Taiwanese Journal of Orthodontics

Volume 21 | Issue 4 Article 1

January 2009

Clinical Managements for Missing Maxillary Lateral Incisors – Literature Review

Chih-Yu Lin
Department of Orthodontics, Wan Fang Hospital

Li-Hsiang Lin
Department of Orthodontics, Wan Fang Hospital; Taipei Medical University, School of Dentistry, Dental Department

Follow this and additional works at: https://www.tjo.org.tw/tjo

 Part of the Orthodontics and Orthodontology Commons

Recommended Citation

Lin, Chih-Yu and Lin, Li-Hsiang (2009) "Clinical Managements for Missing Maxillary Lateral Incisors – Literature Review," *Taiwanese Journal of Orthodontics*: Vol. 21: Iss. 4, Article 1.
DOI: 10.30036/TJO.200912.0001
Available at: https://www.tjo.org.tw/tjo/vol21/iss4/1

This Review Article is brought to you for free and open access by Taiwanese Journal of Orthodontics. It has been accepted for inclusion in Taiwanese Journal of Orthodontics by an authorized editor of Taiwanese Journal of Orthodontics.

Clinical Managements for Missing Maxillary Lateral Incisors – Literature Review

Abstract

The etiology of missing maxillary lateral incisors may include congenital missing ones, and previous extractions due to traumatic injury or large dental caries. Spacing and malocclusions following missing maxillary lateral incisors often result in significant impacts on facial esthetics and oral function. To treat these patients, there are orthodontic alternatives to choose from: (1) canine substitution, (2) autotransplantation, (3) conventional prosthetic restorations, and (4) single implants. The aim of this article is to review the prevalence of congenital missing maxillary lateral incisors, and the above-mentioned treatment options for managing missing maxillary lateral incisors.

Keywords

missing lateral incisor, maxillary lateral incisor, canine substitution, single implant

Creative Commons License

This work is licensed under a Creative Commons Attribution-Noncommercial-No Derivative Works 4.0 License.

This review article is available in Taiwanese Journal of Orthodontics: https://www.tjo.org.tw/tjo/vol21/iss4/1

REVIEW ARTICLE

CLINICAL MANAGEMENTS FOR MISSING MAXILLARY LATERAL INCISORS — LITERATURE REVIEW

Chih-Yu Lin[1], *Li-Hsiang Lin*[1,2]
Department of Orthodontics, Wan Fang Hospital[1]
Taipei Medical University, School of Dentistry, Dental Department[2]

The etiology of missing maxillary lateral incisors may include congenital missing ones, and previous extractions due to traumatic injury or large dental caries. Spacing and malocclusions following missing maxillary lateral incisors often result in significant impacts on facial esthetics and oral function. To treat these patients, there are orthodontic alternatives to choose from: (1) canine substitution, (2) autotransplantation, (3) conventional prosthetic restorations, and (4) single implants. The aim of this article is to review the prevalence of congenital missing maxillary lateral incisors, and the above-mentioned treatment options for managing missing maxillary lateral incisors. ***(J. Taiwan Assoc. Orthod. 21(4): 4-10, 2009)***

Key words: missing lateral incisor, maxillary lateral incisor, canine substitution, single implant

INTRODUCTION

There are alternatives in managing orthodontic patients with missing maxillary lateral incisors. Patients with one or two missing maxillary incisors constantly face the problems of compromised oral function and facial esthetics on smiling. Functional and esthetical balance of the final results after orthodontic treatment is the crucial concern for the above-mentioned patients when making a decision among the treatment options. To achieve a satisfactory result, interdisciplinary treatment might constantly be indicated. Current treatment options for managing missing maxillary lateral incisors include canine substitution, premolar autotransplantation, conventional prosthetic restoration, and single implant. Clinicians should know that what is the most beneficial choice for the patient, and make proper suggestions.

Received: January 28, 2010 Revised: February 22, 2010 Accepted: March 1, 2010
Reprints and correspondence to: Dr. Li-Hsiang Lin, Taipei Medical University, School of Dentistry, Dental Department
No.250, Wuxing St., Xinyi Dist., Taipei City 110, Taiwan

PREVALENCE

The incidence of congenitally absent maxillary lateral incisors is 6-10% in Northwest European origin[1], while in American whites 2% and blacks 1%[2]. On the oriental aspect, the study by Endo et al[3] demonstrated that the prevalence of 0.85% Japanese with missing maxillary lateral incisors. In Koreans, Chung et al[4] reported 1.2% missing upper lateral incisor cases among lay persons. In the study by Davis[5], among Southern Chinese in Hong Kong , the percentage of missing upper laterals was 0.64%. The maxillary lateral incisors are usually the most frequently missing teeth in America[2] and the second most at risk of hypodontia in Europeans[6] after the third molars; however, upper lateral incisors were the fourth commonly missing teeth among Japanese[3], the fifth[4] in Koreans, and the third[5] in Hong Kong. A distinct difference is there between the west and the east on the prevalence of missing maxillary lateral incisors.

Besides those whose upper laterals were born to be absent, poor oral hygiene or traumatic accidents can also lead to a decision of extracting maxillary lateral incisors, which often results in the need of a treatment plan resembling cases with congenital missing lateral incisors.

TREATMENT OPTIONS

The common treatment choices for missing maxillary lateral incisors are discussed in 4 parts: canine substitution, autotransplantation, conventional prosthetic restoration, and single implant.

CANINE SUBSTITUTION

In 1952 Carlson[7] was the first to describe a method of selective cuspid recontouring for canine substitution treatment of missing maxillary lateral incisors. Nowadays, for the purpose of achieving a most conservative and least invasive treatment plan, it's a commonly adopted solution --using canines to replace missing lateral incisors.

A suitable candidate for canine substitution should be selected carefully. Kokich[8] emphasized that cases are patients with Angle Class II malocclusion with no mandibular crowding and Angle Class I malocclusion with enough crowding indicating mandibular extractions. For Class III cases, space closure in maxillary arch may deteriorate the incisor relationship[9]. As for profile, a nearly straight or a mild convex profile is considered ideal[8].

The pretreatment diagnostic wax-up[8,9] can always play a useful role as a predictive tool to evaluate final occlusion and to show patients the visual demonstration of the final outcome.

When reshaping the canine, attention should be paid to the patient's personal Bolton ratio. Back in 1970, Tuverson[10] described a detailed method for recontouring the cuspid on the mesial, distal, labial and incisal aspects. The minimal reduction[11] of tooth structure of canine substitution is quite an advantage over other treatment options for young patients with large pulp chambers.

Matching the color between the canines and the central incisors is relatively important in cases undergoing canine substitution. The canine is sometimes 1-2 shades darker than the central incisor[8]. Reshaping of canine can lead to enamel thinning and tooth discoloration. One solution to the problem is single canine bleaching[8,9] with 10% carbamide peroxide[9]. A porcelain veneer[8,9,11] can also do perfectly to help approximate the desired color.

It's generally known that the gingival height of a person's upper canine is equal to that of the central incisor. Care must be taken for bracket position of the cuspid in canine substitution cases. To mimic maxillary lateral incisors, the bracket should be bonded more gingivally in order to extrude the canine[8,9] that allows the gingival margin to be positioned more incisally.

About retention, a wrap-around or Hawley retainer[9] should be provided for canine substitution cases.

AUTOTRANSPLANTATION

For patients with missing maxillary lateral incisors,

autotransplantation with premolars planned to be extracted can be an interesting treatment option. The best timing for autotransplantation of premolars to the maxillary anterior region is when the root formation reached two thirds or three fourth of the final root length[12]. The prognosis for periodontal healing at this stage of root formation is better than 90%[13]. Tsukiboshi[14] described 250 autotransplants with 82% success rate in fully developed teeth over a 15-year period. In Tanaka's study[15], the 4-year success rate of autotransplantations to upper anterior region reached 100%. Czochrowska[16] reported in 2002 that teeth undergone autotransplantation was with the long term 90% survival rate and 79% success rate within a mean follow-up period of 26.4years, and that teeth with partly formed roots were more favorable donors.

However, autotransplantation is technique-sensitive to oral surgeons. The final outcomes vary with knowledge, skills, experience of the surgeon who performs the transplantation. After the surgery, a follow-up period of 3-6 months was suggested[12,17]. In cases with successfully autotransplanted teeth, the healed periodontal ligaments served as good as other natural teeth during orthodontic movement.

Premolar crowns can be reshaped to resemble maxillary incisors. Temporary composite resin buildups and later final porcelain laminate veneers (or full coverage crowns)[12,17] are usually indicated for autotransplanted donor teeth. Endodontic therapy should be applied if needed. Excellent results of autotransplantations for missing upper laterals were showed in the previous studies[12,15,17]; yet there is unpredictable factors influencing the final gingival esthetics especially on mesial and distal papilla height[17].

CONVENTIONAL PROSTHETIC RESTORATION

The amount of space[18] required for a fixed partial denture is crucial in patients with missing maxillary lateral incisors. The amount of space can be decided according to the normal contralateral lateral incisor or by means of conducting an anterior Bolton analysis. A diagnostic model set-up can certainly help simplify the treatment for both the orthodontist and prosthodontist.

Resin-bonded fixed partial denture

Generally known as "Maryland bridge", the resin-bonded fixed partial denture is the tooth supported restoration that demands least tooth preparation. The survival rate of this type of restoration ranged from 71%[19] over 10 years to 83%[20] over 13 years; the mean survival time varied from 59months[21] to 119months[22] in the maxillary anterior region. Debonding and fracture are most common reasons for failures[18].

For an ideal resin bonded fixed partial denture, several criteria must be met[18]. First, a shallow overbite, which allows maximum bonding surfaces and decreases occlusal force from lateral excursion, is most desirable. Second, the inclination of the abutment tooth should better be upright to withstand more load before failure. No mobility jeopardizing longevity of the restoration should be found on abutment teeth. Thickness and translucency of the abutments should be evaluated beforehand. The color of the metal retainer may be showed through leading to unaesthetic graying of abutments[9,18]. Patients with occlusal parafunction ought to be avoided for the increased risk of debonding or fracture.

Conventional full-coverage fixed partial denture

As the least conservative tooth supported restoration, conventional full-coverage fixed partial denture is the best choice for replacing an existing bridge or heavily restored teeth. The inclination and angulation[18] for the central incisor and canine are key points for the orthodontists to align the abutments of this conventional 3-unit bridge. From a frontal view, the long axis of the central incisor must be parallel to the labial surface of the canine. Meanwhile, from a lateral perspective, the long axis of the canine must be parallel to the labial surface of the central incisor as well. When abutments properly positioned, tooth preparation for restorative dentists can be simplified.

To avoid joint fracture in full-coverage fixed partial denture, particularly all-ceramic ones, the orthodontists may leave a slight anterior openbite or a little more overjet (about 0.5-0.75mm). The space can be closed with the restoration, and increase the dimension and rigidity of the joint.

SINGLE IMPLANT

In the past a few decades, single implants have become a common and reliable way of treating patients with missing teeth. To achieve a satisfactory final result in missing maxillary lateral incisor cases, interdisciplinary teamwork is often necessary.

For orthodontists, the main objective for these cases is to create an appropriated site facilitating further surgical and prosthetic treatment. The thickness of alveolar bone is important for a future implant site. However, without eruption of the permanent maxillary lateral incisor, the alveolar ridge at the implant site would not fully develop. If the deciduous lateral incisor can be extracted in advance, the permanent maxillary canine can thus be guided to erupt into a more mesial position as where a maxillary lateral incisor should be. In this way, when the permanent maxillary canine is orthodontically moved distally, there would be an increase in the alveolar ridge in the buccolingual width[23]. Studies have shown that alveolus created with this procedure remains stable over time[24,25].

There are minimal requirements for an implant site prepared for restoring missing maxillary lateral incisors. Today the narrowest implant is approximately 3.2mm in diameter. To leave the room for aesthetic papillae, 1.5 to 2.0mm[26] of space is suggested between the implant head and the adjacent teeth. So, the minimal space required between the maxillary central incisor and the canine should be 6.2mm. The interradicular space is recommended to be at least 5mm for leaving 0.75[27] to 1mm[24] of bone between the implant and the adjacent roots. Prior to the removal of orthodontic appliances, periapical radiographs are handy and essential for confirming the amount of space and root position for a future implant site.

For young patients who cannot receive implant placement immediately after the orthodontic treatment, the edentulous space can be maintained in several ways. A removable retainer[9,27] with a prosthetic tooth usually works well in both esthetics and retention. A resin-bonded fixed partial denture[27] can also serve as a competent long-term provisional.

The timing of implant placement should be postponed until the patient's growth reached completion. To find out the completion of growth, superimposition of serial lateral cephalometric radiographs is the most predictable method. The lateral cephalometric radiographs should be taken at a 6-month to 1-year interval[24,27]. When 2 sequential radiographs show no growth in vertical facial height, then it's about time to place an implant for a missing maxillary lateral incisor.

CONCLUSION

There are several alternatives for treating patients with missing maxillary lateral incisors. To choose a most beneficial solution for the patients is an unchanged goal for orthodontists. Whether the chosen option is canine substitution, autotransplantation, conventional prosthetic restorations, or single implant, there are various indications and key points to be kept in mind. With a correct diagnosis, a careful treatment planning, and the attentive treatment procedures, patients with missing maxillary lateral incisors can all eventually have a brilliant smile after well-design interdisciplinary dental treatments.

REFERENCES

1. 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.
2. Harris EF, Clark LL. Hypodontia: an epidemiologic study of American black and white people. Am J Orthod Dentofacial Orthop 2008;134:761-767.
3. Endo T, Ozoe R, Kubota M, Akiyama M, Shimooka S. A survey of hypodontia in Japanese orthodontic patients. Am J Orthod Dentofacial Orthop 2006;129: 29-35.
4. Chung CJ, Han JH, Kim KH. The pattern and prevalence of hypodontia in Koreans. Oral Dis 2008;14:620-625.
5. Davis PJ. Hypodontia and hyperdontia of permanent teeth in Hong Kong schoolchildren. Community Dent Oral Epidemiol 1987;15:218-220.
6. Jorgenson RJ. Clinician's view of hypodontia. J Am Dent Assoc 1980;101:283-286.
7. Carlson H. Suggested treatment for missing lateral incisor cases. Angle Orthod 1952;22:205-216.
8. Kokich VO, Jr., Kinzer GA. Managing congenitally missing lateral incisors. Part I: Canine substitution. J Esthet Restor Dent 2005;17:5-10.
9. Savarrio L, McIntyre GT. To open or to close space--that is the missing lateral incisor question. Dent Update 2005;32:16-18, 20-12, 24-15.
10. Tuverson DL. Orthodontic treatment using canines in place of missing maxillary lateral incisors. Am J Orthod 1970;58:109-127
11. Zachrisson BU. Improving the esthetic outcome of canine substitution for missing maxillary lateral incisors. World J Orthod 2007;8:72-79.
12. Zachrisson BU, Stenvik A, Haanaes HR. Management of missing maxillary anterior teeth with emphasis on autotransplantation. Am J Orthod Dentofacial Orthop 2004;126:284-288.
13. Kristerson L. Autotransplantation of human premolars. A clinical and radiographic study of 100 teeth. Int J Oral Surg 1985;14:200-213.
14. Tsukiboshi M. Autotransplantation of teeth: requirements for predictable success. Dental Traumatol 2002;18:157-180.
15. 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;78:12-19.
16. Czochrowska EM, Stenvik A, Bjercke B, Zachrisson BU. Outcome of tooth transplantation: survival and success rates 17-41 years posttreatment. Am J Orthod Dentofacial Orthop 2002;121:110-119.
17. Czochrowska EM, Stenvik A, Album B, Zachrisson BU. Autotransplantation of premolars to replace maxillary incisors: a comparison with natural incisors. Am J Orthod Dentofacial Orthop 2000;118:592-600.
18. Kinzer GA, Kokich VO, Jr. Managing congenitally missing lateral incisors. Part II: tooth-supported restorations. J Esthet Restor Dent 2005;17:76-84.
19. Audenino G, Giannella G, Morello GM, Ceccarelli M, Carossa S, Bassi F. Resin-bonded fixed partial dentures: ten-year follow-up. Int J Prosthodont 2006;19:22-23.
20. Ketabi AR, Kaus T, Herdach F, Groten M, Axmann-Krcmar D, Probster L et al. Thirteen-year follow-up study of resin-bonded fixed partial dentures. Quintessence Int 2004;35:407-410.
21. Zalkind M, Ever-Hadani P, Hochman N. Resin-bonded fixed partial denture retention: a retrospective 13-year follow-up. J Oral Rehabil 2003;30:971-977.
22. Garnett MJ, Wassell RW, Jepson NJ, Nohl FS. Survival of resin-bonded bridgework provided for post-orthodontic hypodontia patients with missing maxillary lateral incisors. Br Dent J 2006;201:527-534; discussion 525.
23. Kokich VG. Managing orthodontic-restorative treatment for the adolescent patient. Am J Orthod Dentofacial Orthop 2001:395-422.
24. Kokich VG. Maxillary lateral incisor implants: planning with the aid of orthodontics. J Oral Maxillofac Surg 2004;62:48-56.
25. Ostler MS, Kokich VG. Alveolar ridge changes in

patients congenitally missing mandibular second premolars. J Prosthet Dent 1994;71:144-149

26. Saadoun AP, Le Gall MG, Touati B. Current trends in implantology: part II--treatment planning, aesthetic considerations, and tissue regeneration. Pract Proced Aesthet Dent ;16:707-714
27. Kinzer GA, Kokich VO, Jr. Managing congenitally missing lateral incisors. Part III: single-tooth implants. J Esthet Restor Dent 2005;17:202-210.

上顎側門齒缺失之臨床處置－文獻回顧

林芝瑜[1]．林利香[1,2]
萬芳醫院牙科部齒顎矯正科[1]
台北醫學大學牙醫學院牙醫學系[2]

上顎側門齒缺失的可能原因包含先天缺失，或者因為深度齲齒、外傷等因素拔除而缺失。上顎側門齒的缺牙空間與繼之而成的異常咬合常造成顏面美觀及口腔功能上的顯著影響。關於這類患者，在齒顎矯正方面的治療方式有多種選擇：(1) 上顎恆牙犬齒取代上顎側門齒，(2) 自體移植小臼齒取代上顎側門齒，(3) 傳統贋復牙橋，(4) 單顆植牙。本文內容即由上顎側門齒先天缺牙盛行率，以及上述各種治療方式做一回顧，以期供醫師在臨床治療上之參考。**（J. Taiwan Assoc. Orthod. 21(4): 4-10, 2009）**

關鍵詞：側門牙缺失、上顎側門牙、犬齒取代、單顆植牙

收文日期：99年1月28日　修改日期：99年2月22日　接受日期：99年3月1日
聯絡及抽印本索取地址：臺北醫學大學牙醫學院牙醫學系　台北市吳興街250號　林利香