



Short Communication

Association of congenital missing of maxillary lateral incisors with cervical vertebral body fusions and/or atlas posterior arch deficiency



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Abstract To evaluate the association between congenital missing of maxillary lateral incisor (MLI) with cervical vertebral body fusions, posterior arch deficiency, and both anomalies. A total of 64 subjects (24 males and 40 females; mean age 16 ± 4.5 years) were detected to have congenital missing of MLI and selected as a study group. Two hundred and fifty-six subjects (87 males and 169 females, mean age 18.1 ± 3.2 years) were assigned to the control group. In the congenital absence of MLI, 53.7% revealed cervical column body fusion, 11.1% indicated a posterior arch deficiency, and 9.3% showed cervical column body fusion with posterior arch deficiency. Morphological deviations of the cervical column showed significant associations with congenital absence of MLI compared to control group ($p < 0.001$). There were no significant differences in gender among the study and control groups ($p > 0.05$). Subjects with congenital MLI tend to have an increased frequency of cervical anomaly.

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Introduction

In the permanent dentition phase, the most common missing teeth are the mandibular second premolars, followed by MLIs and maxillary second premolars and tends to occur in 0.8–2% of the population.^{1,2} The etiology of a congenital absence of MLI is obscure and probably multifactorial such as abnormal tooth shape, abnormal tooth eruption, irregularities in tooth position, palatally impacted upper canines, and microdontia.¹ The commonest site of involvement of congenital fusion of cervical vertebrae is C2–C3.³ Previous study has established a strong association between bilateral congenital absences of MLIs and palatally displaced maxillary canines.⁴ A significant correlations between cervical column fusion with mandibular over jet,³ skeletal open bite,⁵ mandibular condylar hypoplasia⁵ have been studied previously. However, the correlations between congenitally missing of MLI and cervical column fusion, posterior arch deficiency or both abnormalities have not been assessed before. Hence, in the present study we aimed to investigate the association between congenital absences of MLI with these anomalies.

Materials and methods

This study protocol was approved by the institutional review board of Local Research Ethics Committee of School and Hospital of Stomatology, China Medical University, Shenyang, China. All procedures followed were in accordance with the principles of Helsinki Declaration. A total of 64 subjects (24 males and 40 females, mean age 16 ± 4.5 years) with congenital missing of at least one of the two MLIs (excluding the third molars) was selected as study group based on the eligibility criteria. From the remainder of radiographs, a total of 256 subjects (87 males and 169 females, mean age 18.1 ± 3.2 years) of normally erupted lateral incisors (excluding the third molars) was randomly selected as control group. Congenital missing of MLI, fusion of cervical anomaly, and atlas posterior arch deficiency were diagnosed using dental panoramic and lateral radiographs by the principal author. The first five cervical vertebral units were assessed on a standardized lateral skull radiograph. Inclusion criteria for control group included neutral occlusion and normal craniofacial morphology, at least 24 permanent teeth present (excluding the third molars), no craniofacial anomalies or systemic muscle or joint disorders, and availability of a profile radiograph with the five first cervical vertebrae units visible.^{5,6} Proper quality of the lateral cephalometric

radiographs and dental pantographs was also needed. Exclusion criteria for the study were radiographs showing previous surgical removal or extraction of MLI, craniofacial abnormalities, evidence of cleft lip and palate, severe jaw deviation, trauma and fractures, poor image qualities, syndrome-associated patients. The Statistical Package for Social Sciences (SPSS Inc, version 8.0, Chicago, Illinois, USA) was used for statistical analyses.

Results

The prevalence of morphological characteristics of the cervical column in study group and control group are shown in Table 1. The prevalences of cervical vertebral body fusions, atlas posterior arch deficiency, and both (cervical vertebral body fusions plus atlas posterior arch deficiency) were significantly higher in the study group (53.7%, 11.1%, and 9.3%, respectively) than in the control group (13.2%, 2.8%, and 1.2%, respectively) (all P-values < 0.001). Comparisons of prevalences of cervical vertebral body fusions, atlas posterior arch deficiency, and both (cervical vertebral body fusions plus atlas posterior arch deficiency) between male and female patients in both the study and control groups are shown in Table 2. No significant differences in the prevalences of cervical vertebral body fusions, atlas posterior arch deficiency, and both were found between male and female patients in both the study and control groups.

Discussion

In this study, females were more frequently affected with the missing MLI teeth than males by a ratio of about 2:1. Missing of both MLIs was more frequent than unilateral agenesis. These findings support the fact that genetics contribute to the etiology of congenital missing of MLI.⁴ In agreement, the prevalence of dental agenesis has been widely reported in the literature to be higher in females than in males.⁴

The findings of the present study indicate that cervical vertebral body fusions are significantly and positively correlated with the agenesis of MLI. A previous study demonstrated a significant association of cervical vertebral body fusions (C2–C3) with skeletal deep bite by comparing a group of patients with deep bite (41.5%) to a control group (14.3%) comprising subjects with abnormal craniofacial morphology.⁷ Previous investigations also reported significant correlations of fusion of cervical vertebra with skeletal open bite (42.1%),⁵ skeletal mandibular over jet

Table 1 Prevalence of morphological characteristics of cervical column in study group and control group.

Variables	Missing MLI group (n = 64)		Control group (n = 256)		P
	n	%	n	%	
Normal	24	44.4	213	85.2	0.000
Fusion anomalies	29	53.7	33	13.2	0.000
Posterior arch deficiency	6	11.1	7	2.8	0.000
Fusion and posterior arch deficiency	5	9.3	3	1.2	0.000

P < 0.001 for all 4 statistical analyses.

Table 2 Comparisons of prevalences of cervical vertebral body fusions, atlas posterior arch deficiency, and both (cervical vertebral body fusions plus atlas posterior arch deficiency) between male and female patients in both the study and control groups.

	Male (n = 24)		Female (n = 40)		P
	n	%	n	%	
Study group					
Normal	13	59.1	11	34.4	0.089
Fusion anomalies	9	40.9	20	62.5	0.089
Posterior arch deficiency	1	4.5	5	15.6	0.100
Fusion and posterior arch deficiency	1	4.5	4	12.5	0.164
Control group					
Normal	71	83.5	142	86.1	0.494
Fusion anomalies	13	15.3	20	12.1	0.494
Posterior arch deficiency	2	2.4	5	3.0	0.792
Fusion and posterior arch deficiency	1	1.2	2	1.2	1.000

(61.4%),³ maxillary retrognathia of the jaw,³ large cranial base angle,³ and inclination of the jaws.³ It has been reported that cervical fusions do not occur more frequently in patients with cleft lip and palate than in non-cleft subjects.⁸ However, another previous study found cervical fusions in 12.1% of cleft lip and palates subjects;⁹ this may be caused by a developmental defect of the mesenchyme.³

The occurrence of agenesis of MLI was also correlated positively to the occurrence of posterior arch deficiency of atlas. The finding of a previous study discovered a significant correlation between posterior arch deficiency of atlas and cleft lip and palate (7.7% in cleft patients and 5% in non-cleft subjects).⁹ Another study reported that the atlas posterior arch deficiency significantly occurs more often in patients with cleft palate (16%) than in non-cleft palate subjects,⁸ and in patients with mandibular condylar hypoplasia (4.8%) than in subjects with normal craniofacial morphology.⁶ However, other studied confirmed no significant correlation between atlas posterior arch anomaly and mandibular over jet,³ skeletal open bite,⁵ and deep bite.⁷

The occurrence of congenital missing of MLIs was also correlated significantly and positively to the occurrence of atlas posterior arch anomaly and to the occurrence of both anomalies. Previous studies found a stronger association of cervical vertebral fusions with posterior arch deficiency in patients with clefts than in subjects without clefts,⁹ and in patients with mandibular condylar hypoplasia than in those without mandibular condylar hypoplasia.⁶ However, other previous studies showed no significant association of more than one anomalies with skeletal Class III patients,³ skeletal deep bite,⁷ or skeletal open bite.⁵ Further molecular genetic studies and prenatal researches into normal and pathologic associations between development in the craniofacial and cervical region may be essential to explain the etiology.³ In this study, the incidences of fused cervical vertebrae C2 with C3 were 40.9% and 62.5% for males and females, respectively, with no statistically significant differences. Moreover, the results of this study showed no significant differences in the cervical vertebral fusion anomalies between male and female patients in both the study and control groups. The incidence of fused cervical vertebrae C2 with C3 in the previous studies has been

shown to be 0.4%–0.7% with no sex predilection.¹⁰ In the current study, only radiographic features were examined. The molecular and genetic studies in the association of congenital missing of maxillary lateral incisors with cervical vertebral body fusions and/or atlas posterior arch deficiency are needed in the near future.

In conclusion, cervical vertebral anomalies occur significantly more commonly in patients with congenital missing of MLI as compared to the control group. Associations were found between congenital absence of MLI and fused cervical C2 and C3, posterior arch deficiency, or both. Subjects with congenital MLI tend to have an increased frequency of cervical anomaly. However, no significant differences in the prevalences of cervical vertebral body fusions, atlas posterior arch deficiency, and both are found between male and female patients in both the study and control groups.

Conflict of interest

No conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jds.2019.12.006>.

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