of permanent teeth. *Community Dent Oral Epidemiol* 2004;32:217-26.
11. Bassiouny DS, Afify AR, Baeshen HA, Birkhed D, Zawawi KH. Prevalence of maxillary lateral incisor agenesis and associated skeletal characteristics in an orthodontic patient population. *Acta Odontol Scand* 2016;74:456-9.
 12. Johal A, Katsaros C, Kuijpers-Jagtman AM; Angle Society of Europe membership. State of the science on controversial topics: missing maxillary lateral incisors--a report of the Angle Society of Europe 2012 meeting. *Prog Orthod* 2013;14:20.
 13. Thilander B. Orthodontic space closure versus implant placement in subjects with missing teeth. *J Oral Rehabil* 2008;35 Suppl 1:64-71.
 14. Silveira GS, de Almeida NV, Pereira DM, Mattos CT, Mucha JN. Prosthetic replacement vs space closure for maxillary lateral incisor agenesis: A systematic review. *Am J Orthod Dentofacial Orthop* 2016;150:228-37.
 15. Robertsson S, Mohlin B. The congenitally missing upper lateral incisor. A retrospective study of orthodontic space closure versus restorative treatment. *Eur J Orthod* 2000;22:697-710.
 16. Peck S, Peck L. Classification of maxillary tooth transpositions. *Am J Orthod Dentofacial Orthop* 1995;107:505-17.
 17. Ciarlantini R, Melsen B. Maxillary tooth transposition: correct or accept? *Am J Orthod Dentofacial Orthop* 2007;132:385-94.
 18. Rabie AB, Gu Y. Diagnostic criteria for pseudo-Class III malocclusion. *Am J Orthod Dentofacial Orthop* 2000;117:1-9.
 19. Reyes A, Serret L, Peguero M, Tanaka O. Diagnosis and treatment of pseudo-Class III malocclusion. *Case Rep Dent* 2014;2014:652936.
 20. Nordquist GG, McNeill RW. Orthodontic vs. restorative treatment of the congenitally absent lateral incisor--long term periodontal and occlusal evaluation. *J Periodontol* 1975;46:139-43.
 21. Bjerklin K, Bennett J. The long-term survival of lower second primary molars in subjects with agenesis of the premolars. *Eur J Orthod* 2000;22:245-55.
 22. Tanaka T, Deguchi T, Kageyama T, Kanomi R, Inoue M, Foong KW. Autotransplantation of 28 premolar donor teeth in 24 orthodontic patients. *Angle Orthod* 2008;78:12-9.