Oral Airway Volumes in Pediatric Dental Patients with Bilateral Cleft Lip and Palate

Krizia Acosta, DDS; Carolyn Kerins, DDS, PhD; Yong Jong Park, DDS, MS

TAMU School of Dentistry and Children's Medical Center, Dallas, TX

OBJECTIVE

To compare the oral airway volumes in healthy pediatric dental patients with those who have repaired bilateral cleft lip and palate.

INTRODUCTION

Cleft lip and palate (CLP) is one of the most common congenital craniofacial anomalies affecting 1 in every 1,600 babies.[1]

Care for these patients requires a team-based approach, consisting of specialists from multiple areas including oral and maxillofacial surgery, otolaryngology, plastic surgery, speech pathology, and more.[2] Therefore, it is essential for pediatric dentists to be familiar with the unique health care needs of these patients.

Lip and palate surgeries usually occur in the first year of life. While these are critical for repair, negative sequela have been cited: maxillary hypoplasia, otitis media, speech pathology, bifid uvula, dental malocclusion, and velopharyngeal incompetence.[3]

Considering the potential surgical impact on the maxilla, it is important to evaluate the possible change in oral airway volume. Few studies have completed a 3-D pharyngeal airway analysis in patients with bilateral cleft lip and palate, and the results are contradictory. [4-8]

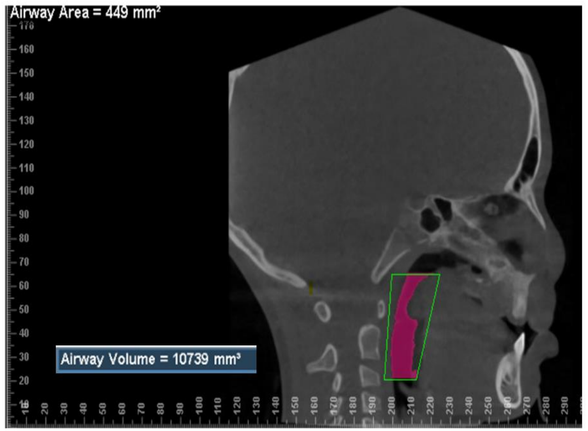

Figure 1: Determination of airway volume using Dolphin software.

MATERIALS AND METHODS

A retrospective chart review was conducted of CMC Dallas Orthodontic patients.

Inclusion criteria: patients with bilateral cleft lip and palate who are otherwise healthy, ages 6-18, history of lip and palate repair, no history of orthognathic jaw surgery, and have had a cone beam computed tomography (CBCT) scan.

Out of 39 patients who had bilateral cleft lip and palate, 14 patients were excluded due to age, co-occurring health conditions, and/or history of orthognathic surgery.

25 patients included in the study.

- Group 1: Ages 6-8 (N=4)
- Group 2: Ages 9-11 (N=14)
- Group 3: Ages 12-14 (N=4)
- Group 4: Ages 15-17 (N=3)

The data was analyzed using Dolphin 3D software.

Airway was analyzed from the posterior nasal spine to the position of the tip of the epiglottis as described by Schendel, et. al. [9]

Dolphin software automatically calculates airway volume and area based on defined parameters (Figure 1).

Using data from a previous study obtained by the same researchers in this study (Figure 2), compared bilateral cleft lip and palate data to unilateral cleft lip and palate data (Table 1). [10]

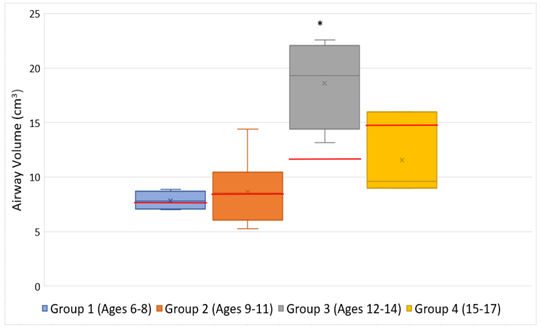

Figure 3: Bilateral CLP airway volumes for each age group with comparison to the literature value.

RESULTS

For each of the groups, a one-sample t-test was performed to compare the data to the corresponding literature value (Figure 3).

- For Group 1, the average value was 7.89 cm^3 which was not significantly different compared to the literature value of 7.18 cm^3 (*P*-value > .20).
- For Group 2, the average value was 8.65 cm^3 which was not significantly different compared to the literature value of 8.39 cm^3 (*P*-value > .72).
- For Group 3, the average value was 18.59 cm^3 and this was significantly different compared to the literature value of 11.62 cm^3 (*P*-value < .04).
- For Group 4, the average value was 11.54 cm^3 which was not significantly different compared to the literature value of 8.39 cm^3 (*P*-value > .28).
- As depicted in Figure 3, the average for each group is depicted as an "X" and the median is depicted with a corresponding-colored line.
- A red line depicts what the comparative literature value is for each group.
- Only Group 3 showed a significant difference.

	Unilateral	Bilateral	Normal value
Group 1	8.95	7.89	7.18
Group 2	9.91	8.65	8.39
Group 3	9.13*	18.59*	11.62
Group 4		11.54	14.8

Table 1: Airway volume (cm^3) comparisons. Significant values are denoted by an asterisk.

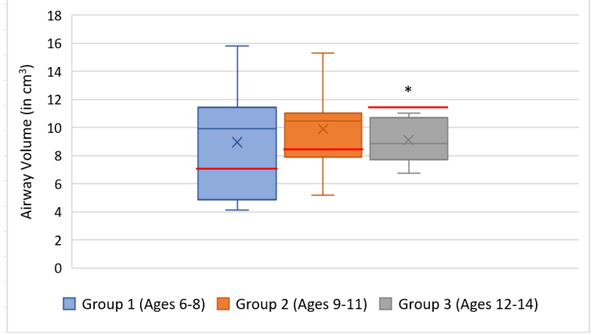

Figure 2: Unilateral CLP airway volumes for each age group with comparison to the literature value.

DISCUSSION

Interestingly, of the 25 patients that were analyzed, Group 1 and Group 2 both had an average airway volume that was higher than the corresponding literature value. However, neither of these results was statistically significant. Only Group 3 had a higher average airway volume that was statistically significant compared to the literature value for non-CLP. Due to maxillary hypoplasia and possible negative effects of repair surgeries on growth, one would have expected the airway volume to be lower in patients with CLP. One explanation could be maxillary expansion. Patients in the age range of groups 1-3 undergo maxillary expansion in preparation for alveolar bone graft in the cleft sites. This could explain why the airway volumes are higher than the normal value. In Group 4, the value was lower than the normal value. By this age range, expansion is approaching completion or has already been completed. A possible explanation for the findings in group 4 could be that the maxilla in children without CLP continues to grow, catches up and surpasses the maxillary growth in patients with CLP. A limitation in this study was small sample sizes. The limited data set may be a contributing factor to these findings and thus additional research with a larger patient pool is needed.

CONCLUSIONS

1. Bilateral CLP patients in the age range of 12-14 years have a significantly larger airway volume compared to patients of the same age without CLP
2. A larger data set is needed to determine if there are significant differences in airway volumes for patients in other age ranges.

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