

Dental and skeletal features of patients with congenitally missing maxillary lateral incisors

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Abstract

Aim: the prevalence of maxillary missing lateral incisor (MMLI) is 1-2% which is responsible for 20% of all missing teeth. Increased knowledge of causes and clinical manifestations of cases with this situation can be helpful in their diagnosis and treatment planning. The aim of the present study was to determine dental and skeletal features of patients with missing of maxillary lateral incisors.

Materials and methods: The material consisted of pre-treatment dental casts and cephalograms of 26 patients (14 females and 12 males with average age of 17.5) with unilateral or bilateral MMLI. The following parameters were measured on the dental casts: the maxillary and mandibular intercanine width (ICW) and intermolar width (IMW), overjet, overbite, missing or anomalous of other teeth. Parameters that were measured on cephalogram including: SNA, SNB and ANB angle and Wits. The parameters were finally compared to a control group with normal occlusion by means of paired t-test.

Results: Eight subjects out of 26 patients with MMLI had bilateral missing and from 18 subjects with unilateral missing, 66.67% (12 subjects) had lateral missing on the right side. MMLI was associated with other anomalous or congenital tooth absence in 12 subjects. In comparison with control group, the overjet was significantly lesser ($p < 0.05$) and upper and lower ICW were smaller. Both ANB angle and Wits were significantly decreased in lateral missing group ($p < 0.05$).

Conclusion: Missing of maxillary lateral incisor was highly correlated with other tooth anomalies. Most of patient with this situation had skeletal and dental Class III tendency.

Keywords: Hypodontia, Lateral Aplasia, Maxillary Missing Lateral Incisor

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Hypodontia is one of the most common situation in dentistry that define as developmental absence of at least one tooth.^{1,2,3} The prevalence of this condition varies among different populations and has been generally reported between 3 to 6 percent regardless of third molar.⁴

The maxillary lateral incisor is the second^{4,5,6,7} or third^{2,8,9} most affected tooth depending on ethnic groups and investigative methods.^{10,11} The prevalence of congenitally maxillary missing lateral incisor (MMLI) have been reported between 1 to 2 percent which is responsible for 20percent of all missing teeth.^{3-5,8,9,12,13} The frequency have been found to be slightly more in females than males albeit it is ignorable.^{8,9,14} Although different etiological factors have been suggested for dental Aplasia, the genetic basis is well documented.^{1,2,3,15} The maxillary lateral aplasia is usually associated with some other dental anomalies like microdontia, delayed dental development, ectopic eruption, impaction or transposition and it has been suggested that it

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may be only one manifestation of a complex craniofacial anomaly.^{1,12,15,16,17} This can be explained by certain gene mutation that have several manifestations. On the other hand, involvement of both lateral incisors is more common than one side which can also prove the genetic contribution.^{2,3,9} The absence of maxillary lateral incisors adversely affects the esthetic zone and smile and finally on an individual's appearance and self-esteem. Thus, orthodontic treatment demand of these patients is high.^{4,9,18} Orthodontic treatment modalities for management of such phenomenon must reconcile both esthetic and functional objectives.^{11,19} Since, MMLI represents a clinical problem impairing dental esthetics and function from a very young age, the most important treatment decisions must be linked to long-term outcome.^{20,21} In conclusion, treatment of the congenitally MMLI is a challenge to the dental profession.^{7,18,22} Early investigation is especially important because of the higher association of this situation with other anomalies. It also will give the patient time to find all possible treatment options.²³ For diagnosis and the best treatment choice, a full set of orthodontic records including radiographs, models and clinical photographs are recommended.²³ Choosing the best way for resolving this problem depends on a number of factors, including skeletal pattern, type of malocclusion, overjet and other dental features, so increased understanding of the causes of MMLI and other clinical manifestations of these cases with this problem, would be helpful in their diagnosis and treatment planning. The aim of the present study was to determine dental and occlusal features of patients with missing of one or two maxillary lateral incisors and comparing them with occlusal characteristic of individuals with normal dentition and occlusion.

Method & Materials

The material consisted of pre-treatment dental casts and lateral cephalograms of 26 non-syndromic orthodontic patients (12 males and 14 females) with unilateral or bilateral congenitally missing maxillary lateral incisor. This sample was collected from documents of the patients who were treated in Orthodontic Department of Tehran University of medical science in the

period between 2008 and 2012. The diagnosis of a lateral agenesis was made on the basis of dental pantomograms with attention to patient interview for no history of extraction in upper maxillary region. The ages of the subjects were between 10 to 22 years, with average of 17.5 ± 3.2 years old.

The control group consisted of plaster casts and lateral cephalograms of 35 subjects (16males and19females) of the same age range with normal class I occlusion that maxillary lateral incisors had erupted normally.

The following parameters were obtained from the dental casts using a digital caliper with an accuracy of 0.01 mm:

- Maxillary and mandibular intercanine width (UICW and LICW): It was recorded with the caliper tips placed on the cusp tips of right and left canines. In the cases of canine impaction, the cusp tip of primary canine was substituted.
- Maxillary and mandibular intermolar width (UIMW and LIMW): In upper jaw, it was measured as the distance between mesiobuccal cusp tip of right and left first molars and in lower arch, the lowest point of buccal fissure at buccal surface of right and left first molars.
- Overjet and overbite: Overjet was defined as a horizontal overlap of the incisors and overbite as a vertical overlap of the incisors. These parameters were measured using digital calipers accurate to 0.1 mm.
- Missing or anomalous teeth: Anomalies like microdontia were identified by direct observation of the dental casts. Impaction and aplasia of other teeth were diagnosed from the panoramic radiographs.
- The other parameters obtained from hand-traced lateral cephalograms included: Sella-Nasion-A (SNA) angle, Sella-Nasion-B (SNB) angle, ANB angle and Wits.
- Measuring arch parameters and cephalometric angles were done by two examiners which were calibrated beforehand. Ten randomly selected dental casts and radiographs were examined by both examiners. The Cronbach's alpha for inter-examiner

reliability was 0.81 for dental casts and 0.77 for cephalometric analysis.

Statistical Analysis: The mean and standard deviation of all aforementioned parameters were calculated and compared between MMLI group and control group by means of Paired t-test at the significance level of 0.05 using SPSS for Windows (v14.0; SPSS, Chicago, IL, USA).

Results

Eight subjects out of 26 patients with MMLI had bilateral missing and from 18 subjects with unilateral missing, 66.67% (12 subjects) had lateral missing on the right quadrant of maxillary arch. The distribution of unilateral and bilateral subjects in the maxillary lateral missing sample is shown in Table 1. The number of subjects with anomalous or other teeth missing was significantly greater in the lateral missing group. Five subjects had generalized microdontia (Four subjects had bilateral MMLI and one subject had unilateral MMLI) and two others had impacted tooth (one of them was impaction of maxillary canine in the opposite side of lateral missing and

the other was the second mandibular premolar in an bilateral MMLI case with remained second deciduous molar). Lateral missing in 9 samples were accompanied with absence of some other teeth—mostly mandibular second premolar (Table 2).

None of these anomalies were found in the parameters, overjet was significantly lesser than control group ($P=0.04$). However, the difference was not significant in overbite ($P=0.25$). The mean values of UICW, LICW, UIMW and LICW in MMLI group were 27.99, 24.86, 50.13 and 47.57 respectively in which ICW was significantly smaller than control group in both arches (Table 3). Data from cephalometric measurements is shown in (Table 4). The findings revealed that the value of Wits decreased significantly in MMLI group ($P=0.03$). Regarding sagittal skeletal characteristic in comparison with normal group, ANB angle demonstrated significant decrease ($P=0.00$) in MMLI group, while SNA and SNB angle were not statistically different between two groups.

Table 1 Distribution of subjects with congenitally missing lateral incisors.

Gender	Bilateral MMLI	Unilateral right MMLI	Unilateral left MMLI	Total
Male	4	6	2	12
Female	4	6	4	14
Total	8	12	6	26

MMLI: maxillary missing lateral incisor

Table 2 Distribution of maxillary lateral incisor missing with respect to different anomalies.

Type of anomaly	Bilateral MMLI	Unilateral MMLI	Total
Microdontia	4	1	5
Impaction	1	1	2
Other teeth missing	3	6	9

MMLI: maxillary missing lateral incisor

Table 3 Comparison of dental and skeletal parameters between two groups

	MMLI Mean(SD)in mm	Control Mean(SD)in mm	Sig.*
LIMW	47.57(3.85)	47.16(4.11)	0.73
UIMW	50.13(3.32)	49.15(3.26)	0.34
LICW	24.86(2.66)	26.30(2.38)	0.03*
UICW	27.99(3.69)	33.45(2.59)	0.00*
OJ	1.55(2.28)	2.67(1.63)	0.04*
OB	1.92(2.01)	1.25(1.95)	0.25

*. The mean difference is significant at the 0.05 level.

MMLI: maxillary missing lateral incisor; mm: millimeter; SD: standard deviation

Table 4 Comparison of the cephalometric data between the two study groups.

	MMLI Mean(SD)	Control Mean(SD)	Sig.*
SNA(degree c)	79.44(3.32)	80.65(3.43)	0.20
SNB(degree c)	78.13(4.58)	76.90(3.61)	0.25
ANB(degree c)	1.30(3.26)	3.74(.97)	0.00*
Wits(mm)	-2.57(5.46)	0.15(2.42)	0.03*

*. The mean difference is significant at the 0.05 level.

MMLI: maxillary missing lateral incisor; mm: millimeter; c:centigrade; SD: standard deviation

Discussion

Agenesis of maxillary lateral incisor is a relatively common situation in orthodontic patients and may cause a challenge for clinicians to handle. This event involves esthetic zone and it is also important functionally regarding anterior tooth guidance. Thus, improving our knowledge about etiology and associated features of this abnormality seems to be helpful for better clinical management. In this way, we tried to determine the occlusal, dental and skeletal characteristics of patient with congenitally MMLI

The results of the present study indicated that frequency of some abnormalities like microdontia, impaction and other tooth agenesis in MMLI group is more than normal population. These findings would be expected when considering gene contribution for this phenomenon which is in agreement with previous studies. Generalized microdontia was observed in 5 patients (19.23% of all MMLI patients) from which 4 samples had bilateral lateral missing. Missing of other teeth was the most observed feature in MMLI group.

Nine patients had dental agenesis in addition to maxillary lateral incisor. The most affected tooth was lower second premolar, as was shown in 7 cases of these 9 samples. This high frequency of lower second premolar aplasia might be because of generally high prevalence of this phenomenon. According to many studies, missing of mandibular second premolar is the most common congenitally missing tooth.^{5,8} Other tooth aplasia in present study were detected in incisors, canine, premolars and second molar in upper arch and just incisors in lower one. Finding a relationship between dental anomalies and unilateral or bilateral cases was not possible in this investigation because of small number of samples. It would be suggested to design a study with larger samples to understand if there is any differences between patients with unilateral and bilateral missing of maxillary lateral incisor or not. Garib et al.¹ reported that permanent tooth agenesis, microdontia, palatally displaced canines, and disto-angulation of mandibular second premolars are frequently associated with maxillary lateral incisor agenesis, providing additional evidence of a genetic interrelationship in the causes of these dental anomalies. In another research, Woodworth et al.¹² revealed that the rate of microdontia, impaction and absence of other teeth is greater in patients with MMLI than normal sample. Same results were observed in Pinho's study² who stated a higher frequency for microdontia and other teeth aplasia in MMLI patients. The study of Yaqoob et al.¹⁴ also determined that isolated bilateral absence of maxillary lateral incisors is associated with reduced mesio-distal tooth widths in both maxillary and mandibular anterior segments.

Based on this study and previous researches, MMLI is highly associated with other tooth anomalies, thus, early diagnosis is critical. In this way, any condition which is suspicious to absence of maxillary permanent lateral incisor such as a family history of congenitally missing teeth, asymmetric loss of primary teeth, over-retention of deciduous lateral incisors and canines and impacted maxillary canines should be immediately investigated.²³ It is also suggested that when a maxillary lateral incisor has failed to erupt by the age of 9 years, or within 6 months of the contralateral tooth, its

presence or absence should be confirmed radiographically.³

According to present study, overjet and upper inter-canine width was reduced in MMLI sample. These results seem reasonable when considering decreased tooth material in upper jaw. However, these findings were not in accompany with Woodworth et al.'s¹² results that reported a normal overjet and arch width in their sample. These contradict results can be attributed to different methodology, as Woodworth had no control group and just used normal range of each parameter for comparison which might be different from ours. This study also showed significant decrease in lower ICW that can be justified by high frequency of dental missing in mandibular arch and so arch collapse in sagittal and transverse dimension would be more probable. On the other hand, IMW in both arches were normal in comparison to control group. The rational of this finding can be that MMLI generally induces arch collapse just in the anterior segments without any adverse effect on the posterior part.

Considering cephalometric data, both Wits and ANB angle showed reduction in values in MMLI cases. Determining sagittal relationship based on Angle classification may not be reasonable in these patients because of dental aplasia, so we preferred to use cephalometric criteria rather than canine and molar relationship from dental cast. In this way both angular and linear measurements were considered including SNA, SNB and ANB angle and Wits. Findings revealed that ANB angle and Wits were significantly smaller in samples with maxillary lateral aplasia than normal samples. This class III tendency in patient with MMLI was expected because of decreased tooth material in the maxillary arch. However, the skeletal components should also be taken into consideration. According to our findings, neither SNA nor SNB showed significant differences in relation to normal group, so it cannot be concluded that this class III occlusal pattern was just due to maxillary deficiency. It could be hypothesized that these patients have a special genetic skeletal pattern which make them predisposed to Class III malocclusion. Although Woodworth et al.¹² observed a Class III tendency in his sample, it was just based on occlusal relationships and up to now, no study

has evaluated skeletal parameters of MMLI patients.

Comprehensive knowledge about occlusal and especially skeletal features of MMLI cases is crucial while making decision between space closure and dental implant substitution during treatment planning. Accordingly, further studies should be setup with larger sample in order to achieve a definite result about skeletal pattern of these patients by considering the fact that maxillary lateral agenesis is one of the major challenges that face orthodontists. Moreover, further studies on the genetic basis of maxillary lateral aplasia and related dental and skeletal anomalies are needed to clarify the exact etiology of these dentofacial features

Conclusions

Based on findings from this study we concluded that:

Some dental anomalies like impaction, microdontia and tooth aplasia were more common in MMLI cases.

Both upper and lower ICW significantly decreased in MMLI group.

Patients with MMLI showed smaller overjet, ANB angle and Wits that can make them predispose to Class III malocclusion.

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