

Implant rehabilitation of canines in case of bilaterally missing maxillary lateral incisors

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This article reports the successful treatment of a patient with a malocclusion and missing maxillary lateral incisors with an unusual implant-prosthetic rehabilitation in place of the canines. A man, 25 years 5 months of age, was referred by his general dentist with the chief complaint of retained maxillary deciduous canines. He had a skeletal Class I and an Angle Class I malocclusion with an open-bite tendency and prolonged retention of both deciduous canines. The malocclusion was treated with extraction of the maxillary deciduous canines, a fixed edgewise appliance, and implant-prosthesis rehabilitation in place of the canines. A functional and an esthetic occlusion was achieved. (*Am J Orthod Dentofacial Orthop* 2013;144:110-8)

The primary problem associated with the treatment of malocclusion involving agenesis of the maxillary lateral incisors is identifying the procedure that will result in the best esthetic and functional results; this involves more than mere decisions regarding when to open or close the edentulous spaces.^{1,2}

In cases involving congenitally missing maxillary lateral incisors, an interdisciplinary treatment approach is beneficial for obtaining the most predictable outcomes. The management of a patient with such a malocclusion involves multiple treatment options, including acceptance of the space, orthodontic closure of the space (eg, with the maxillary canine substituting and camouflaging this appearance), single-tooth implants, bridges, and tooth-supported restorations.³⁻⁹

The most satisfactory results are achieved when the spaces are closed with mesial movement of the

canines.^{10,11} However, canine substitution is often associated with difficulty in achieving acceptable esthetic results because of the inherent size and shape of the teeth and differences between the maxillary canines and the lateral incisors.¹¹ Therefore, for patients who do not meet the specific qualifications necessary to be considered optimal candidates for canine substitution, an alternative form of treatment must be considered. Restorative treatment alternatives can be divided into 2 categories: a single-tooth implant and a tooth-supported restoration.¹² Today, such alternative treatments are a great choice because of osseointegrated implants and the difficulty associated with obtaining a satisfactory cosmetic result via the closure of edentulous spaces, especially with regard to unilateral agenesis.¹

This case report illustrates a successful treatment involving canine substitution and implant-prosthetic rehabilitation in a patient who was missing both maxillary lateral incisors.

DIAGNOSIS AND ETIOLOGY

A man, 25 years 5 months of age, was referred by his dental implantologist to an orthodontist with the chief complaint of the presence of the maxillary deciduous canines. He requested that the treatment time not last for more than 1 year.

The patient was diagnosed with an Angle Class I malocclusion with an open-bite tendency, missing maxillary lateral incisors, and prolonged retention of the deciduous canines. The permanent canines had erupted in place of the lateral incisors. Both maxillary deciduous canines were in crossbite with the mandibular first

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Fig 1. Pretreatment facial and intraoral photographs.

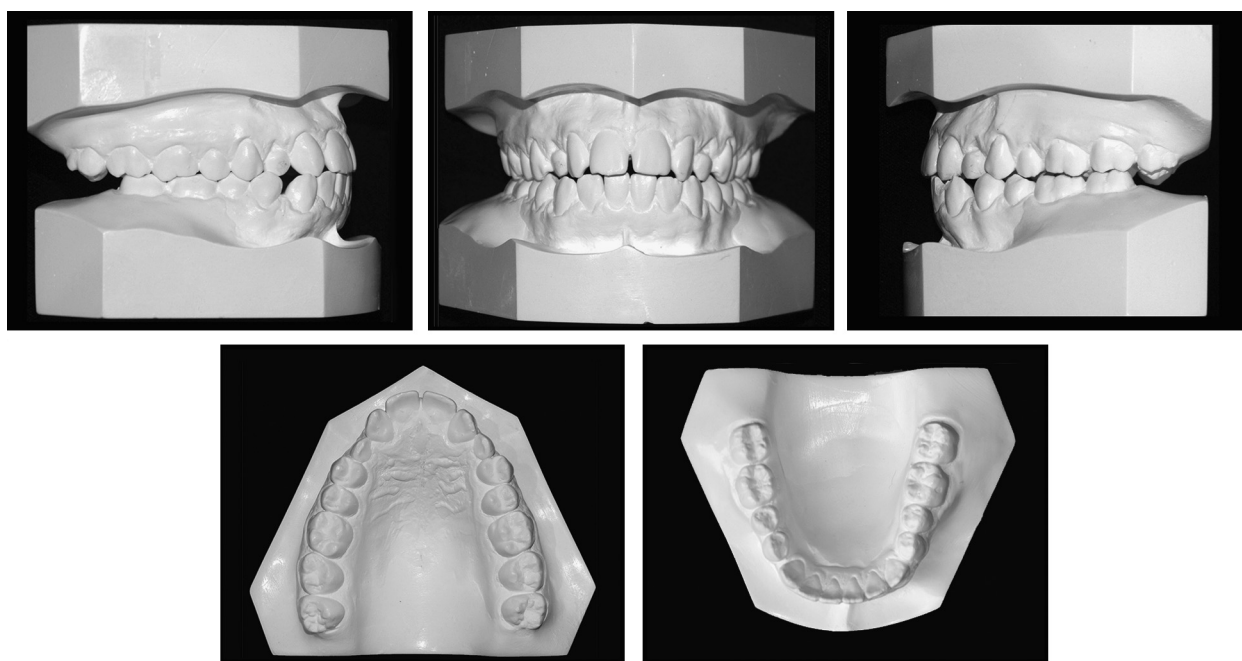


Fig 2. Pretreatment dental casts.

premolars. The patient also had a slight midline diastema between the maxillary central incisors, which also fell between the mandibular first premolars and canines. The

maxillary midline was deviated 1 mm to the right, and the mandibular midline was coincident with the facial midline. The mandibular third molars were absent, but

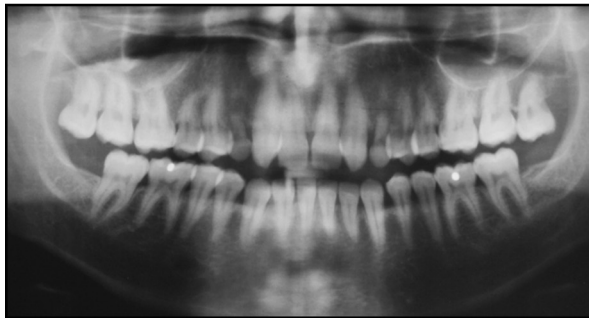


Fig 3. Pretreatment radiographs.

the maxillary molars were overerupted. There were no signs or symptoms of temporomandibular joint dysfunction. The patient had a straight profile; although the lower lip was more prominent than the upper lip, a good facial profile was observed (Figs 1 and 2).

The panoramic radiograph showed that all permanent teeth except the maxillary lateral incisors and the mandibular third molars were present, as well as the prolonged retention of his deciduous canines with some evidence of external root resorption. The maxillary third molars displayed mild extrusion. Root parallelism was evident, including the maxillary canines and first premolars (Fig 3). The cephalometric values showed a skeletal Class I relationship, a slight proclination of the maxillary incisors, and proclined mandibular incisors (Table).

TREATMENT OBJECTIVES

The treatment objectives for this patient were to achieve dental esthetics, which was his chief

Table. Cephalometric measurements

Measurement	Pretreatment	Posttreatment	1-year retention
SNA angle (°)	89	90	91
SNB angle (°)	87	87	88
ANB angle (°)	2	3	3
Convex angle (°)	1	1	2
Y-axis (°)	53	52	54
Facial angle (°)	92	90	91
GoGn-SN (°)	32	30	29
FMA (°)	26	25	25
IMPA (°)	95	88	89
I-NA (°)	27	31	28
I-NA (mm)	7	9	8
I-NB (°)	32	25	24
I-NB (mm)	8	7	8
Interincisal angle (°)	127	123	125
LS-S (mm)	-3	0	-1
LI-S (mm)	0	0	0
Z-angle (°)	80	80	80

complaint, using one of the following alternative techniques: (1) opening a space between the maxillary central incisors and the canines via implants or a fixed prosthesis; (2) closing the space between the maxillary canines and the first premolars and moving all teeth forward; (3) opening a space between both premolars; (4) keeping the space between the canines and the first premolars and replacing the canines with implants; (5) achieving canine guidance; (6) obtaining anterior guidance; (7) extracting the maxillary third molars; and (8) ultimately establishing a healthy occlusion.

The short-term treatment goals were the maintenance of good anteroposterior relationships and improvement of the overbite as well as alignment and leveling of all teeth with a slight posterior dentoalveolar expansion. Other goals involved retraction of the mandibular anterior teeth because of a space between the canines and first premolars; this would improve the position of the lower lip and increase the space for future implants in the maxillary canine area. The final esthetic goals involved closure of the midline diastema, replacing the permanent canines with implants, and reshaping both canines into lateral incisors.

TREATMENT ALTERNATIVES

There were 2 treatment alternatives. To ultimately achieve a Class II molar relationship, the first option was to maintain the maxillary canines in the position of the missing lateral incisors, extract the deciduous canines, and close the spaces by moving the premolars and molars anteriorly. This would have involved setting up 2 temporary anchoring devices between the central



Fig 4. Posttreatment facial and intraoral photographs.

incisors and the canines to mesialize the posterior teeth or placing a T-bar on the palate. This option would also have required reshaping of the permanent canines into lateral incisors.

The second option was based on the distalization of the maxillary permanent canines after the extraction of the deciduous canines with open-coil nickel-titanium springs between the central incisors and the permanent canines. The canines would be in a Class I relationship, whereas the posterior teeth would also be in excellent intercuspation. In addition, this option involved implant-prosthetic rehabilitation in place of the missing maxillary lateral incisors.

The patient was told that both options would require a longer treatment time than he had initially desired because of its peculiar difficulties. In the first option, it would be difficult to move the teeth anteriorly without tipping the 4 posterior teeth on each side. In the second

option, it would be difficult to control and achieve the correct root parallelism in preparation for dental implants.

However, the patient did not have the time for any of these procedures and wanted all treatment to be completed in 1 year. After a meeting between the orthodontist and the dental implantologist who made the initial orthodontic referral, the possibility of using dental implants to replace both canines was suggested as well as using the canines to substitute for the missing lateral incisors.

Previous reports in the literature have indicated that replacing 1 tooth with a dental implant is a predictable procedure with a high success rate.¹³⁻¹⁶ The patient chose the second treatment option.

TREATMENT PROGRESS

Roth prescription fixed appliances were used. Both deciduous canines remained when the implants were

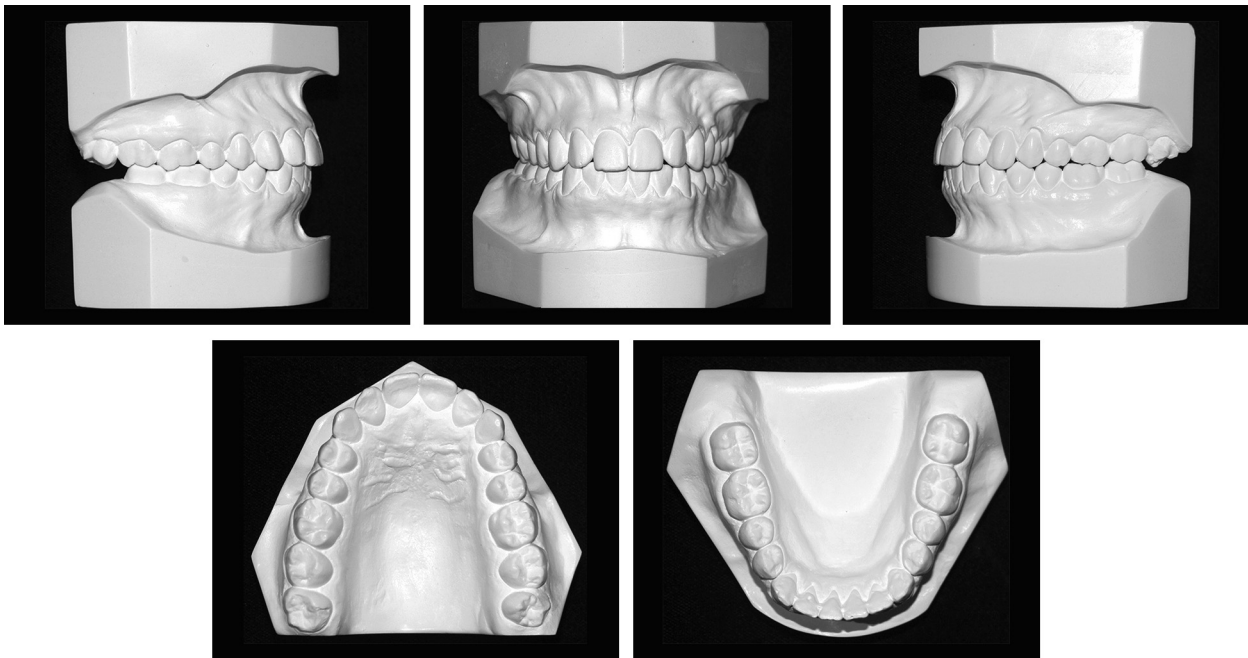


Fig 5. Posttreatment dental casts.

placed. At the implant placement, provisional teeth were delivered and fixed in the archwire for esthetic reasons. The following archwires were used: 0.014- and 0.016-in nickel-titanium, and 0.016-in to 0.020-in and 0.018 \times 0.025-in stainless steel in both arches to improve the overjet. Intermaxillary Class III elastics were used bilaterally, and some vertical Class I elastics were used between the canines and the premolars for intercuspation.

TREATMENT RESULTS

After 10 months of treatment, the patient achieved correct alignment of all teeth, proper overjet and overbite, and adequate space for implants in the region of the permanent canines, and the canines were used to replace the missing maxillary lateral incisors (Figs 4 and 5). The maxillary incisors were slightly proclined, and the mandibular incisors were uprighted (Table). The profile remained balanced. The patient was referred to his general dentist for extraction of the maxillary third molar and reshaping of the canines (Fig 6), although this treatment was not completed for personal reasons.

At the 1-year follow-up, we observed a slight change in the position of the maxillary lateral incisors, but there was excellent intercuspation in the posterior teeth. There was no evidence of abrasion in the mandibular canines, because the patient had proper canine guidance

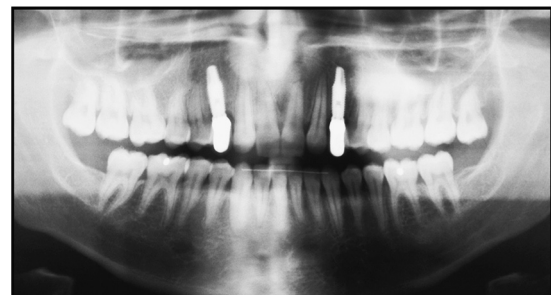


Fig 6. Posttreatment radiographs.



Fig 7. One-year follow-up facial and intraoral photographs.

(Figs 7 and 8), and the maxillary third molars are still present (Fig 9).

DISCUSSION

The maxillary lateral incisors are among the most common congenitally missing teeth. Prompt diagnosis and careful evaluation of treatment determinants are essential with a multidisciplinary approach to achieve the proper management of clinical problems, because each rehabilitation option has its own advantages, disadvantages, indications, and limitations.¹⁷

Furthermore, correcting tooth transposition requires patient cooperation and great care in treatment design. In general, optimal treatment involves the movement of transposed teeth into the correct positions, although this is not always possible or practical.^{18,19} The decision to keep spaces from missing lateral incisors, as in this case report, or to close them orthodontically should be

evaluated carefully after consideration of both the treatment plan and the biomechanics.^{7,20-22} Esthetically and functionally satisfactory results are difficult to achieve, and treatment should involve more than just closing or opening spaces in the affected area.¹

When the option is to close the edentulous space, attention must be paid to inconveniences such as the lack of development of canine guidance, flattening of the facial profile with an increase in the nasolabial angle, a possible predisposition to a Class III relationship, impaction of other teeth in the arch,²⁰ and deepening of the bite.⁶ There are also certain advantages to closing the edentulous space, including improved regional gingival contour, increased stability, and lower treatment cost because implants or prosthetic replacements are not required.^{1,9}

Today, modern prosthetic porcelain bonded to gold, resin-bonded bridges, and single-tooth implants might



Fig 8. One-year follow-up dental casts.

provide a better result in terms of periodontal health and general esthetics, but the patient's opinion is certainly more important than the dentist's and should be considered.⁸

Nevertheless, the clinician must exercise careful consideration when closing edentulous spaces because of the differences in morphology between the lateral incisor and the canine. Moreover, the overall decision depends on whether the patient is a good candidate and whether the result will be acceptable and esthetically pleasing.²³

Many factors can affect the treatment results and must be considered, such as esthetics, occlusion, treatment time, patient comfort, patient compliance, and periodontal support.^{18,19} For our patient, functional and esthetic considerations were prioritized to obtain an appropriate clinical outcome, which involved replacing the lateral incisors with the canines to prevent any gingival damage near the incisors, as well as space maintenance between the canines and premolars to preserve the occlusal stability and maintain the patient's facial profile.

More recently, on the grounds of function and dysfunction, the importance of canine-protected occlusion on lateral movement has been emphasized.⁸ It is necessary to understand that fixed biomechanics can be used to control tooth movement, but it seems that safe movement does not exist, and torque is probably one of the most detrimental factors.¹⁹

Regarding esthetic factors, although the patient was satisfied with the results after treatment and 1 year later, the orthodontist (M.S.P.B.) again suggested reshaping the canines. The procedure was temporarily performed by the orthodontist on 1 tooth on the left side to enable the patient to compare it with the other side. He was satisfied with the result and chose to reshape the other side, with plans for definitive restorative treatment. When this type of procedure is performed, orthodontists prefer the canines to be narrow rather than wide. They also prefer canines with natural shades, gingival margins just below the adjacent central incisor, and rounded tips.²³

Moreover, considering time as a factor, which was a priority criterion for the treatment of this patient, the option to open spaces in the region of the deciduous canines favored the achievement of adequate space for the future installation of osseointegrated implants. By contrast, if the choice of treatment involved repositioning the permanent canine into its proper location and opening spaces in the region of the lateral incisors, the treatment time would have increased.^{24,25}

The installation of osseointegrated implants tends to cause more plaque to accumulate and to increase the areas of gingivitis.⁸ However, this patient showed adequate gingival health 1 year after treatment.

In this case report, the treatment plan was facilitated because the patient chose to keep the canines in place of the missing maxillary lateral incisors. The treatment plan was also driven by the maintenance of good posterior

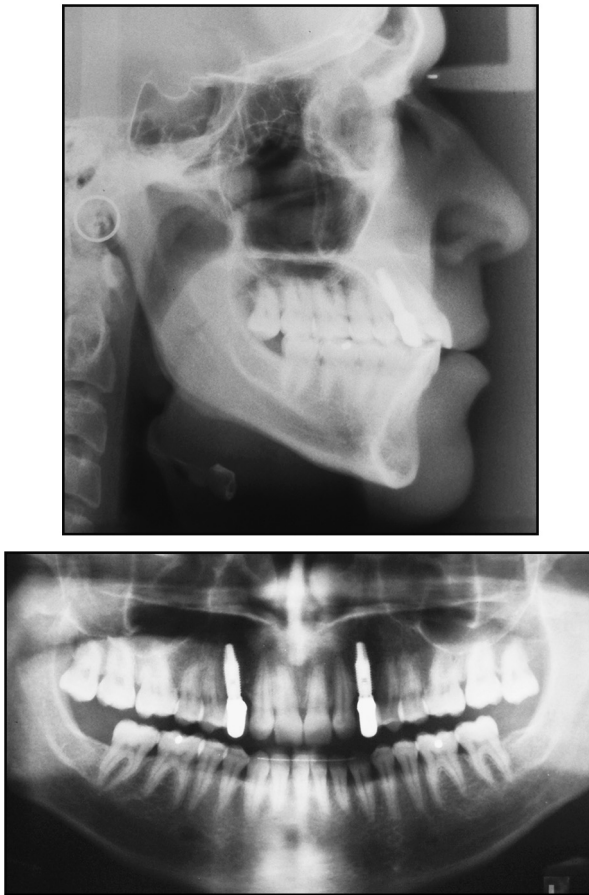


Fig 9. One-year follow-up radiographs.

intercuspatation and rehabilitation with a single-tooth, implant-supported prosthesis with good results, as reported by some authors.¹³⁻¹⁶ The presence of good alveolar bone for implant rehabilitation led to a good resolution in this clinical case. Additionally, the patient's cooperation, the practitioner's skill and experience, esthetics, and function were all important factors that affected the treatment results. These factors must always be considered.

CONCLUSIONS

This case report shows that successful treatment is achievable in cases involving missing maxillary lateral incisors and the use of implant-prosthesis rehabilitation in place of canines, although patient compliance and competent interdisciplinary interaction are mandatory.

REFERENCES

1. Rosa M, Zachrisson BU. Integrating esthetic dentistry and space closure in patients with missing maxillary lateral incisors. *J Clin Orthod* 2001;35:221-34.
2. Rosa M, Zachrisson BU. Integrating space closure and esthetic dentistry in patients with missing maxillary lateral incisors. *J Clin Orthod* 2007;41:563-73.
3. Kinzer GA, Kokich VO Jr. Managing congenitally missing lateral incisors. Part III: single-tooth implants. *J Esthet Restor Dent* 2005;17:202-10.
4. Kinzer GA, Kokich VO Jr. Managing congenitally missing lateral incisors. Part II: tooth-supported restorations. *J Esthet Restor Dent* 2005;17:76-84.
5. Kinzer GA, Kokich VO. Managing congenitally missing lateral incisors. Part I: canine substitution. *J Esthet Restor Dent* 2005;17:5-10.
6. Dermaut LR, Goeffers KR, De Smit AA. Prevalence of tooth agenesis correlated with jaw relationship and dental crowding. *Am J Orthod Dentofacial Orthop* 1986;90:204-10.
7. Fekonja A. Hypodontia in orthodontically treated children. *Eur J Orthod* 2005;27:457-60.
8. 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.
9. Tanaka O, Kreia TB, Maciel JVB, Camargo ES. The agenesis of maxillary lateral incisors: closing or reopening the space? *Rev Dent Press Ortodon Ortop Facial* 2003;2:27-35.
10. Czochrowska EM, Skaare AB, Stenvik A, Zachrisson BU. Outcome of orthodontic space closure with a missing maxillary central incisor. *Am J Orthod Dentofacial Orthop* 2003;123:597-603.
11. Zachrisson BU. Improving the esthetic outcome of canine substitution for missing maxillary lateral incisors. *World J Orthod* 2007;8:72-9.
12. Kokich VO Jr, Kinzer GA, Janakievski J. Congenitally missing maxillary lateral incisors: restorative replacement. Counterpoint. *Am J Orthod Dentofacial Orthop* 2011;139:435, 437, 439 passim.
13. Polizzi G, Fabbro S, Furri M, Herrmann I, Squarizoni S. Clinical application of narrow Branemark system implants for single-tooth restorations. *Int J Oral Maxillofac Implants* 1999;14:496-503.
14. Priest G. Single-tooth implants and their role in preserving remaining teeth: a 10-year survival study. *Int J Oral Maxillofac Implants* 1999;14:181-8.
15. Sadan A, Blatz MB, Dederich DN, Bellerino M. Replacement of missing maxillary canines with dental implants: prosthesis design considerations. *Pract Proced Aesthet Dent* 2004;16:625-30.
16. Vigolo P, Givani A. Clinical evaluation of single-tooth mini-implant restorations: a five-year retrospective study. *J Prosthet Dent* 2000;84:50-4.
17. Kavadia S, Papadiochou S, Papadiochos I, Zafiriadis L. Agenesis of maxillary lateral incisors: a global overview of the clinical problem. *Orthodontics (Chic.)* 2011;12:296-317.
18. Doruk C, Babacan H, Bicakci A. Correction of a mandibular lateral incisor-canine transposition. *Am J Orthod Dentofacial Orthop* 2006;129:65-72.
19. Babacan H, Kilic B, Bicakci A. Maxillary canine-first premolar transposition in the permanent dentition. *Angle Orthod* 2008;78:954-60.
20. Woodworth DA, Sinclair PM, Alexander RG. Bilateral congenital absence of maxillary lateral incisors: a craniofacial and dental cast analysis. *Am J Orthod* 1985;87:280-93.
21. Sabri R. Management of missing maxillary lateral incisors. *J Am Dent Assoc* 1999;130:80-4.
22. Baidas L, Hashim H. An anterior tooth size comparison in unilateral and bilateral congenitally absent maxillary lateral incisors. *J Contemp Dent Pract* 2005;6:56-63.
23. Brough E, Donaldson AN, Naini FB. Canine substitution for missing maxillary lateral incisors: the influence of canine

- morphology, size, and shade on perceptions of smile attractiveness. *Am J Orthod Dentofacial Orthop* 2010;138:705.e1-9; discussion 705-7.
24. Bergendal B, Bergendal T, Hallonsten AL, Koch G, Kurol J, Kvint S. A multidisciplinary approach to oral rehabilitation with osseointegrated implants in children and adolescents with multiple aplasia. *Eur J Orthod* 1996;18:119-29.
25. Carter NE, Gillgrass TJ, Hobson RS, Jepson N, Eechan JG, Nohl FS, et al. The interdisciplinary management of hypodontia: orthodontics. *Br Dent J* 2003;194:361-6.